A MIXED-METHOD STUDY OF STEM QUALIFIED PROFESSIONALS' PERSISTENCE INTENTIONS WITHIN THE AUSTRALIAN AGRICULTURE SECTOR

A Thesis submitted by

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ABSTRACT

There is currently a demand for Science, Technology, Engineering or Mathematics (STEM) trained personnel within the Australian agriculture industry driven by the precision agriculture revolution and subsequent digitisation of many work tasks. This research explored the utility of Social Cognitive Career Theory (SCCT) as a framework for explaining career persistence intentions among STEM trained professionals working in the Australian agriculture sector. SCCT has previously been found to be generalisable in a variety of educational and career contexts. While STEM academic and career choice, and persistence have been extensively explored within the SCCT literature, few studies have focused on the application of STEM skills within an Agricultural workforce context. This thesis addresses the gap in the literature and aims to contextualise the operationalisation of SCCT constructs to the Australian STEM of agriculture workforce.

The SCCT choice and persistence literature is reviewed to understand the direct and indirect effects of hypothesised pathways within STEM and agricultural populations. Prior operationalisation of SCCT constructs are discussed and used to inform the current studies instrumentation. An adapted model of career persistence was developed to test SCCT (a) self-efficacy expectations, (b) outcome expectations, (c) goal directed activity, (d) environmental supports, and (e) personality trait propositions.

A sequential mixed-methods design was utilised, in which an initial qualitative study was undertaken, and semi-structured interviews conducted to conceptualise SCCT variants within a STEM and agriculture context relevant to the Australian workforce. Face validity of prospective measures was assessed using theory-driven thematic analysis. A STEM task-specific self-efficacy measure was developed as a result of qualitative analysis. In addition, interpretation of interviewee responses led to the inclusion of variety seeking, an expression of the openness to experience personality trait in the second quantitative study.

The follow-up quantitative study tested the predictive utility of SCCT using online survey data. Hierarchical regression analysis was used to test the predictive utility of independent variables on persistence intentions. Mediation analysis was then utilised to test indirect relationships among variables.

Testing of the SCCT Model of STEM Professionals Persistence within Australian Agriculture revealed that perceived organisational support and work engagement were direct predictors of persistence intentions. The inclusion of work engagement as a mediator also demonstrated that the path from perceived organisational support to persistence intentions was mediated by work engagement. Therefore, to contribute to persistence within the field organisations should provide adequate support, and individuals whom seek career counselling may benefit from interventions that clarify their goals and broaden their coping strategies.

KEYWORDS

Social Cognitive Career Theory, Mixed Methods, STEM, Agriculture, Career Persistence

Certification of Thesis

This Thesis is entirely the work of Kristen Anne Lovric except where otherwise acknowledged. The work is original and has not previously been submitted for any other award, except where acknowledged.

Principal Supervisor: Dr Peter McIlveen

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Student and supervisors signatures of endorsement are held at the University.

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LIST OF ABBREVIATIONS

STEM	Science, Technology, Engineering and Mathematics
SCCT	Social Cognitive Career Theory
VPA-FFF	Vocational Psychology of Agriculture – Farming, Food and Fibre
PhD	Doctor of Philosophy
sic	Verbatim
etc.	Etcetera
CAD	Computer-Aided Design
GPS	Global Positioning System
GIS	Geographic Information Systems
CEDLE-E	Career Exploration and Decision Learning Experiences Positive and Negative Emotion Scales
MIQ	Minnesota Importance Questionnaire
SPOS-SF	Survey of Perceived Organizational Support – Short Form
SPSS	Survey of Perceived Supervisor Support
PFC-RS	Problem-Focused Style of Coping Scale – Reflective Style
UWES-SQ	Utrecht Work Engagement Scale – Short Questionnaire
POS	Perceived organisational support
PSS	Perceived supervisor support.

CHAPTER ONE: INTRODUCTION

This chapter outlines global challenges facing the Australian agriculture sector, discusses the impact of the recent revolutions within agriculture and subsequent demand for Science, Technology, Engineering and Mathematics (STEM) skills and knowledge, and argues the need for psychological research to investigate the problem of agricultural workforce motivation and retention, particularly as they are often carried out in rural and regional locations. Vocational psychology is positioned as a discipline with the means to investigate these workforce issues (McIlveen & McDonald, 2019) using Social Cognitive Career Theory (SCCT; Lent, Brown, & Hackett, 1994) as a platform to understand STEM professionals career experiences. The SCCT model of career choice will be introduced, aims, objectives and research questions listed. An overview of all the sections within this thesis will conclude this chapter.

1.1 Global Challenges Facing Agriculture

World hunger is a serious issue that affects the physical health and wellbeing of millions of people. While recent evidence suggests that undernourishment is declining, hunger still negatively impacts the lives of vulnerable people such as children and people residing in high conflict areas (FAO, IFAD, UNICEF, WFP, & WHO, 2017). This is a concern given that starvation can lead to chronic health difficulties, for example, significantly poor growth in children which heightens the risk of early death. Malnutrition is a challenge facing agriculture in which food is needed to be produced at a higher rate and more efficiently.

Australia is a major producer of agricultural resources with the second largest area of farming land use in the world which employs more than 300,000 people and is estimated over $60 Billion dollars in worth (National Farmers Federation, 2018). Whilst this nation has prosperous meat and livestock markets, grains and other cropping industries with enough

produce to feed the country and exporting twice that amount, global supplies demand is rapidly mounting. Population growth is projected to increase food requirements by 60 percent within the next 30 years (FAO et al., 2017). This is an alarming figure which challenges international production and export capabilities.

In 2017, the United Nations Development Programme chartered a collection of Global Sustainable Development Goals in part due to the estimated 815 million people undernourished and without enough access to food (FAO et al., 2017). One of the Sustainable Development goals outlined included zero hunger (i.e., goal 2) which was second to no poverty alone (i.e., goal 1). This is unsurprising given the cost of malnutrition which was anticipated to amount in 3.5 trillion USD financial to the global economy per annum (World Food Program, 2017). Stakeholders notified of priority areas were subsequently tasked with overcoming chronic hunger (United Nations, 2017). Practice advancements are, however, required to facilitate goal achievement.

The recent, post 1980's, precision and digital revolutions have headed exciting advancements in Australian agriculture of which have included the adoption of new technology such as drones that collect large amounts of data and in more efficient ways than before (Perez, 2018). While the new applications of technology are promising, more professionals with STEM skills and knowledge are required to carry out specialist tasks, develop and maintain these technologies (National Farmers Federation, 2017, 2018). The value of STEM utilisation within the agriculture workforce has been demonstrated through the $800 million per annum investment in research and development alone (National Farmers Federation, 2017). Hence the need for STEM trained professionals within the agriculture sector has increased. Heightened calls for these occupations within agriculture have, however, been met with some uncertainty about our nation's ability to fill future workforce needs with the best trained personnel (National Farmers Federation, 2018). Success in

meeting the Global Sustainable Development Goal of Zero Hunger target by 2030 is argued to rely on cross-disciplinary collaboration, particularly in driving workforce development in occupations inspired by the digitisation of the agriculture industry.

1.2 The Vocational Psychology of Agriculture

Vocational psychology research can help identify facilitators and inhibitors to workers continuation in an agricultural-related profession. Yet, to date, there has been little research enquiry into STEM professions within the agriculture sector (McDonnald, 2017). Vocational psychology should weigh in on these workforce issues as the discipline can contribute key knowledge to better understand the psychosocial factors that attract and retain professionals to their job.

SCCT (Lent et al., 1994) is a well-established overarching framework that has been heavily studied in the past 25 years across student populations (Blanco, 2011; Inda, Rodríguez, & Peña, 2013; Lent, Taveira, & Lobo, 2012; Lent, Taveira, Sheu, & Singley, 2009; Sheu, Chong, Chen, & Lin, 2014) and that is asserted as equally useful in ascertaining the modifiable factors that contribute to professionals' persistence within their agricultural-related careers. These factors could be critical to informing the career education of STEM students and the career development of practicing professionals. Similarly, the utility of SCCT within an agricultural career context appears to not have been fully explored in the documented literature.

In 2015 McIlveen established the Vocational Psychology of Agriculture – Farming, Food and Fibre (VPA-FFF) research agenda with the objective of seeing the broader adoption of the discipline of vocational psychology within vital infrastructure workforces, particularly those that grow regional communities. McIlveen (2015) argued that the psychological research has been an underutilised yet incredibly valuable resource in the world of work.

Therefore, McIlveen and McDonald (2019) suggested that the VPA-FFF research focus on the STEM of agriculture. The current research project is an attempt to help address this issue.

SCCT is among the most rigorous career theories within the discipline of vocational psychology. The theory draws attention to the important role of people's thoughts, feelings and behaviour in interaction with their environment on career-decision making (Lent et al., 1994). Social cognitive research has been concerned with understanding a range of career related factors such as the interest development, choice actions, performance outputs, self-management and satisfaction. Most SCCT research appears to have been conducted using convenience samples of university students, leaving a smaller proportion of studies that have been performed within a workplace context which used samples of teachers (Badri, Mohaidat, Ferrandino, & El Mourad, 2013; Lent, Nota, et al., 2011). SCCT has been applied to STEM education (Turner & Spence, 2014; Turner & Hawkins, 2014) and careers, and within agricultural contexts (McDonnald, 2017). However, STEM trained professionals' career persistence within the agriculture sector has not been previously investigated. This has led to a gap in the literature concerned with working agriculturalists.

Several social-cognitive models of academic and career interests and choice (Lent et al., 1994), career self-management (Lent & Brown, 2013), and job satisfaction and wellbeing (Lent & Brown, 2008) have been developed. Some recent studies have combined and adapted these models to understand academic persistence intentions (e.g.,Lee, Flores, Navarro, & Kanagui-Muñoz, 2015; Lent et al., 2016). However, the combination of SCCT constructs in understanding intended career persistence requires further exploration and testing.

The SCCT Model of Career Choice (Figure 1.1) was originally developed to depict the interaction of person factors, environmental supports and barriers specific to the domain of work on career goal formation, actions and choices (Lent et al., 1994). The model

represents proposed interrelations of self-efficacy beliefs, outcome expectations, participation in goal progress, goal directed activity, predispositions and contextual supports/barriers on influencing people's career decisions. Whilst prior choice research has predominantly focused on the choice to pursue a potential career (i.e., attraction of a worker to a job) the current study seeks to investigate the choice to continue a career or persist in a job (i.e., retention of a worker to a job). Therefore, this project seeks to adapt this model in its investigation of workforce persistence.

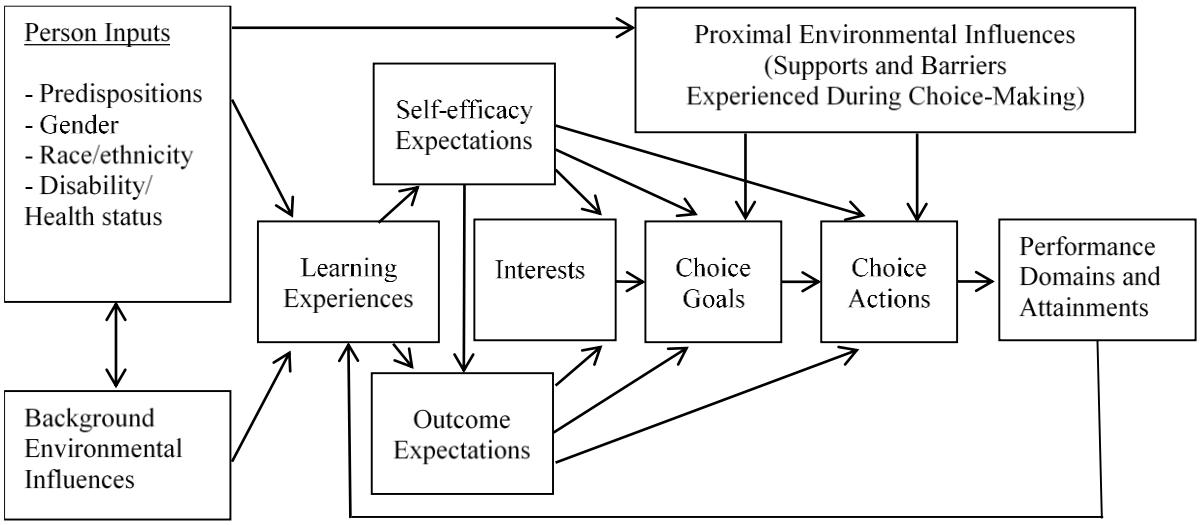

Figure 1.1. The SCCT Model of Career Choice illustrating direct and indirect pathways among predictor variants. Adapted from "Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance." by R. W. Lent, S. D. Brown, and G. Hackett, 1994, *45*(1), p. 93. Copyright 1994 The Authors

1.3 Aims, Objectives and Research Questions

This project aims to fill a gap identified in the current body of vocational psychology research using SCCT as an explanatory framework and the Model of Career Choice as a foundation to test SCCT constructs within a workforce context. The validity of the predictors will be explored among STEM trained professions working in the agriculture industry to contextualise the model and guide the selection of measures to operationalise the variables and test the theoretical pathways within that population. The following research questions are the focus of this investigation:

Research Question 1: What are key occupational self-efficacy beliefs, outcome expectations and goals of agricultural scientists (technicians, engineers and statisticians)?

Research Question 2: What are key occupational supports and barriers among agricultural scientists (technicians, engineers and statisticians)?

Research Question 3: What measures are appropriate to operationalise SCCT constructs within agricultural professions?

Research Question 4: What SCCT factors influence scientists, technicians, engineers and statisticians' intentions to persist in agricultural careers?

1.4 Original Contributions of the Research

This research project provides several original contributions to research, industry and regions. First, this research will add to the available vocational psychology literature and SCCT through the undertaking of further vocational research in a workforce context and contextualising the SCCT model of Career Choice among a previously unexplored occupational group. This project will also assist in informing Australian agricultural workforce strategy and career development interventions through practical recommendations based upon the research findings.

1.5 Thesis Overview

Chapter Two reviews the SCCT literature relevant to career decision making - choice and persistence. An argument for the significance of the project is put forward. Appropriate operationalisation of SCCT variants are discussed in consideration of theoretical alignment, prior vocational psychology and educational research, and industry publications.

Chapter Three outlines the current research projects methodology. The aims, objectives and research questions are restated, post-positivist research paradigm discussed, axiological considerations in the context of social research are made and researcher-as-instrument provided outlining the primary investigators relevant personal experiences and assumptions. The self-reflection process undertaken was framed using SCCT constructs as a 'loose' guide for the author to systematically consider personal biases at various stages of their own career development. Motivation for participating in this PhD are disclosed and an argument is put forward for the practical utility of the chosen research design in investigating the phenomena of persistence intentions among STEM-trained professionals' working in the agriculture sector.

The method, results and discussion of Study One are reported in Chapter Four. The participant recruitment, semi-structured individual interview data collection method and approach to thematic analysis are outlined. The results are discussed using SCCT as an organising framework and face validity for the proposed operationalisation of constructs is argued in consideration of the themes identified and with the use of direct quotes representative of those themes. This analysis references and informs the selection of measures for Study Two.

Chapter Five outlines the quantitative study method and reports the results of Study Two. Participant recruitment, survey data collection method and the analytical approach are

reported. An adapted, contextualised model of STEM professionals' persistence intentions within the agriculture sectors is tested. Findings are discussed in the proceeding chapter.

Chapter Six discusses the findings from Study Two integrating the findings from Study One to assist in the explanation of the results. Theoretical and practical implications of the current research endeavour will be put forward in consideration of prior research. Limitations of the present research will be outlined with respect to the rigour of the chosen methodological approach and external validity of the results. Future research directions will be provided within the discipline of vocational psychology, investigation of SCCT and workforce development of STEM professionals within the agriculture sector.

CHAPTER TWO: LITERATURE REVIEW

This chapter reviews the conceptual and empirical literature related to SCCT and the STEM of agriculture workforce context. The predictive utility of SCCT including the Career Choice Model will be examined with the objective of improving understandings of direct and indirect pathways within the model that may be relevant to examine in the current study. Gaps in the literature regarding a previously unexplored occupational group will be highlighted. Operationalisation of environmental factors, self-efficacy beliefs, outcome expectations and goals will all be discussed in the literature review.

2.1 Australian STEM Workforce

There is currently a demand for STEM trained personnel within the Australian agriculture industry driven by the precision agriculture revolution and subsequent digitisation of many work tasks. Nevertheless, high turnover rates hinder the retention of knowledgeable and appropriately skilled professionals to their jobs (Rimfire Resources, 2017). This is especially concerning considering the Global Sustainability Goal of Zero hunger which relies on innovation for more efficient production to feed and clothe a growing population. To date, there has not been in-depth investigation into the psycho-social factors that motivate individuals to continue to apply their skills as agriculturalists.

There are approximately 2.3 million STEM qualified personnel in Australia most of which are male and vocationally trained (Office of the Chief Scientist, 2016). While unemployment of STEM trained professionals (i.e., 3.7%) is comparatively low compared to non-STEM disciplines (4.1%), there has been a lack of growth in the STEM population (Office of the Chief Scientist, 2016). This indicates that competition across sectors for STEM skills and knowledge is currently high. Therefore, retention of STEM qualified individuals is an important issue for Australian agriculture.

2.2 Australian Agricultural Workforce

Higher skilled individuals are growing in demand in the Australian agriculture sector. Most of the agricultural workforce is male and while there is a trend in agricultural workers completing higher education such as a certificate, diploma or degree, the majority of the workforces highest level of education is still currently secondary education (Wu, Dawson, Fleming-Muñoz, Schleiger, & Horton, 2019). Despite the need for agriculturalists there has been a 7% decline in the agricultural workforce and 14% increase in job vacancies particularly in regional areas of Australia (Wu W. et al., 2019).

There are several barriers noted in the initial attraction of individuals to STEM careers within the agriculture sector. Public misconceptions of agricultural careers can detract science students from pursuing jobs in the field. Turner and Hawkins (2014) found that students were influenced by other people's beliefs that an agricultural career is hard, farm work which is an inaccurate, broad generalisation of the jobs available in the agriculture industry. Agricultural scientists perform a starkly different role to that described, while they may consider the work that they perform to be challenging, workers collect and analyse sophisticated data to improve agricultural production as opposed to physically demanding on-farm tasks (O*NET OnLine, 2019). This is a concern given that science is a knowledge and skill area of growing need within the industry.

2.3 Social Cognitive Career Theory

SCCT was based on Bandura's (1986) general Social Cognitive Theory and applies its core constructs within a career context. A fundamental assumption of Social Cognitive Theory is that individuals are proactive agents in their decision making and the execution of subsequent actions. According to Bandura's (1986) Social Cognitive Theory, motivation is primarily driven by the interaction of personal attributes, behaviour and from an individual's environmental context. Social Cognitive Theory was intended to explain human behaviour

within specific life domains. Therefore, social cognitive constructs should be investigated within a single domain and have been appropriately operationalised using domain-specific measures tailored to that area of functioning (Bandura, 1986; Bandura, 2006).

Derived from Social Cognitive Theory, SCCT focuses on the interaction of cognitive constructs and environmental factors in explaining and predicting career-related behaviour such as choice or persistence (Lent et al., 1994; Lent, Brown, & Hackett, 2000). Established SCCT models include academic and career interest, and choice (Lent et al., 1994), career self-management (Lent & Brown, 2013), and job satisfaction and wellbeing (Lent & Brown, 2008). These models overlap in explaining academic and career related behaviour. The SCCT models have focused on both the content such as educational major (i.e., Choice Model) and processes such as coping (i.e., Self-Management Model) of behaviour within academic and career domains.

The core cognitive constructs described in SCCT are self-efficacy beliefs, outcome expectations, and goals (Lent et al., 1994, 2000). Environmental factors such as perceived supports and barriers are among an additional set of non-cognitive variables theorised to impact career decision-making processes through a causal chain of events (Lent et al., 1994). SCCT has been shown to be applicable across a diverse array of populations (e.g., Byars-Winston, Estrada, Howard, Davis, & Zalapa, 2010; Flores, Robitschek, Celebi, Andersen, & Hoang, 2010; Lent et al., 2005; Lent, Lopez, Sheu, & Lopez Jr, 2011; Lent, Sheu, Gloster, & Wilkins, 2010; Waller, 2006). Therefore, SCCT is proposed as a domain-specific framework that is potentially useful to understand STEM-skilled professionals' persistence in the Australian agriculture industry (McIlveen & McDonald, 2019).

The following sections review the SCCT Models of Academic Choice, Adjustment and Persistence, and Career Choice. Findings of prior research in relation to the hypothesised direct and indirect effects will be discussed. First the predictive utility of the model will be

explored in an academic context on which much of the prior literature has focused. Second, an overview of the results from studies that examined the social-cognitive predictors of career choice will be provided. Finally, findings from qualitative research that sought to contextualise the models to diverse populations and prior syntheses will be outlined.

2.3.1 Academic choice, adjustment and persistence. SCCT asserts that social-cognitive variables contribute to persistence in academic and career pursuits (Lent et al., 1994, 2000). Theorists hypothesised that self-efficacy beliefs, interests and outcome expectations inform goals and actions, and persistence intentions in both academic and career domains. Individuals with high self-efficacy, positive outcome expectancies, are more likely to continue in academic and career pursuits that align with their goals. Furthermore, people whom perceive themselves to be efficacious and believe that they will obtain desired results because of their actions are more likely to persist in their academic or career endeavours when faced with environmental barriers.

Lent et al. (1994, 2000) SCCT framework has been regularly featured in academic publications that sought to conceptualise and understand academic choice making. Specifically, there are numerous primary studies published on the SCCT Model of Academic Choice. Most of these studies investigated the role of self-efficacy beliefs in academic choice making. Many of which also included measures of outcome expectations, while fewer accounted for the role of environmental factors on academic choice (e.g., Deemer, Marks, & Miller, 2017; Garriott, Navarro, & Flores, 2017; Jiang & Zhang, 2012; Kantamneni, McCain, Shada, Hellwege, & Tate, 2018).

This body of research has explored the utility of the Academic Choice Model across disciplines, gender, and race or ethnicity. Most published studies investigated the utility of the Academic Choice Model among STEM disciplines (e.g.,Brown, Concannon, Marx, Donaldson, & Black, 2016; Mueller, Flickinger, & Dorner, 2015) such as science and

engineering (e.g.,Byars-Winston et al., 2010; Hunt, Flores, Navarro, & Lee, 2016), math and science (e.g.,Fouad & Smith, 1996; Waller, 2006), and agriculture (e.g.,Fraze, Wingenbach, Rutherford, & Wolfskill, 2011). Around half of the studies published examined underrepresented populations (e.g.,Kim & Seo, 2014; Lent, Lopez, & Bieschke, 1991; Navarro et al., 2019) or gender differences (e.g.,Chang Rundgren, Sun, & Jidesjö, 2019; Fort & Murariu, 2018; Inda et al., 2013; Lent, Lopez Jr, Lopez, & Sheu, 2008) in academic choices. A few of the identified studies also investigated the impact of race or ethnicity in relation to academic choice goals (e.g., Lent et al., 2005; Lent, Lopez, et al., 2011; Lent et al., 2013). Just one study was conducted in an Australian context (Hu, Hood, & Creed, 2017).

Results regarding the outcome expectations variable have been shown to be inconclusive. Contrary to SCCT hypotheses, several studies have indicated that outcome expectations were not an unique predictor of academic choice goals (Jiang & Zhang, 2012; Kim & Seo, 2014; Lent et al., 2005; Lent, Lopez, et al., 2011; Lent, Lopez Jr, et al., 2008; Lent, Sheu, et al., 2010). Wallers' (2006) findings suggested that the relationship between outcome expectations and academic choice was primarily mediated by interests. This finding was corroborated by other researchers (Lent et al., 2016) who only found the indirect path between outcome expectations and academic persistence to be significant. These findings could explain the discrepancies in effects documented in the SCCT academic choice literature.

Inconsistent findings have also been reported regarding the relationship between self-efficacy beliefs, outcome expectations and academic choice goals. Some studies did not support the relations between self-efficacy and outcome expectations nor academic goals. For example, Garriott, Navarro, et al. (2017) did not find a significant effect of self-efficacy on outcome expectancies. Similarly, Jiang and Zhang (2012) found that self-efficacy beliefs were not a direct predictor of students' academic goals. Deemer, Navarro, Byars-Winston,

Jensen, and Chen (2019) found that neither self-efficacy nor outcome expectations were direct predictors of graduate education intentions. Findings suggest that the relations between self-efficacy and intentions are mediated by interests.

It is noted that gender differences have been detected in the academic choice literature. Group differences have been found regarding self-efficacy beliefs, environmental supports and barriers. For example, one study indicated that females endorsed lower maths self-efficacy than males (Lent et al., 1991). Conversely female students have been shown to report higher supports and fewer barriers than males (Inda et al., 2013; Lent et al., 2005). Chang Rundgren et al. (2019) suggested that while females endorsed a higher degree of environmental influence and males reported greater self-efficacy beliefs and intention to persist with their goals. These findings indicate that sources of self-efficacy may, in part, explain differences between males and females in academic choice. Women, however, also appear more susceptible to a lack of support than their male counterparts.

Hu et al. (2017) used SCCT as one of two overarching theoretical perspectives to examine the relations between negative career feedback and career goal disengagement. Their research was conducted in an Australian context with a sample of university students, most of whom were engaged in part-time work. Results indicated that greater levels of perceived negative career feedback were related to disengagement from career goals. These findings lend support to the SCCT environmental barriers hypotheses.

The Academic Choice Model has been examined using different research methods. Longitudinal and mixed-method studies featured among the most rigorous of the research designs applied in these investigations e.g., (Lent et al., 2015; Lent, Sheu, et al., 2010; Lent, Sheu, et al., 2008; Lent et al., 2009; Navarro, Flores, Lee, & Gonzalez, 2014). This literature will now be discussed in relation to the current research project. Theoretical implications will be outlined, and similarities/differences explained.

2.3.1.1 STEM academic intentions. Longitudinal research focused on the SCCT Academic Choice Model among STEM disciplines has provided strong support for the model's utility across gender, and race or ethnicity. Most longitudinal studies examined the effect of self-efficacy beliefs (Larson et al., 2015; Lee et al., 2015) and outcome expectations e.g., (Lent, Sheu, et al., 2008). Three of these studies included environmental variables within the model e.g., (Lent et al., 2015; Lent, Sheu, et al., 2010; Navarro et al., 2014). While results generally supported the model anomalies are discussed in context below.

Lent, Sheu, et al. (2010) conducted a longitudinal study of the SCCT model of academic choice in a sample of university students studying engineering. Their investigation examined the relationships between person and environmental variables. Results mostly supported the model and theory consistent relationships between self-efficacy, outcome expectations, supports and persistence goals. However, neither outcome expectations nor barriers were not found to be a direct predictor of goals

Another study conducted by Lee et al. (2015) investigated the SCCT Persistence Model among engineering students using a longitudinal research design. Their research was focused on examining racial/ethnic and gender differences in a predominately Latino/a and White sample of male and female students. Engineering self-efficacy beliefs, academic goals and persistence were among the measured variables and results supported the model's utility in explaining academic persistence. In the full sample self-efficacy predicted goals as well as persistence. The direct path from self-efficacy beliefs to persistence was, however, non-significant. The path from goals to persistence was also non-significant for males. This finding indicates that females' goals predicted their persistence but that the same was not true for males.

Similarly, Lent et al. (2015) also undertook a longitudinal study of engineering student's academic adjustment. Their research integrated person, cognitive and

environmental variables from several SCCT models including choice and satisfaction to develop the Model of Academic Adjustment tested in the study. Results supported the utility of the model in explaining engineering student's academic adjustment. Support predicted self-efficacy, and both predicted outcome expectations but self-efficacy alone predicted intentions to persist at both time points. These findings replicate results from the other primary studies that do not show a significant direct relationship between outcome expectations and academic goals and assist in understanding how the variants may function among STEM professionals working in agriculture.

2.3.2 Career choice. According to SCCT (Lent et al., 1994), individuals select careers in which they foresee themselves attaining desired outcomes as a result of their actions. The studies using SCCT as a theoretical framework to examine career choice have explored the model's utility among both high school (e.g., Lent, Brown, Nota, & Soresi, 2003; Lent, Paixão, Silva, & Leitão, 2010) and university students (e.g., Chan, 2018; Chan, Chen, Lin, Liao, & Lin, 2018; Flores et al., 2010; Yeagley, Subich, & Tokar, 2010). Overall, this research has supported the utility of the SCCT Career Choice Model (Yeagley et al., 2010). An overview of this literature will now be provided. First non-STEM studies will be reviewed followed be research that focused on STEM disciplines.

In non-STEM disciplines self-efficacy beliefs and outcome expectations have consistently been shown to share indirect relationships with occupational choice, however, several studies have indicated that neither directly predicted choice goals across Holland RAISEC interest types (Flores et al., 2010; Lent et al., 2003; Lent, Paixão, et al., 2010). These findings indicate that interests mediate the paths from self-efficacy and outcome expectations to goals. While environmental support has been associated with self-efficacy beliefs, results consistently indicate that neither support (Chan, 2018; Chan et al., 2018) nor barriers (Lent et al., 2003; Lent, Paixão, et al., 2010) share a direct relationship with career

intentions. This finding is inconsistent with the theory and suggests self-efficacy may fully mediate the relations between these variables.

2.3.2.1 STEM career intentions. Around half of the identified articles focused specifically on STEM career intentions (Blondeau & Awad, 2016; Deemer, Thoman, Chase, & Smith, 2014; Fouad, Singh, Cappaert, Chang, & Wan, 2016; Garriott, Raque-Bogdan, Zoma, Mackie-Hernandez, & Lavin, 2017; Kang & Keinonen, 2017; Turner, Joeng, Sims, Dade, & Reid, 2019). Only one of these studies examined cognitive and environmental factors, and gender differences (Fouad et al., 2016). A further three included both cognitive and environmental variables in the model tested (Deemer et al., 2014; Garriott, Raque-Bogdan, et al., 2017; Turner et al., 2019). Another two of these studies explored gender differences in cognitive variables (Blondeau & Awad, 2016; Kang & Keinonen, 2017). The STEM literature will now be summarised, findings discussed, and similarities and differences across the studies highlighted.

Deemer et al. (2014) used SCCT to examine the indirect impact of stereotype threat, an environmental barrier, on women's intention to pursue a career in science. Results showed a negative impact of stereotype threat on female physics students' intentions to pursue a science-related career. Among chemistry students, however, stereotype threat was not found a significant predictor of career intentions. The non-significant indirect path from stereotype threat to intentions in the latter group might be explained by the mediating role of self-efficacy beliefs. Strong self-efficacy beliefs may mitigate threats to science-related career choice. Although, it is noted that this study included research intentions as another variable within the model and calculation of indirect effects. The inclusion of this variable differs from the SCCT Career Choice Model and may have impacted the results.

Garriott, Raque-Bogdan, et al. (2017) investigated the SCCT Model of Career Goals in a sample of high school students. Their research was focused on mathematics and science

careers and involved a sample of Mexican American students. Participants responded to measures of environmental support, self-efficacy beliefs, and mathematics and science career goals. Results supported the utility of the model in explaining career goals among this population. Support predicted self-efficacy and both predicted goals. These findings are consistent with SCCT in that higher perceived support is theorised to foster perceived self-efficacy and in turn generate career choices in which the individual expects to both perform well and have access to the greatest level of resources.

Turner et al. (2019) also investigated STEM career goals and actions among a sample of high school students enrolled in low to moderate SES areas. Results indicated theory consistent relationships between self-efficacy and career choice goals/actions. Outcome expectations, however, were not found to be a predictor of either. This finding is not dissimilar to tests of the SCCT Model of Career Choice in non-STEM disciplines nor tests of the SCCT Model of Academic Choice. Differences were found in outcome expectancies and environmental barriers between the SES groups. Findings suggest moderate school social economic status students have more positive expectations, and experience fewer barriers and higher levels of support.

Fouad et al. (2016) conducted a study of engineering persistence among women with an engineering degree. Their research used SCCT as one their explanatory frameworks and focused on group comparisons of people who did and did not choose to persist as a working engineer. Results indicated that people who persisted endorsed higher environmental supports than their counterparts. No group differences were found in self-efficacy, outcome expectancies or environmental barriers. Findings indicate that organisational support is an important determinant of women's persistence in an engineering occupation following graduation from a degree.

Blondeau and Awad (2016) adapted the SCCT Model of Career Choice in their study of undergraduate students enrolled in STEM courses. Their focus was on mathematics-related work intentions. Results supported the SCCT self-efficacy hypothesis among male participants in that mathematics self-efficacy predicted career intentions among men. The non-significant path from self-efficacy beliefs to work intentions among women is inconsistent with theory, however, self-efficacy was a predictor of interests in this group which is consistent with other tests of the SCCT Career Choice Model in non-STEM disciplines and supports the notion that interests mediate the paths from self-efficacy to goals. Nevertheless, findings do indicate gender differences in the understanding of mathematics career choice, a result that was also detected in tests of the SCCT Academic Choice Model. This lends weight to the argument that other factors not represented in the model tested such as sources of self-efficacy may help explain these results.

Finally, Kang and Keinonen (2017) examined the SCCT Career Choice Model among adolescent school students. Their research focused on science career aspirations and was undertaken in a Finnish context. Results of structural equation modelling supported the utility of the model across genders. Self-efficacy and outcome expectations were associated with science-related career aspirations. Notably, females reported higher outcome expectancies than their male counterparts. This study did include inquiry learning experiences, a source of self-efficacy beliefs, in the model and found learning experiences were a predictor of self-efficacy. The finding that female school students endorsed higher outcome expectations is also explained by the Finnish context in which the study was undertaken and where females are more likely to perform favourably. This indicates that cultural differences affect the strength of cognitive variables primarily through their influence on outcome perceptions. This notion is supported by Garriott, Raque-Bogdan, et al. (2017) who found moderate social economic status students had more positive expectations.

It is worth mentioning that Ramos-Diaz, Sandoval, and Barboza-Palomino (2018) conducted a qualitative study to explore women engineering students' experiences using the SCCT Choice Model constructs. Findings from thematic analysis supported the cognitive and environmental variables inclusion in the model. Themes used to represent the variables in this context included coping self-efficacy, psychological self-approval, content-goals, institutional and social supports. Their research highlighted the applicability of SCCT constructs among women in engineering. Quantitative tests of the model among women in STEM that were reviewed earlier lend weight to these findings.

2.3.3 Meta-analyses and literature reviews. The SCCT Choice Model has also been the secondary literature reviews, and meta-analytic studies. These studies sought to summarise the STEM and international literature and analyse the overall effect of the model in explaining academic and career choices across Holland RAISEC interest types and within STEM disciplines. Findings from these sources support the argument presented within the current literature review. Therefore, this next section will provide an overview of these complimentary sources and conclude with a summary of the secondary literature that investigated the SCCT Academic and Career Choice Models.

Sheu et al. (2010) were among the first to conduct a meta-analysis of primary research that tested the SCCT choice model across Holland interest types. Results supported the utility of the model across interest types. Environmental variables (i.e., contextual supports & barriers), however, were found to share an indirect relationship with choice goals through self-efficacy beliefs and outcome expectations. This finding is inconsistent with theory but corroborates conclusions made earlier in this papers review of the literature.

Fouad and Santana (2017) later reviewed the SCCT literature focused on STEM discipline choice among women and racial/ethnic minorities. Their review indicated that much of the research focused on student populations enrolled in high school and college. A

trend in workforce-related research, however, was noted in more recent publications. These studies tended to focus on underrepresented groups such as women in STEM. Indeed, this trend was evidenced by the studies included in the current paper's literature review. Most research was focused on high school and university students, a large proportion of the studies examined STEM disciplines, and several articles explored racial/ethnic groups and gender differences.

Sheu and Bordon (2016) also reviewed the international SCCT literature undertaken in locations other than the United States. Their review revealed a large proportion of the international studies originated from Asia or Europe and examined the Choice Model among STEM students. Findings indicated that self-efficacy was consistently shown to share theory consistent relationships in the model, however, differences were found in the predictive utility of outcome expectations. Again, the inconsistency in outcome expectancies prediction of the outcome variable has been well-established in the present paper's review.

Lent et al. (2018) conducted another meta-analytic study of the SCCT Choice Model across STEM disciplines. Results supported the utility of the model in explaining choices across gender and racial or ethnic groups. Group differences were, however detected in the strength of associations between groups (e.g., gender). Self-efficacy predicted outcome expectations, and both produced direct effects to choices. Although, outcome expectations were the stronger predictor of the two, indicating STEM self-efficacy informs STEM-discipline choices more so through outcome expectancies. Similarly, while supports and barriers were both found to directly predict self-efficacy beliefs and choices, the direct paths to choices were comparatively small. This finding indicates that environmental factors are largely mediated by self-efficacy beliefs and assist in explaining the non-significant relationship between the variables in Sheu et al. (2010) earlier meta-analysis.

2.3.4 Summary of the SCCT choice model. In summary, the SCCT Choice Model has demonstrated rigour across academic and career contexts, disciplines, gender, and race or ethnicity. Review of the SCCT literature has shown inconsistent relationships among variables at times and indicates further testing of the model is warranted, particularly in STEM disciplines in which group differences have been detected. Examination of the model in specific STEM occupations will assist in generalisation of the findings to previously unexplored populations. This would enable domain specific operationalisation of the constructs tailored to the Australian STEM and agriculture workforce.

This review will now focus on the most proximal and malleable factors in understanding career persistence intentions. Therefore, background environmental factors, person inputs such as predispositions, prior learning experiences and interests will not be explored. These variants are either distal in the career decision-making process or remain relatively static in adulthood. Self-efficacy expectations, outcome expectations, goals and actions, and proximal environmental supports, resources and barriers will now be discussed in relation to their prior operationalisation. Prior operationalisation will assist in informing potential measures for the current study that will be decided upon in consideration of the initial qualitative study in the current research.

2.3.5 Self-efficacy expectations. Self-efficacy refers to an individual's belief in their ability to achieve desired outcomes through their actions (Bandura, 1986). Thus, self-efficacy is conceived as an individual's judgment about their capability to perform specific tasks in service of an intended goal, as opposed to an objective measure of their performance. Self-efficacy is a core construct of Social Cognitive Theory (Bandura, 1977), and Hackett and Betz (1981) were among the first to introduce self-efficacy as a key determinant in career decision making. SCCT theorists propose that self-efficacy beliefs predict (a) outcome

expectations, (b) interests, (c) choice goals, and (d) choice actions. Self-efficacy beliefs are depicted top right of the model which is presented in Figure 2.1.

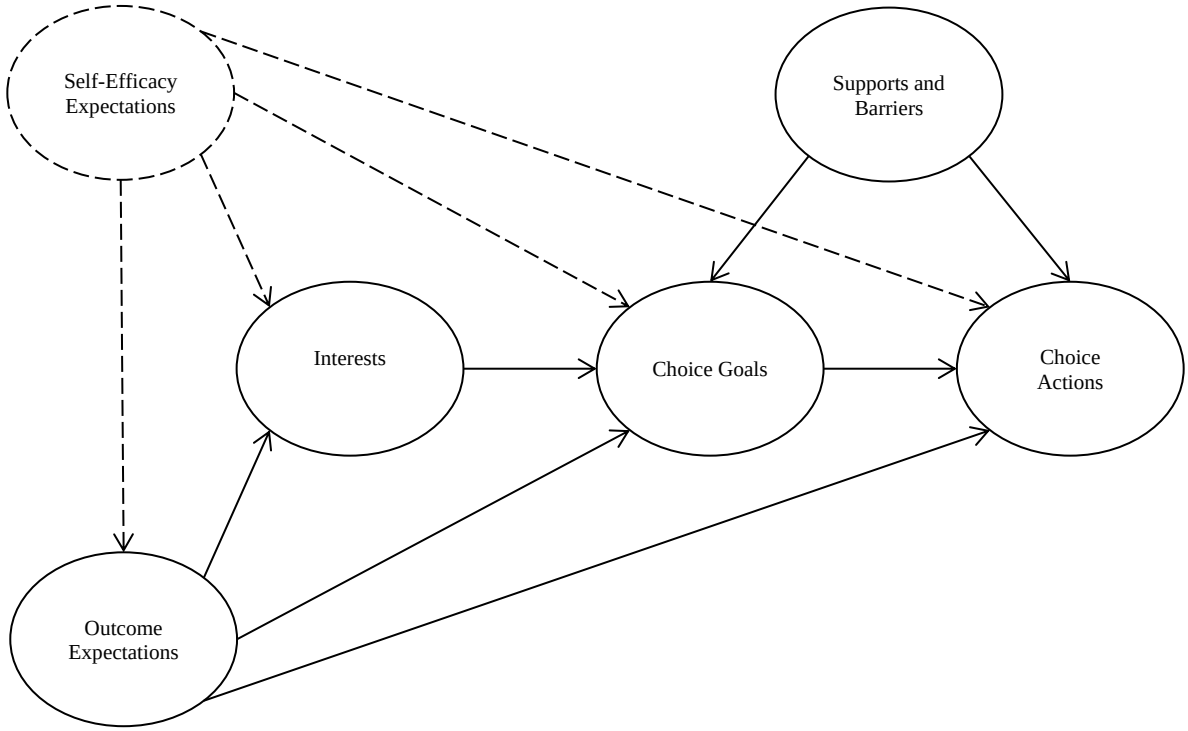

Figure 2.1 An SCCT Derived Model of Career Choice highlighting self-efficacy pathways. Note. Dashed lines highlight Self-Efficacy Beliefs and denote direct effects on Outcome Expectations, Interests, Choice Goals, and Choice Actions. Adapted from "Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance." by R. W. Lent, S. D. Brown, and G. Hackett, 1994, *45*(1), p. 93. Copyright 1994 The Authors

According to Social Cognitive Theory, there are four primary sources of self-efficacy: mastery experiences, vicarious experiences, verbal persuasion, and emotional arousal (Bandura, 1977). It is noted that task self-efficacy (e.g., I can perform a task), markedly differs from other forms of self-efficacy (e.g., coping). Coping efficacy, as described by Bandura (1997), refers to individuals perceived ability to manage environmental obstacles or barriers. Individuals with high coping efficacy are likely to believe that environmental barriers are manageable and consequently sustain goal-directed activity.

Theoretically, self-efficacy beliefs are pivotal in academic and career choice, and persistence intentions (Bandura, 1977, 1986). Self-efficacy beliefs have been widely studied in SCCT literature that has focused on academic choice (e.g., Fraze et al., 2011; Hunt et al., 2016; Inda et al., 2013; Waller, 2006). Studies of career choice have also commonly examined the predictive utility of self-efficacy beliefs (e.g., Chan et al., 2018; Kang & Keinonen, 2017; Turner et al., 2019). The influence of self-efficacy beliefs on persistence outcomes have also been the focus of several studies (e.g., Brown et al., 2016; Byars-Winston et al., 2010; Chang Rundgren et al., 2019; Deemer et al., 2019; Fouad & Smith, 1996; Garriott, Navarro, et al., 2017; Larson et al., 2015; Lee et al., 2015; Lent et al., 2015; Lent, Sheu, et al., 2010; Lent, Sheu, et al., 2008; Navarro et al., 2019).

SCCT studies that investigated academic choice outcomes operationalised self-efficacy beliefs as (a) academic self-efficacy (e.g., Garriott, Navarro, et al., 2017), (b) barrier-coping self-efficacy (e.g., Fort & Murariu, 2018), and (c) course self-efficacy (e.g., Chang Rundgren et al., 2019). The majority of these studies utilised both Lent, Brown, and Larkin (1986) Self-efficacy for Academic Milestones Scale and Lent et al. (2001) Coping Efficacy Scale (e.g., Jiang & Zhang, 2012; Kim & Seo, 2014; Lent et al., 2005; Lent, Lopez, et al., 2011). Some of which adapted, combined, added or omitted item-content to better contextualise the aggregated scales to science, agriculture and engineering (Byars-Winston et

al., 2010) or computing (Lent, Lopez Jr, et al., 2008) majors. This literature has consistently supported the hypothesised pathway from self-efficacy beliefs to interests and demonstrated mixed results for the direct hypothesised pathways from self-efficacy beliefs to outcome expectations and from self-efficacy beliefs to academic choice goals.

The SCCT Career Choice studies have measured (a) academic self-efficacy, (b) task self-efficacy, and (c) occupational self-efficacy. A wide variety of indices were used to operationalise self-efficacy beliefs. These included Glynn (2006) Confidence Learning Subscale (Deemer et al., 2017; Deemer et al., 2014), Betz, Klein, and Taylor (1996) Career-decision Making Self-efficacy scale (Chan, 2018), Yeagley et al. (2010) Self-Efficacy Expectations for Elite Leadership Questionnaire, Lapan and Turner's (2003) Investigative Scale of Mapping Vocational Challenges (Flores et al., 2010), and Cunningham et al.'s (2005) Self-efficacy Scale (Garriott, Raque-Bogdan, et al., 2017). Adapted versions of Midgley et al. (2000) Academic Self-Efficacy section of the Patterns of Adaptive Learning Scales (Blondeau & Awad, 2016), Betz and Hackett (1983) Mathematics Self-efficacy College Courses Scale (Lent et al., 1991), and Gore Jr (1996), Gore Jr and Leuwerke (2000) Occupational Self-Efficacy Beliefs scale (Lent et al., 2003; Lent, Paixão, et al., 2010) have also been utilised. Studies that tested the SCCT Career Choice Model have consistently found indirect positive relations between self-efficacy beliefs and career choice goals through interests. The mixed results for the direct hypothesised pathway from self-efficacy beliefs to goals is consistent across SCCT academic and career choice studies. These findings indicate that higher levels of confidence facilitate choices in academic and career domains of interest.

The SCCT Academic Choice studies that included an aggregated measure of both academic and barrier-coping self-efficacy showed the most theory-consistent results, with all but one study demonstrating self-efficacy beliefs as a direct predictor of choice. While researchers have operationalised barrier-coping as self-efficacy beliefs, engagement in coping

strategies can also be conceptualised as choice goal commitment (Chang & Edwards, 2015). In other words, individuals with high academic, occupational or task self-efficacy are more likely to work on difficulties encountered, increasing the likelihood that they will sustain actions in the pursuit of their vocational or occupational goals. Conversely, individuals with low self-efficacy would be less likely to apply effort to work on difficulties encountered, decreasing the likelihood that they would sustain goal-oriented behaviour relative to that vocation or occupation.

This notion is, in part, supported by the SCCT persistence studies that found a combination of academic and barrier coping self-efficacy positively predicted academic adjustment (Lent et al., 2009), goal progress (Lent, Sheu, et al., 2010) and persistence intentions (Lent et al., 2016; Lent et al., 2013; Navarro et al., 2014). This research indicates that barrier coping self-efficacy is a precursor to academic outcomes and suggests that coping may be an expression of progress towards goals in individuals academic interest domains longitudinally.

Nevertheless, evidence supports the multifaceted nature of self-efficacy beliefs and the need for self-efficacy within SCCT studies to be measured relative to the operationalisation of other variables in the SCCT model of choice. Notably Fouad et al. (2016) developed an engineering task self-efficacy scale using O*Net engineering related tasks (e.g., operating software to execute designs). A five-point scale from 1 (i.e., *not at all confident*) to 5 (i.e., *very confident*) was used to assess participants confidence in performing engineering tasks (e.g., "I am confident in researching the requirements or specifications for a new product or project"). While reliability and validity were not discussed, their work illustrates the potential for the development of a task-specific self-efficacy measure that could be contextualised to STEM professions within agriculture. This would allow for the

operationalisation of coping as goal commitment and enable testing of the relations between the two variables with choice actions and persistence intentions.

In consideration of the secondary research that found a unique effect of self-efficacy beliefs on choice actions, the strength of the predictor in explaining variance in the outcome variable has been found to be weaker than other variants within the model. For example, Lent et al. (2018) meta-analysis found outcome expectations to be the stronger predictor of STEM academic choice compared to self-efficacy beliefs and reported group differences in the strength of associations (i.e., gender). This is an interesting finding in consideration of the mixed results regarding the direct path from outcome expectations to goals and actions. These results would, however, indicate that the relations between task self-efficacy beliefs and choices are indeed partially mediated by other variables in the model and that the effect of self-efficacy is increased through its' relations with those variants. Regarding the earlier proposition, that coping be operationalised as goal commitment, it may be that confidence in STEM tasks predicts engagement in relevant coping strategies but that coping intentions accounts for higher variance in choice actions and persistence intentions.

SCCT academic and career choice studies that examined person inputs have proposed group differences in levels of self-efficacy beliefs which were shown to be influential in the model goodness of fit. With regards to self-efficacy beliefs and gender, women appear to be more likely to report lower STEM self-efficacy. This is especially evident in traditionally male dominated STEM disciplines. Furthermore, the Career Choice Model has been shown to demonstrate better fit among male samples in research that measured STEM work intentions. In other words, high self-efficacy beliefs have more consistently been shown to produce positive associations with men's intentions to pursue STEM-related work. This literature often involved student samples. Therefore, findings are not readily generalisable to working populations.

Prior research has also indicated that sources of self-efficacy differ across genders. It has been reported that, in some countries, women are more likely to perform favourably in STEM occupations. Yet, males typically appear to have a higher likelihood of exposure to STEM learning experiences than women. It has been argued that the inequalities of efficacy relevant STEM experiences confound self-efficacy results found in SCCT literature among women.

There is a gap in knowledge about the influence of self-efficacy beliefs on choice actions among STEM-trained individuals working in Australian agriculture. While gains have been made in relation to STEM disciplines, and more specifically women in STEM, which assist in theorising SCCT within a STEM of agriculture context, including the path from self-efficacy to goals and actions, scope remains to investigate the relations among SCCT variants within a workforce context.

2.3.5.1 Summary of self-efficacy expectations. In sum, self-efficacy beliefs were found to demonstrate both indirect and direct relations within the SCCT Choice Model. The hypothesised pathways performed differently between studies, demonstrating the influential role of learning experiences and negative impact of stereotypes on self-efficacy beliefs. Self-efficacy beliefs are important in STEM occupations within agriculture, in which workers are required to perform work tasks to a high standard. While individuals with low self-efficacy beliefs might have greater objective performance, confidence in tasks performed are desirable. As such, a measure of task-specific STEM self-efficacy will be developed for workers applying STEM skills within the agriculture industry.

2.3.6 Outcome expectations. Outcome expectations is a core, yet, lessor featured SCCT cognitive construct in the published literature and is depicted in Figure 2.2. Outcome expectations, theoretically, predict (a) interests, (b) choice goals, and (c) choice actions. Outcome expectations, as characterised by Bandura (1986), refer to anticipated consequences

of actions. Outcomes can be categorised as either positive rewards or negative consequences, with the former functioning as a behavioural reinforcement and the latter a deterrent. Social Cognitive Theory posits several types of outcome expectations; social, material or physical and self-evaluative. Qualitative research has indicated that generativity and relational may also be important STEM career outcome expectations (Shoffner et al., 2015).

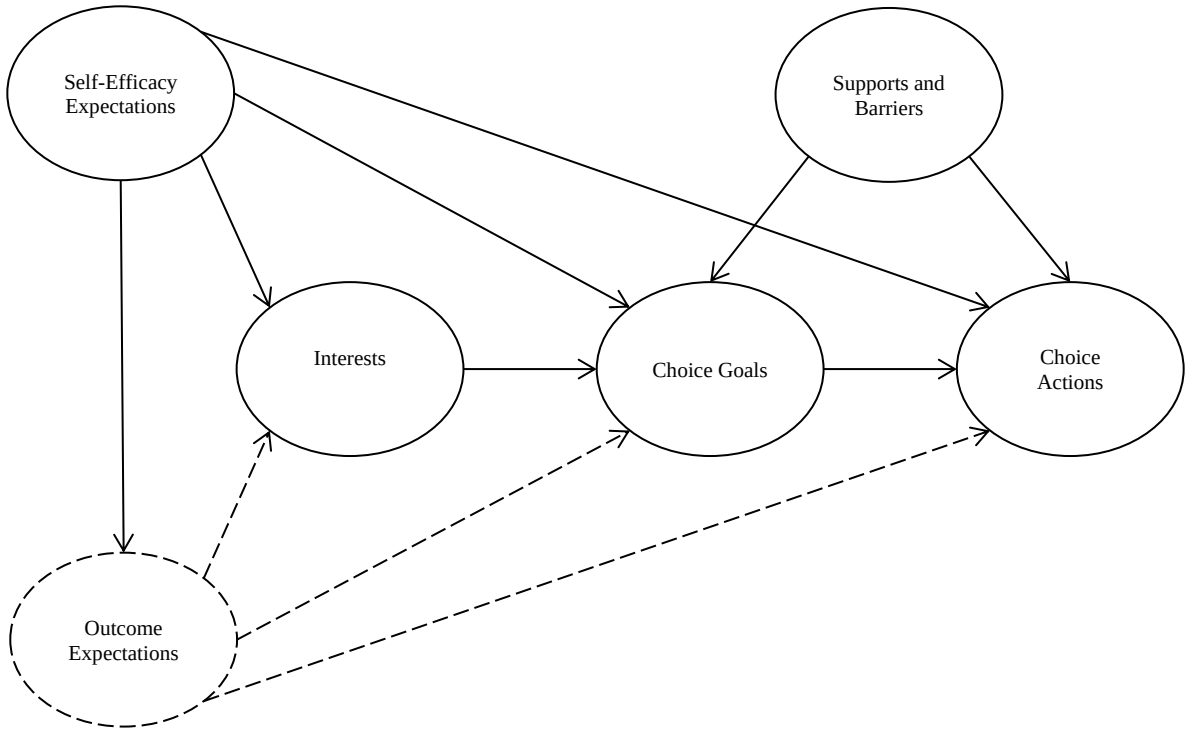

Figure 2.2 An SCCT Derived Model of Career Choice highlighting outcome expectations pathways.

Note. Dashed lines highlight Outcome Expectations and denote direct effects on Interests, Choice Goals, and Choice Actions. Adapted from “Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance.” by R. W. Lent, S. D. Brown, and G. Hackett, 1994, *45*(1), p. 93. Copyright 1994 The Authors

SCCT studies of the Academic and Career Choice Model operationalised outcome expectations as (a) positive outcomes expected from completing a degree (e.g., Byars-Winston et al., 2010; Inda et al., 2013; Lent, Lopez, et al., 2011; Lent, Sheu, et al., 2008), (b) importance and utility of learning subject knowledge (e.g., Kang & Keinonen, 2017; Turner et al., 2019), (c) positive and negative outcomes expected from engaging in an elite leadership position (Yeagley et al., 2010), and (d) positive outcomes expected from engaging in an occupation (e.g., Chan et al., 2018; Lent et al., 2003; Lent, Paixão, et al., 2010). Measures included a broad variety of extrinsic and intrinsic items pertaining to several types of outcome expectations; social (e.g., approval from others, prestige), material or physical (e.g., financial impact), self-evaluative (e.g., satisfaction, well-being), generativity (e.g., creativity), and relational such as ability to participate in desired activities (Chan, 2018; Lent et al., 1991; Shoffner, Newsome, Barrio Minton, & Wachter Morris, 2015). This research supported the direct relationship between outcome expectations and interests and the indirect relationship between outcome expectations and academic or career choice goals and actions through interests. These studies, however, found mixed results in relation to the direct paths from outcome expectations to goals and actions (e.g., Jiang & Zhang, 2012). This literature was focused on student populations and asked participants to reflect on their beliefs about future occupational, ‘‘earn an attractive salary” (Kim & Seo, 2014; Lent et al., 2005; Lent, Sheu, et al., 2010) and life, “mathematics is of no relevance to my life” (Waller, 2006) outcomes. Therefore, proximity of outcome expectations item content might be a confounding factor in the results.

One study that investigated the SCCT Model of Career Persistence in a STEM context operationalised outcome expectations as outcomes expected from completing discipline specific tasks. Fouad et al. (2016) used three measures of outcome expectations which included a combination of social, material/physical, self-evaluative and organisational

expectations workers may have such as co-worker respect, increase in salary, feeling good or valued by their organisation. Their research was focused on examining group differences in outcome expectations between women who stay and leave engineering. Therefore, the relationship between outcome expectations and persistence was not examined. While no significant difference was found between the two groups of women in their level of outcome expectations, they did differ in their level of perceived occupational organisational support. These findings indicate that expectations pertaining to organisational support outcomes may be better conceptualised solely as environmental support rather than as an indicator of outcome expectations.

There are a range of other ways in which STEM outcome expectations can be operationalised that, in part, depend on the societal context of the research. For example, more recent qualitative research that sought to contextualise SCCT variables to women in STEM found self-approval, social-community and economical outcomes were important expectations to women in engineering (Ramos-Diaz et al., 2018). This study was conducted in a Peruvian context which is a collectivistic society unlike Australia which is individualistic. Therefore, outcome expectancies of Australian STEM professionals are considered more likely to involve self-approval, social and material or physical outcomes as opposed to community and economic expectations.

2.3.6.1 Summary of outcome expectations. Overall, prior studies of the SCCT Choice and Persistence Models have operationalised outcome expectations as academic or occupational outcomes that could be expected by students or workers. However, it is possible that the proximity of the outcome to individual's present experiences may be a confounding factor in examining the relations between outcome expectations and other variables within the model. It is argued that in the current study outcomes should be measured proximally to participants current work experiences (i.e., recent reflections such as,

"over the past week"). While research on STEM persistence included an additional measure of organisational outcome expectations, review of the results suggests that this might be better operationalised as environmental support. Therefore, it is proposed that outcomes in the present study should focus on other types of expectations such as social, material or physical and self-evaluative. It is also expected that Australian workers will regard individualistic outcomes more highly than collectivistic. This will also be taken into consideration in the current study.

2.3.7 Proximal environmental influences (supports and barriers experienced during choice-making). According to Bandura (1986), environmental structures can pose both opportunities and constraints. SCCT highlights the role of environmental factors such as perceived supports and barriers on career decision-making (Lent et al., 2000). The predictive paths of environmental factors are distinguished in SCCT by the proximity of the environmental factor to the outcome domain (e.g., career choice). Distal supports and barriers such as role models shape the development of individuals self-efficacy beliefs and outcome expectations (Lent et al., 2000). In contrast, proximal supports and barriers are critical to individuals career choices (Lent et al., 2000). Supervisor support and organisational support are examples of different sources of proximal support that encourage an individual in their goal progress and positively relate to career choice making (Lent et al., 2000).

Perceived supports and barriers are hypothesised to have direct effects on (a) choice goals and (b) choice actions (Lent et al., 2000) and are depicted in Figure 2.3. For example, an individual who believes that they are receiving adequate levels of support are likely to sustain their current behaviour. Whereas, individuals who perceive a lack of support are more likely to revise their goals and subsequent actions. Perceived supports have featured more commonly in SCCT literature in comparison to barriers, likely, due to the practical

utility of their implications (e.g., career developments services). It is noted that in SCCT, barriers represent non-cognitive variables, and therefore, differs from a lack of coping efficacy (Lent et al., 2000).

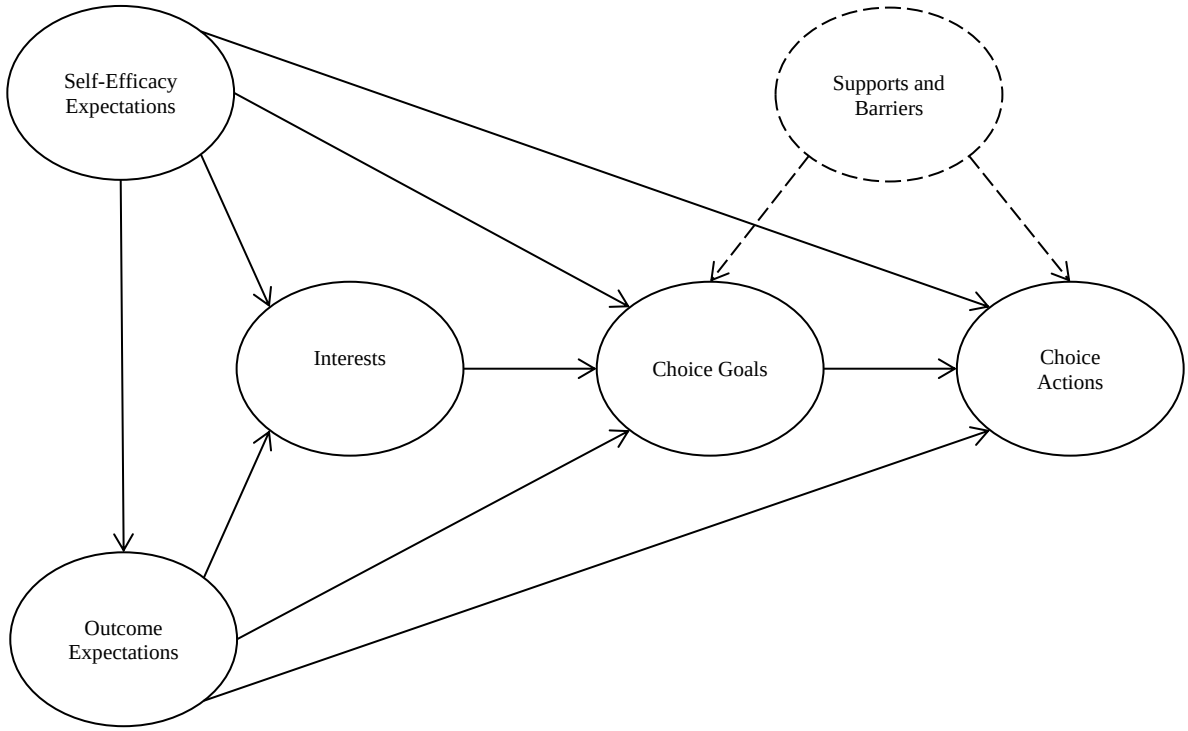

Figure 2.3 An SCCT Derived Model of Career Choice highlighting perceived supports and barriers pathways.

Note. Dashed lines highlight Perceived Supports and Barriers and denote direct effects on Choice Goals and Choice Actions. Adapted from “Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance.” by R. W. Lent, S. D. Brown, and G. Hackett, 1994, *45*(1), p. 93. Copyright 1994 The Authors

Previous SCCT research of the Academic and Career Choice Models operationalised contextual supports and barriers in various (Fort & Murariu, 2018; Inda et al., 2013) ways proximal to goals and actions. The majority of these studies measured (a) social supports (Chan, 2018; Chan et al., 2018; Garriott, Raque-Bogdan, et al., 2017; Kantamneni et al., 2018) or (b) barriers (Jiang & Zhang, 2012; Lent et al., 2003; Lent et al., 2005; Lent, Lopez, et al., 2011; Lent, Lopez Jr, et al., 2008; Lent, Paixão, et al., 2010). Some of the studies also focused on (c) academic and career barriers (Kantamneni et al., 2018), (d) financial support (Kim & Seo, 2014), and (e) instrumental and gender barriers (Kim & Seo, 2014).

Measurement of supports and barriers most often included items pertaining to parental, family member (i.e., relative), peer, friend, significant/important other or teacher attitudes. Primary and secondary studies have consistently shown mixed results for the direct path from supports and barriers to goals. Primary research has indicated that environmental variants in the model may be better conceptualised as efficacy and outcome relevant supports and barriers. Yet, a more recent meta-analysis demonstrated a small but significant overall effect of supports and barriers on STEM choice. Gender differences have also been noted in individual studies that investigated supports and barriers, wherein, women indicated greater influence from environmental factors, higher levels of support and fewer barriers than men. Hence person inputs such as gender may also affect the relations between contextual variables and choice goals and actions. It is possible though, that the inclusion of peripheral support persons (e.g., friend) might not have been the most significant indicator of academic or career choice.

Prior studies of the SCCT Persistence Model indicate that environmental support was the more helpful measure in understanding persistence goals as opposed to contextual barriers. Organisational support was one useful operationalisation of environmental support in explaining women's STEM persistence after obtaining a degree. In contextualising

supports among STEM professionals working in agriculture within the present study, perceived organisational support appears to be the most proximal of the operationalisations to prospective participants current work experiences. It is noted that beliefs pertaining to an organisation are more likely to be discussed by employed individuals, whereas other types of support are expected to be more commonly discussed by self-employed persons.

2.3.7.1 Summary of proximal environmental influences. To summarise, environmental supports and barriers have been operationalised in a variety of ways. While there have been mixed results in the relations between contextual factors, and goals and actions, it appears as though supports most proximal to choice goals and actions may be the most evidence based operationalisation of the SCCT variant. This study will, therefore, not include environmental barriers. Organisational support was posited as a potential proximal measure of STEM worker persistence in agriculture. Whereas others of lessor significance to the outcome variable such as friends will not be highly regarded for inclusion.

2.3.8 Goals and goal directed activity. Bandura (1991) Social Cognitive Theory postulates that goals as a core construct of human functioning. His theory suggests individuals formulate goals, engage in goal directed activity, monitor goal progress and sustain or revise their actions accordingly. Based on this view, individuals are driven to reduce perceived discrepancies between desired goals and actual attainments, typically through increased levels of effort expenditure, goal adjustment or abandonment (Bandura, 1991).

In the SCCT Academic and Career Choice Models, goals are described as a motivating factor that mediate outcomes. The relationship between goals and actual persistence has previously been reported (e.g., continuation in an academic major). These constructs are depicted in Figure 2.4, which demonstrates the indirect and direct effects of the

preceding variables on the variants. Theoretically, these are mediated and moderated by self-efficacy beliefs, outcome expectations and perceived supports and barriers.

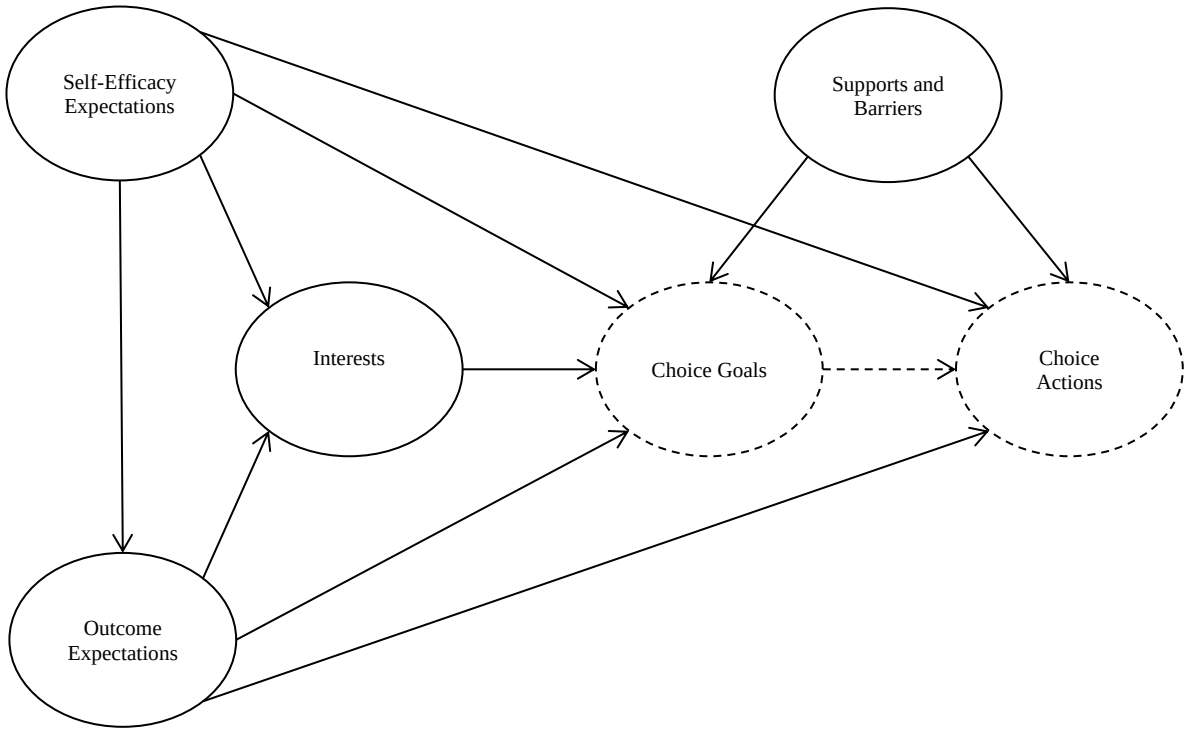

Figure 2.4 An SCCT Derived Model of Career Choice highlighting goals and goal directed activity pathways.

Note. Dashed lines highlight Goals and Goal Directed Activity. Adapted from "Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance." by R. W. Lent, S. D. Brown, and G. Hackett, 1994, *45*(1), p. 93. Copyright 1994 The Authors

SCCT studies that examined the role of choice goals and/or actions in an academic context operationalised the variables as (a) educational or academic goals (Fort & Murariu, 2018; Inda et al., 2013; Jiang & Zhang, 2012; Lent, Lopez Jr, et al., 2008), (b) STEM degree goals (Byars-Winston et al., 2010), (c) major choice goals (Kim & Seo, 2014; Lent et al., 2005), (d) maths and science goals (Garriott, Raque-Bogdan, et al., 2017), (e) engineering goals (Lee et al., 2015), (f) engineering goal progress (Navarro et al., 2019), and (g) agricultural subject and college major attitudes (Fraze et al., 2011). Instrumentation varied across studies and included a purposefully developed single item-measure (Byars-Winston et al., 2010), Lent et al.'s (2003) 4-item scale (Fort & Murariu, 2018; Inda et al., 2013; Kim & Seo, 2014; Lee et al., 2015; Lent et al., 2005), a series of 15-item attitudinal measures (Fraze et al., 2011), Smith and Fouad's (1999) Math/Science Intentions and Goals Scale (Garriott, Raque-Bogdan, et al., 2017), as well as Dik, Sargent and Steger's (2008) Goal Strivings Scale (Navarro et al., 2019).

The majority of these studies utilised Lent et al.'s (2003) 4-item scale. Some of which adapted item content to contextualise the phrasing for the participants level of education (Jiang & Zhang, 2012) or to alternative discipline majors such as computing (Lent, Lopez Jr, et al., 2008). The original scale uses a five-point response format (i.e., from 1 = *strongly disagree* to 5 = *strongly agree*) for each item (e.g., "I plan to remain enrolled in an engineering major over the next semester") wherein higher total scores indicate stronger engineering persistence goals. While the measure has evidence of both adequate reliability and validity, the scale does not provide information about goal directed activity that theoretically precedes performance outcomes or in this case intentions to persist. Only one of these studies included a measure of choice-related actions. Navarro et al. (2019) assessed goal striving and included items pertaining to goal progress (e.g., "studying effectively for examinations in engineering"). This measure also utilised a five-point scale (i.e., from 1 = *no*

progress at all to 5 = *excellent progress*) and yielded adequate reliability estimates as well as convergent and discriminant validity.

SCCT research that explored the role of choice goals and/or actions in a career context operationalised the variants as (a) career choice goals (Chan, 2018; Flores et al., 2010; Fraze et al., 2011), (b) maths and/or science career goals (Garriott, Raque-Bogdan, et al., 2017; Kang & Keinonen, 2017), (c) statistics related-activities (Blanco, 2011), (d) sports management career intentions (Chan et al., 2018), and elite leadership goals. Measures included Mu (1998) Career Goals Scale (Chan, 2018), purposefully developed 4 or 6-item scales (Blanco, 2011; Chan et al., 2018), a 15-item attitudinal measure (Fraze et al., 2011), Math/Science Intentions and Goals Scale (Garriott, Raque-Bogdan, et al., 2017), a computed variable based on a secondary questionnaire source (Kang & Keinonen, 2017), and a newly developed Goals for Elite Leadership Questionnaire (Yeagley et al., 2010). Interestingly none of these studies examined the combination of both choice goals and actions using multiple instruments. Rather, goals were typically the dependant variable of focus across studies.

While choice goals are theoretically congruent with vocational interests, the expression of goals also includes a series of actions to implement intentions. This process involves a level of commitment to engage in goal directed activity in order to remain on ones' desired path. There is a gap in the empirical literature regarding the commitment- goal directed activity- intended persistence links. Therefore, the current research will seek to understand and measure both the function of goal commitment and goal related activity in progressing persistence intentions among STEM qualified personnel working within the Australian agriculture sector.

2.3.8.1 Summary goals and goal directed activity. In summary, choice goals and actions are posited as outcomes of the social cognitive constructs such as self-efficacy and outcome expectations, as well as contextual affordances. Goal commitment and activity are

argued as important functions of intended persistence. While many prior studies have operationalised goals as the dependant research variable, goals can be expressed in various ways that may precede continued persistence in an occupational domain. Consequently, further research is warranted to understand these SCCT constructs within a previously unexplored occupational population.

2.4 Adapted SCCT Model of Career Persistence Intentions

Based on the literature reviewed, SCCT self-efficacy and outcome expectations, as well as supports and barriers propositions require further testing to better understand the interrelations among variants. In an occupational context, the most proximal and modifiable factors represented within the SCCT Career Choice Model included self-efficacy beliefs, outcome expectations, goals and directed activity, and supports or barriers. Therefore, these constructs form the variables of interest in the current investigation. Self-efficacy has previously been operationalised as task-specific and will be considered for the purposes of the present research. Proximal outcome expectations that represent individualistic attitudes will also be explored in the current research. Furthermore, contextual supports such as organisational support have demonstrated the strongest evidence above that of barriers and will therefore form the focus of further enquiry within this study. Goal commitment and activity have previously been unexplored as separate goal processes, and therefore will be further examined in this study. The resulting model is presented in Figure 2.5.

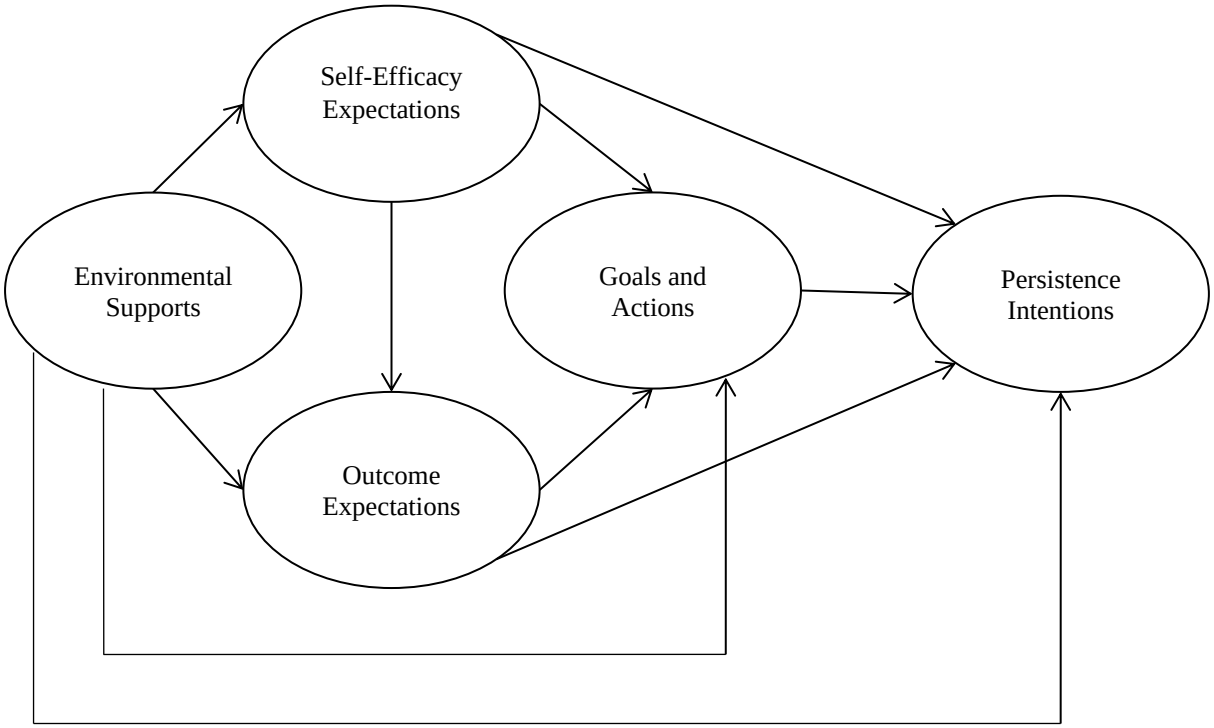

Figure 2.5 Adapted SCCT Model of Career Persistence Intentions. Adapted from "Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance." by R. W. Lent, S. D. Brown, and G. Hackett, 1994, *45*(1), p. 93. Copyright 1994 The Authors

2.5 Research Aim, Objectives and Questions

There is a lack of research investigating SCCT constructs within a work context. Moreover, there is limited knowledge about the relevance of SCCT constructs (e.g., self-efficacy) with respect to careers of professionals working in STEM occupations in agriculture. Therefore, the aim of this research is to evaluate the effect of SCCT constructs on agricultural career persistence intentions. Specifically, the objectives of the current investigation are to: (a) explore the nature of SCCT constructs among agricultural scientists, technicians, engineers and statisticians; (b) identify appropriate measures to operationalise SCCT constructs within an agricultural career context; (c) analyse the impact of SCCT constructs on agricultural career persistence intentions. The following research questions were formed based on the literature reviewed to assist in carrying out the research aim and objectives:

Research Question 1: What are key occupational interests, self-efficacy beliefs and outcome expectations of agricultural scientists (e.g., technicians, engineers and statisticians)?

Research Question 2: What are key occupational supports and barriers among agricultural scientists (e.g., technicians, engineers and statisticians)?

Research Question 3: What measures are appropriate to operationalise SCCT constructs within agricultural professions?

Research Question 4: What SCCT factors influence scientists, technicians, engineers and statisticians' intentions to persist in agricultural careers?

CHAPTER THREE: METHODOLOGY

This section discusses the current research endeavour, methodology, theoretical and epistemological underpinnings. Therefore, this chapter will follow the proceeding format. First the research paradigm will be outlined. Second axiological considerations will be made, and a researcher-as-instrument statement will document my personal engagement in the research project. Finally, an explanation will be presented for the chosen research design.

3.1 Research Paradigm

The current investigation adopts the scientific method to investigate SCCT constructs within an agricultural career context. Post-positivists argue that knowledge is subjective but can be accessed via measures that approximate people's beliefs (Morrow, 2005). Within the post-positivist paradigm (Morrow, 2005) both qualitative and quantitative research methods are accepted as valid approaches (Hanson, Creswell, Clark, Petska, & Creswell, 2005; Tashakkori & Teddlie, 1998) to collect and analyse data. Consequently, this research is framed within a post-positivist paradigm and a mixed-methods design will be used to allow for the contextualisation of the SCCT model of career choice to agricultural scientists, technicians, engineers and statisticians work. This design also enables the researcher to operationalise SCCT constructs using domain specific measures to adequately capture important variables related to this occupational groups' career experiences. Therefore, it is proposed that a mixed-methods design is appropriate (Hanson et al., 2005; Tashakkori & Teddlie, 1998) within a post-positivist (Morrow, 2005) methodology to interrogate the SCCT model of career choice among agricultural scientists, technicians, engineers and statisticians. This point will be discussed further later in the chapter.

Following the principles of the SCCT, it is argued that there is a need for domain specificity in measurement models and advocacy for the contextualisation of conceptual models of career behaviour to specific occupations (Lent, Brown & Hackett, 1994). The

primary aim of this investigation is focused on gaining knowledge about workers perceptions of their career experiences using the SCCT model of career choice as an organising framework. While this research adopts SCCT as the overarching theoretical perspective to understanding career persistence among scientists, technicians, engineers and statisticians, the primary researcher also acknowledges the influence of the investigators' prior knowledge and theoretical orientation on maintaining objectivity.

SCCT assumes that occupational perceptions direct motivation at work and career-related behaviour. Within this theoretical framework, personal beliefs are considered to interact with environmental influences in shaping expectancies of behavioural outputs and future intentions (Lent et al., 1994). Hence, from this viewpoint knowledge is constructed in-relation with social interaction, and career experiences which vary between individuals, across occupational disciplines and specific work environments. Therefore, it is not possible to answer the research questions using objectively measured data alone.

Agricultural scientists, technicians, engineers and statisticians career experiences likely differ from their cross-industry counterparts who operate more often from metropolitan areas, and therefore, may encounter different socialisation and environments in their work. Their work role in terms of position description also markedly differs from traditional agricultural roles which typically involve on farm labour or management. Additionally, these individuals also tend to work for organisations rather than the farmers themselves. So, there are numerous nuances associated with this line of work that need to be captured in the current study via qualitative research.

3.2 Axiological Considerations

In any psychological research, the investigator is influential in carrying out the research, but this is especially evident regarding the current qualitative project wherein researchers cannot be entirely impartial to their own biases. Investigators have power over

project conceptualisation, including the definition of the problem, literature review, methodological decisions, data collection and analysis, as well as the lens through which results are interpreted. This has the potential to lead to skewed judgements that might undermine the rigour of the research. Consequently, it is believed necessary to declare investigators prior exposures, personal assumptions and values that could introduce bias within the research process. Hence, the investigators position will be discussed further in the next section as a declaration of their axiological stance and with the view to more adequately inform the reader of the investigator's personal values and frame-of reference in undertaking the study (Morrow, 2005). To ensure this is achieved, the primary investigator offers some transparency through a summary of their related personal, educational and work experiences accompanied by a reflection on motivation to engage in this line of research.

3.3 Researcher-as-Instrument Statement

3.3.1 Personal experience. Over the course of my education and career I have engaged in a relatively broad array of learning and work experiences. My first work experiences were as an adolescent when I was still undertaking high school. At around age 14 I began umpiring at a local netball club and accepted a job offer at a fast food outlet before undertaking a school-based traineeship in customer service where I worked for the remainder of my schooling years. In 2007 I completed secondary education and at age 18 I undertook vocational education in screen and media. Since that time, I have held several casual and contract-based roles across different companies, completed my diploma in screen, as well as undergraduate degree, honours year and master's coursework in psychology.

In my opinion these experiences have been highly influential in the development of my career preferences. During my vocational and higher education, I engaged in customer service and retail marketing positions as a 'brand ambassador' that enabled me to meet my personal financial and emotional needs. At the time I was a young adult, developing core

employment skills, and needed a job to earn enough money to cover living expenses and live comfortably. Despite the relatively narrow job opportunities available to me during that time, I still perceived having those positions as a privilege and enjoyed the sense of accomplishment gained through the work that I performed. However, as my work experience expanded and I attained formal qualifications, I found that the work opportunities available to me were broadened. I developed a greater level of self-knowledge and began to make work choices that were more closely aligned with my career values.

I realised the importance of education to my career, gained insight and appreciation for my relentless desire to further develop my knowledge, a keen interest in helping others, and passion to make a meaningful contribution to the broader society through my work. So, I took steps to volunteer as a crisis phone counsellor, completed externships as a provisional psychologist, pursued casual job opportunities as a university tutor, marker, and lecturer that enabled me to apply the knowledge gained through education in an occupational context. This afforded me the opportunity to 'give back' by helping to facilitate other people's mental health journey and higher education pursuits.

While I acknowledge that I have been highly motivated to engage in educational and work experiences that align with my occupational interests and satisfy my career values, environmental factors have also played a role in determining my career intentions. I was advised that, on average, people spend at least 30 percent of their time each week working. I realised that I have regularly fit that profile. This is a proportion of my life that I would prefer to be spent in a work role that facilitates my well-being. Therefore, I believe that an adequate level of perceived occupational support is vital, especially during challenging periods at work to assist in affirming your work-related outputs and contributing toward maintain one's confidence on the job.

In part, I attribute my ongoing motivation to pursue a career in psychology, research and higher education to the perceived positive reinforcement from others. Personally, I have had key supportive family members who have demonstrated a willingness to relocate or otherwise tolerate decisions that I made to move in order to progress my ongoing higher education, passions for psychology and research. Professionally, I believe that I have studied and worked at a university that values student success and through which has provided additional supports in the form of connecting me into positive supervisory relationships, career development opportunities and a Research Training Scheme scholarship.

My career journey, however, has not all been 'smooth sailing'. Indeed, I have perceived several obstacles in my career. For example, due to the casual and contract nature of the job offers extended via the organisations that I have chosen to engage in work with, I have held intermittent concern around my financial security in those roles. Similarly, educational support is not necessarily a readily available resource that is always immediately accessible. The requirement to self-manage workload and complete tasks independently, I found at times, can also lead to periods of self-doubt about your ability to perform the role in accordance with perceived expectations.

3.3.1.1 Summary of personal experience. In summary, I would describe myself as a career motivated individual who not only values the importance of work as a source of basic needs but as a contributor towards psychological wellbeing and a context to strive for greater self-actualisation. I perceive many work-related issues as obstacles that can often be overcome with a resilient attitude, the help of a strong personal network and importantly the support of the organisation and supervisory team under which an individual is employed. Given my own experiences, values and beliefs, my theoretical orientation using SCCT as an explanatory model makes sense to me both personally and in the context of this research.

3.4 Psychology and Work

I argue that psychology has the means necessary to investigate issues of career motivation, choice and persistence among diverse populations. I believe that this is important because of my own career development and occupational experiences but also due to my own professional fascination with understanding the drivers of people's career pursuits. I believe that careers have changed over the years, no longer is a career just the progression through work roles but a compilation of experience that qualifies person to undertake a variety of work roles which could be applied across disciplines. Yet, I have noted scepticism from others about whether psychology as a discipline can assist with practical workplace issues in these various contexts.

My experience of public opinion tends to focus on negative perceptions of psychology in the workplace. The common term appears to be that psychologists exist only to 'psychoanalyse' people and satisfy their own, ulterior, personal motive. This is likely a small subset of the population, yet I have found their opinions to be loud and influential in altering my own perception of how well psychological interventions are received among the community. I myself have personally been deterred at times by public criticism of this profession. However, I have personally engaged in career counselling services, had useful, positive experiences and believe in the interventions available to university students. This is even more so since undertaking my higher education that lead to me better understanding the evidence on which those interventions are based. Moreover, I advocate for career counselling services more broadly as I see the role that they play and future potential in providing timely intervention regarding career interests, choice, and capacity development in our communities from the very young to mature aged persons.

3.5 Motivations for the Current Research Project

My educational experiences have predominately influenced my motivation to complete the current research project. This is illustrated through a plan to complete a PhD first developed during my honour's studies, influenced by situational circumstances (i.e. Research Training Scheme) that supported my endeavours, and an overarching driving passion to apply my psychological knowledge and skills to better understand the key factors that affect people's occupational decision-making and ultimately desired career choice. Prior to undertaking my PhD, I had little exposure to the agriculture industry, and while I possessed training in science, I had poor knowledge of the important work STEM trained professionals undertook in regional Australia or the agriculture industry. Therefore, my initial motivation to undertake this project stemmed largely from my own personal strivings and a desire to contribute to the vocational psychology research agenda which ensured unbiased data collection and analysis.

While, at first, agriculture provided a platform for me to explore my career interests, I also gained a new-found personal appreciation for the industry over the course of carrying out this project. I took it upon myself to better educate my family and peers about agriculture because I was surprised to learn how little other people knew about the contributions of the sector to maintaining their own nourishment and clothing. Inadvertently, it became my endeavour to inform others about the diverse roles available to STEM trained professionals in the field to anyone who asked me about the line of research that I was involved in.

I noticed that I ended up gaining a lot of satisfaction from general conversation with people about the topic who, just like me, were at first ignorant to the science behind agriculture and the international impact of innovation in promoting productivity or sustainability. I found many people were simply not informed food and fibre consumers. So, in a small way, I felt proud that I put world hunger back on the radar for a sub-set of the

population who I found through those conversations comforted themselves with the notion that it was no longer an issue of significance. I think that the challenge presented from my friends, family and associates in explaining the importance of my research was ultimately the hinge factor that drove my passion for this particular project and contributed to fulling my belief that I could use vocational psychology to make a small but meaningful difference.

3.6 Research Design

A sequential exploratory mixed-methods design (Watkins, 2015) in which both qualitative and quantitative approaches are combined will be used to investigate the effect of SCCT constructs on agricultural career persistence intentions. Therefore, there are two data collection and analysis phases involved this research. First, a qualitative approach will be used to undertake the initial study, followed by a larger quantitative study. These phases are discussed in more detail below.

The initial qualitative phase will be used to explore the nature of SCCT constructs among agricultural scientists, technicians, engineers and statisticians and identify appropriate measures to operationalise SCCT constructs within an agricultural career context. This approach is the most appropriate to answer Research Questions 1, 2 and 3 which are focused on describing and interpreting scientists, technicians, engineers and statisticians experiences at work. Furthermore, a qualitative approach will enable the researcher to work with the participants to gather richer information and gain deeper insights into their career-related experiences than a quantitative cohort study or survey design alone which would impose more rigid theoretical boundaries around the nature of professional careers in agriculture.

A second quantitative phase will then be used to analyse the impact of SCCT constructs on agricultural career persistence intentions. A quantitative approach is considered the most appropriate to answer Research Question 4 as it is concerned with testing a model of career persistence intentions among scientists (technicians, engineers and statisticians). This

question is not better answerable using a qualitative approach alone because of the subjective nature of qualitative data and inability to generalisable findings to the broader population. Quantitative data that enables statistical modelling of constructs and predicted relations data will, therefore, enable the researcher to compliment the initial study with objective evidence about the relationship between SCCT constructs, and persistence intentions.

There are various strengths associated with qualitative and quantitative research. Therefore, it is argued that a mixed-methods design offers a superior approach to meet the overall aim of this project (Hesse-Biber & Johnson, 2015). Qualitative data from Study One will be used to inform and develop a rationale for the choice of measures (i.e., establish face validity) to operationalise SCCT constructs among this occupational group in the second study, while quantitative data from Study Two will provide evidence about the strength and direction of relationships among those variables as well as an estimation of the likelihood that identified relationships occurred by chance. Key stakeholders are also likely to respond more favourably to recommendations derived from a mixed-methods research design because both approaches have inherent weaknesses that may limit the confidence with which findings can be interpreted. For example, qualitative research has often been criticised regarding trustworthiness and rigor, and quantitative research critiqued for the use of superficial data which lacks context. Therefore, one of the key advantages of this this approach is that the qualitative data will be used to refine the quantitative research method and enrich the final discussion section by contextualising the numerical results in relation to STEM qualified agricultural workers (e.g., scientists, technicians, engineers and statisticians), while still maintaining the overall rigour of the project. See Figure 3.1 for a visual depiction of the interrelation between Study One and two.

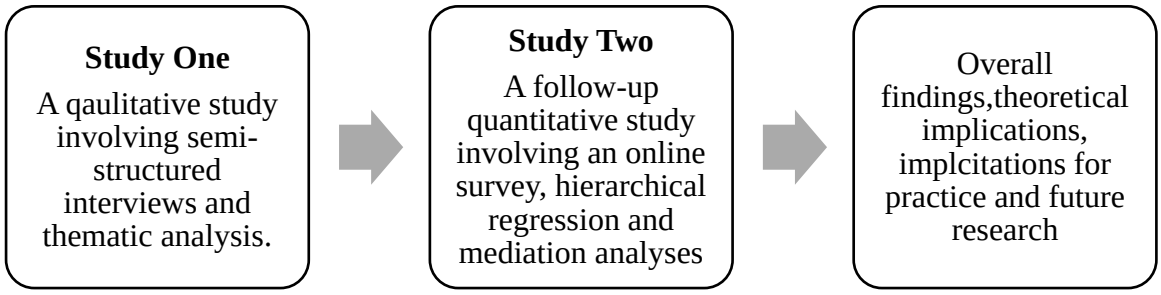

Figure 3.1. Research design for the current research project.

3.7 Conclusion

This section outlined the current research endeavour and explained the overall aim, three objectives and four research questions. This research was positioned within a post-positivist paradigm and associated theoretical and epistemological underpinnings were discussed. Axiological considerations were addressed, and a researcher-as-instrument statement provided to inform the reader of the researcher's biases and theoretical stance. Finally, an explanation was presented for the chosen mixed-methods research design and an argument put forward regarding its appropriateness, rigour and confidence among key stakeholders. The research methods are detailed further in the methods sections contained within the following two chapters.

CHAPTER FOUR: STUDY ONE

This section restates the purpose of Study One and further outlines the method used in undertaking the initial study of the current research project. First the purpose and recruitment strategy will be covered, followed by a description of the participant characteristics. The procedure will then be discussed, and the approach to analysis presented. The results and discussion are included together as one sub-section. Results from this initial study will also be integrated into the overall discussion chapter presented later in the thesis.

4.1 Purpose

The purpose of Study One was to (a) explore the nature of SCCT constructs among STEM-skilled professionals working in the Australian agriculture sector and (b) identify appropriate measures to operationalise SCCT constructs within STEM-related agricultural professions. This study was used to answer the following research questions:

1. What cognitive factors influence STEM-skilled professionals' decisions to work in the Australian agriculture sector?
2. What proximal contextual factors influence STEM-skilled professionals' decisions to work in the Australian agriculture sector?
3. What measures are appropriate to operationalise SCCT constructs within STEM-related agricultural professions?

Therefore, an appropriate recruitment strategy was required to adequately cover each profession within the agriculture industry and will be discussed in the next section.

4.2 Method

4.2.1 Recruitment Strategy

The intended recruitment strategy for Study One was purposive to ensure that a spread of people across STEM disciplines were involved in the qualitative research phase. Prospective participants were predominately identified via existing personal and professional

relationships. Individuals were also approached regarding their potential involvement in the study via either social media (e.g., Facebook, Twitter and LinkedIn), face-to-face communication, phone or email correspondence. They were provided with a Participant Information Sheet (Appendix B) upon request. The Participant Information Sheet provided a description of the project being undertaken, information about what was involved in participation, expected benefits and potential risks, as well as details regarding privacy and confidentiality. Further questions were directed to the broader research team and any concerns regarding the conduct of the project were welcomed to be directed to an independent ethics coordinator.

Snowball sampling was, however, required to identify additional prospective participants working in the agriculture industry and across different organisations. Assistance was sought from people who participated, declined participation, or otherwise deemed ineligible to participate, in order to identify other eligible professionals working in the field. People who lived in regional areas, performing work tasks in or for regional locations within Australia were prioritised. While residence in regional or remote, rural, regional Australia was desirable, it was not a requirement of participation. A summary of the final sample for Study One is provided below. All participants were provided with and completed a Participant Consent Form for the research project.

4.2.2 Participants

The final sample consisted of 10 participants (male $n = 6$) aged between 25 and 35 years who identified as STEM trained professionals (S $n = 4$; T $n = 3$; E $n = 2$; M $n = 1$) and working within the Australian agriculture industry. The sample size was considered to be adequate given that at least one representative from each subpopulation was recruited (Boddy, 2016). Nine participants indicated that they were an employee and one participant was a business partner. Their titles at the time of data collection were: Biometrician (Participant B),

Production Agronomist (Participant A), Senior Technical Officer (Participant C), Postdoctoral Research Fellow (Participant's E & G), Senior Research Fellow (Participant I), Co-Founder (Participant F), Program Manager (Participant D), Chief Executive Officer (Participant H), and Mechatronic Research Engineer (Participant J). Agriculture industries that the participants contributed to in their work included seed, soil, cotton, wheat, and livestock. All the participants resided in locations within Australia, predominately in regional, rural or remote areas, with only two who identified as living in a metropolitan area (i.e., capital city). These two participants were still included in this study as they performed work directly related to agriculture and building regional resilience, just not from a regional, rural or remote location.

4.2.3 Procedure

Data was collected through individual, semi-structured interviews which ranged in duration from 40.5 to 60.5 ($\mu = 52.6$) minutes. Eight interviews were completed using video or audio conferencing, and two interviews were conducted in person and recorded via Zoom at an agreed time and venue. All interviews were recorded and transcribed by the principle researcher, except two that were considered to have poor audio quality. These were subsequently outsourced for transcription from a professional service in order to retrieve optimal amount of data. All participants were informed of their right to terminate the interview or withdraw their data at any time without penalty. Participants were also welcomed to recommend other prospective participants who may be eligible and agreeable to participate in the study at the conclusion of their interview.

An interview schedule was developed (Table 4a) to guide the interviewer in eliciting focused commentary in relation to the SCCT constructs of interest to the current investigation. First, participants were asked about their age, where they grew up, currently live and work. Participants were then prompted to discuss their career experiences, interests and goals. All sessions were thereafter structured around the participants responses.

Individually tailored questions were used to gather information on the main domains of interest to the study and unscripted follow-up questions were used throughout to gather further data on specific concepts discussed with participants. Therefore, the content of the participants answers largely dictated the direction of the interview and allowed for elaboration on important issues, clarification of their initial reactions or expansion on relevant subjects. There were also many instances in which the interviewer deemed participants to have sufficiently covered a topic, therefore, no further inquiry was pursued in regard to that pre-determined line of questioning.

4.2.4 Ethical Considerations

Ethical approval for this study was granted by the University of Southern Queensland's Human Research Ethics Committee. An additional amendment regarding participant recruitment of a specific subpopulation was submitted which also gained the approval of the committee. The Ethical Approval Number is as follows: H17REA176. Recruitment was not pursued until ethical clearance was granted for each respective participant group. Therefore, the appropriate ethical protocol was adhered to prior to data collection.

Privacy was also assured as prospective participants were advised that their responses were confidential, and would not be identifiable by their employer, colleagues or other professionals (etc.) within the field. Therefore, consideration needed to be taken regarding how to manage the reporting of data in relation to identifiable terms, locations, people, and

Table 4a

Interview Schedule

"I will be asking a number of questions related to your career experiences, interests and goals. There are no right or wrong answers, the information collected will be de-identified".

Construct	Question
Demographic Details	How old are you? Where did you grow up?
Background Information	Can you describe a bit of your background in terms of your education and training? How did you get into your current job and how long have you been employed there? Tell me a bit about your role and the important tasks involved? Where is your work predominately located? What were you doing before? If you could do any other job, what would you be doing?
Self-Efficacy	Task-specific self-efficacy: What does a person need to be able to do to be good at your job? What type of person is successful in fulling the full diversity of work demands? How did you learn how to perform the role? Coping efficacy: What factors are the most useful in overcoming challenging work situations in your field? Process efficacy: How would you describe work life management in your industry? Self-regulatory efficacy: What motivates you to continue in the work that you do? Generally, how motivated are people in the industry to undertake professional development or otherwise improve their work?
Outcome Expectations	Social: How respected would you say your industry is among the community and in your social circles? How long do you think you will work in this job?

	Material: Generally, how do find that people working in the field are rewarded for this commitment? How attractive do you find the work is to prospective employees in terms of meeting their job expectations or needs? Self-evaluative: How personally gratifying have you found your career? What are some key reasons that you think people enter the agriculture field? Tell me about the meaning and purpose involved in doing your job?
Goals	What motivates you to do the work that you do? Choice-content goals: What are your career aspirations? What does a successful career look like to you? How inspiring would you say being involved in the agriculture industry is? Performance goals: What's the most important thing that you want to achieve in your work? Personally? In your current role?
Interests	What interests you about the things you do in your chosen career? What are you doing at work when you are most engaged or enjoying what you do?
Supports	How encouraging have you found others to be in pursuing your chosen career? What do you think are the most useful resources to draw upon to be successful in your career? Tell me about the conditions and people that you encounter in your work?
Barriers	What is challenging about your job? What other things could possibly go wrong in your line of work? Tell me about some obstacles that you have found can get in the way of achieving work ambitions in your field? What other factors have you found stops people enjoying or persevering in their work?

Is there anything else that you think we may have missed?

any other information that could be used to re-identify the participant. These identifiable terms were subsequently omitted and replaced with generic synonyms, locations or reference to others in this thesis. Removal of identifiable terms and assurance of anonymity were essential processes as participants were encouraged to report on positive, neutral, and negative aspects of their career experiences which could be anxiety provoking and lead to undue distress should that data not be adequately de-identified.

4.2.5 Trustworthiness and Rigour

Trustworthiness and rigour of the qualitative study have been considered. An extensive Researcher-as-Instrument Statement was provided in the previous chapter to acknowledge personal biases and ensure that the coders assumptions were made explicit to the reader. I also indicated a novice stance in the field of research as a provisional psychologist and recorded field notes to refer to and cross check initial impressions against the final interpretations. A semi-structured interview schedule was provided to demonstrate the attempt to collect both depth and breadth of data, in communication with and approval by the primary research project supervisor. It is understood that this illustrates an appropriate attitude to promote researcher reflexivity in a qualitative research (Morrow, 2005).

4.2.6 Data Analysis

An adapted version of thematic analysis (Braun & Clarke, 2006) was used to analyse the interview transcripts. This analytical method allowed the principle investigator to identify codes and latent themes that reflected patterns across the entirety of the data. Decisions involving the data set such as what constituted a pattern and the prevalence required to generate a theme were initially made following the process described by Braun and Clarke (2006). The style of thematic analysis used in the current research thereafter differed from the original Braun and Clarke (2006) approach. In order to answer the research

questions, the later phase of analysis was instead decidedly theory-driven and deductive in nature. A description of the actual analytical approach is provided below.

First, the principle investigator listened to the recordings of each interview at least twice while transcribing the interview data but before completing the initial coding of the participants answers. Only then were responses imported into NVivo, computer assisted qualitative data analysis software. Once familiarised with the content of the responses and software, the principle researcher proceeded to analyse the data in a systematic, yet flexible manner and with the support of the NVivo data management functions.

There were several iterative phases of data analysis in which codes were generated, interrogated, renamed, and, or merged. For example, several codes were found to be more descriptive rather than interpretive of the interview data, some appeared repetitive and on review were found to represent similar patterns across the data set. The final codes were organised within themes established using the SCCT model of Career Choice. These themes were: Self-Efficacy Expectations; Choice Goals and Actions; Environmental Supports and Barriers Proximal to Goals and Actions; Outcome Expectations; and Personality. Each theme was assumed to be related to the outcome variable within the theoretical framework – career choice and persistence.

The face validity of measures was then evaluated according to the codes and themes generated from the interview data. This involved critical analysis of each code against items considered to operationalise aspects of each SCCT construct that had been identified as a predominant theme. The final cross-analysis is presented in the results section (Table 4b).

Table 4b

Themes, Codes, Proposed Operationalisation and Measure

Theme	Code	Operationalisation	Measure
Self-Efficacy Beliefs	Acceptance of responsibility and ability to communicate Confidence to work and grow within the industry Conflict management and emotion coping skills Problem-solving skills and ambiguity Project management and attention to detail Self-management and research related skills STEM skills and abilities (other) Educational and occupational learning experiences Perceived reinforcement or discouragement from others	Task Specific Self-Efficacy	9-item measure developed to assess confidence in performing STEM tasks within the agricultural sector.
Choice Goals/Actions	Adaption to the work environment and job requirements Resilience and coping self-efficacy at work	Problem-Focused Coping Work Engagement	Problem-Focused Coping Scale: Reflective Style

	Challenges and environmental obstacles at work Motivation for ongoing learning and education Positive mind set, determination and drive It is important to switch off and self-reflect		subscale (Heppner, Cook, Wright, & Johnson, 1995) Utrecht Work Engagement Scale (Schaufeli, Bakker, & Salanova, 2006)
Proximal Environmental Influences (Supports and Barriers Experienced During Choice-Making)	Collaboration, support, networking and guidance High workload, pressures and demands Organisational flexibility and special benefits Perceived professional development opportunities Workplace culture, investment and value in individuals	Perceived Organisational Support Perceived Supervisor Support	Survey of Perceived Organizational Support (Eisenberger, Huntington, Hutchison, & Sowa, 1986) Survey of Perceived Supervisor Support (Kottke & Sharafinski, 1988)
Outcome Expectations	Financial security, renumeration and work hours Title, promotions and recognition Work conditions, structure and resources Team relationships, mentoring and role Attraction and perceived fulfillment	Positive State Affect Needs Satisfaction	Career Exploration and Decision Learning Experiences Scales (Emotions scales) 4-item parcel adapted from the Minnesota Importance

	Perceived job opportunities and choice Perceived emotional and physical isolation		Questionnaire (Gay, Weiss, Hendel, Dawis, & Lofquist, 1971)
Personality	Willingness to try new things and learn Reliable, ethical, empathetic and considerate	Variety Seeking	International Personality Item Pool Scale: Positively keyed items ("International personality item pool: A scientific collaboratory for the development of advanced measures of personality traits and other individual differences," 2020)

4.3 Results

The following results presented represent the data derived from participant interviews and the accompanying discussion interpret that data through an SCCT lens. This section will, therefore, discuss how each code informs the themes identified as an SCCT construct in detail. An argument will also be presented to operationalise each construct either using predetermined measures or newly considered questionnaires supported by a critique of each code and corresponding data pieces.

4.3.1 Self-Efficacy Expectations

This section describes the codes that are conceptually consistent with the SCCT self-efficacy construct. In a work context, self-efficacy concerns a range of factors including an individual's perceived ability to perform work tasks and cope with challenging work situations (Lent & Brown, 2006). The data were coded as:

- Educational and occupational learning experiences;
- Perceived reinforcement or discouragement from others;
- Conflict management and emotion coping skills;
- Problem-solving skills and ambiguity;
- Acceptance of responsibility and ability to communicate;
- Project management and attention to detail;
- Self-management and research related skills;
- STEM skills and abilities (other); and
- Confidence to work and grow within the industry.

When examining the findings through the lens of SCCT, efficacy-relevant information was conceptualised as a) sources of self-efficacy, b) coping self-efficacy and c) task-specific self-efficacy respectively.

In relation to the sources of self-efficacy identified in the interview transcripts, the participants described the influential role of a) education, b) occupational experience and c) reinforcement in developing confidence to work in the agriculture sector. STEM professionals acknowledged the diverse application of their skills within an agricultural context and perceived education as a starting point in their career development:

> "I suppose in our course we don't come out knowing a lot, ah we we're, we're are taught how to learn and what things to look for but it's broad. Agriculture is such a complex, ah (sic) industry that you don't you can't ever know everything, you can just learn a bit about the soil and what you want to look for, or crops or, or animal physiology or the like to give you a basis of, of how everything interacts and affects one another without necessarily preparing you to know anything, because when you go out to industry you are going to be a bit more specific in what you're doing" (Participant F).

In this excerpt, the participant highlighted the discrepancy between the breadth of the material covered in their education and the depth of knowledge required to perform specific work tasks. While education leads to a sense of preparedness in individuals perceived ability to continue to learn in a practical context, occupational experience itself was also highly regarded in relation to the development of STEM skilled professionals' self-efficacy.

Industry experience enhanced workers' knowledge of agriculture and improve their sense of credibility to contribute to the field beyond the level of formal education received. The participants believed that a STEM professionals' ability to do a good job in the agriculture sector was perceived to increase in accordance with the amount of work experience acquired. Individuals who consider themselves to have a strong background in agriculture would likely have positive self-efficacy beliefs about their work, be more engaged in occupational tasks, and have confidence that their efforts will produce expected outcomes.

Participant B, a biometrician, reflected on their supervisor's experiences and the contribution of occupational knowledge to the development of their efficacy in carrying out the work role:

> "The way that she can communicate so um the really tricky stuff but then she's also a farmer herself so she's got this knowledge of the industry um and yeah, you know, what people want to know I suppose so um, it's yeah, it's a very, very useful mix that's for sure." (Participant B).

Here the participant has outlined the benefits of farming knowledge to their occupation. They have identified the utility of agricultural knowledge in building confidence to handle even the more difficult situations workers are presented with in their job.

Feedback from others was considered an additional source of self-efficacy which can operate as a confidence builder or factor that could otherwise negatively impact workers sense of efficacy in their job. For example, positive reinforcement regarding a person's ability to perform a role can act as an encourager. A worker who was concurrently studying at university described the power of verbal persuasion in instilling a sense of belief in their ability:

> "The whole time the lecturers in the building said you will do a PhD and I said - well bugger that - and now I am sort of like, that would be pretty cool to do. Um and so there was the option there to do one straight away, um starting next year, but I thought at this point it would be good just to go out and learn a bit of bit more industry stuff and work out exactly where I wanna (sic) go, what I wanna (sic) do, rather than just [audio drop out] onto something else that someone thinks you should do" (Participant B).

In some cases, discouraging and disproportionate feedback might prompt an individual to reassess their occupational goals. This type of feedback could lead to mixed messages about a person's ability to do a good job at a role that aligns with their occupational

goals. One participant emphasised the importance of relevant and proportionate feedback to others: “and then there’s others around you that might be bringing you down a bit so it's really important” (Participant G).

These quotes illustrate the influential role of important other’s opinions of one’s work ability. The more positive or constructive the feedback, the greater likelihood an individual will perceive themselves to be efficacious in performing their role. Discouraging feedback, however, can lead to a reduced sense of efficacy in a worker and potentially negatively impact their desire to pursue a career in agriculture. In either case, a stronger sense of self-efficacy derived from internal sources (i.e. personal belief) can outweigh poor feedback from others (i.e. external sources) in the decision-making process. This is an important point as poor management or unhelpful colleagues may pass but self-confidence often follows a person regardless of their job.

In relation to coping self-efficacy, interviewees indicated that successful performance at work relies on an ability to a) emotionally cope and b) engage in problem-solving in challenging situations. Poor self-regulation of stress inducing events at work can have a negative impact on a persons’ affectional state. Participant J stated that, “people tend to burn out … So, it's definitely something that's a risk for someone entering the industry. Absolutely”. A Program Manager described their personal perception when asked about burnout:

> “I see that happening in our founders. Um I don’t worry about it in myself but I'm conscious of it. Um at the moment I'm, I’m so interested in the things that I'm doing that I don't feel like it's an immediate pressing risk, um but I am I'm very aware of it and I do spend a lot of time with founders talking about how they manage it, how do they offload work, how they build a support network that make sure that they’re not going over the edge and I feel like there's, personally with everyone that I work with,

> there’s sort of like this threshold that you don’t want to go over, that once you cross you don't recover and if you reach it you need to stop and take a break and recover but there's sort of this threshold which changes with seasons and with your motivation and with stage of the business and with the environment around you, where you want to be very aware of not crossing or not pushing over that threshold for too long because it just sort of, it kind of breaks you for a period” (Participant D).

In this response, burnout is inadvertently described as an undesirable outcome related to poor self-regulation, with the more attractive alternate being effective management of emotionally challenging scenarios that might arise at work. Therefore, efficacy in emotion-focused coping strategies appear to be important for STEM trained professionals to self-regulate their affect in an agricultural work context. State affect can also be conceptualised from an SCCT perspective as an expected outcome of the work performed and is further discussed under the outcome expectations sub header.

While much of work performed by STEM professionals within an agricultural workforce context does involve some degree of uncertainty, interviewees also indicated that many of the problems encountered require a practical response. These problems cannot be addressed using emotion-focused coping strategies alone and were considered to require efficacy in a problem-solving approach. This view taken, a worker with high problem-focused coping efficacy would be more likely to adequately generate appropriate solutions and effectively cope when presented with practical work challenges. One employee stated:

> “Mhm. The other one to add would be problem solving abilities, um so I suppose the area that we are in, there’s not a lot of black and white, um you're always working in that grey area and we've had someone who joined us around the same time I did and we very much struggled with not having that sort of definitive answer all the time.” (Participant B).

This exert illustrates that confidence to apply problem-focused skills add to STEM professionals' overall sense of coping-efficacy in the face of ambiguity. Again, it is worth mentioning that while confidence in taking a problem-focused coping approach can be conceptualised as a type of self-efficacy, the construct can also be expressed as a form of goal commitment using SCCT as a theoretical framework. In other words, individuals who chose to engage in affective and cognitive coping strategies are likely to be more committed to persisting with their work in the agriculture sector. This point is elaborated on later in this thesis.

In relation to task self-efficacy, interview data revealed a) communication of STEM knowledge, b) project management, c) attention to detail, d) self-management, e) research, and f) STEM skills more broadly, were important in agricultural occupations. Participants indicated that agricultural problems are often not clearly defined and that confidence to effectively communicate about complex problems was an asset to the profession. A Biometrician reported:

> "So, researcher's come to us and they've got an idea or a research question that they'd like to answer, and we can help them clarify that question … and then sit down with them and say OK well what does this really mean" (Participant B).

This quote provides one example of a situation in which STEM professionals utilise communication skills in a workplace context. Efficacy in effective communication would lead to clarification of the research problem and likely lead to positive industrial outcomes. Poor communication could, however, have a detrimental effect leading to confusion about the research problem and negatively impact agricultural outcomes.

Those whose roles involve less supervision, a larger amount of control over planning, and independent execution of work tasks also highlighted the importance of confidence in attention to detail and project management. Participant G, a Postdoctoral Research Fellow

with prior experience as a primary investigator discussed a necessity to develop efficacy in operating independent of one's own supervisor:

> **"**because I don't have a supervisor on site so um yeah. So, I just, I mean, I obviously talk to him, but he is very busy man. So, I don't really, yeah it's sort of flying on the seat of your pants a lot of the time which is fine because I had him as a supervisor um through my thesis and I think it's really what helps you along to, to just to be able to self-supervise, and run a project because I mean doing a PhD as I'm sure you'll find out is all about project management and um being able to manage your time, and, and other people as well" (Participant G).

Autonomy to self-manage projects paired with adequate levels of support appear to facilitate worker independence and promote the development of strong self-efficacy beliefs in this area. While supervisory support might indirectly affect self-management confidence, contextual supports are discussed in more detail later in this chapter as they relate to other construct described within the SCCT literature.

Strong project management also draws on a person's ability to identify and manage constraints in carrying out the work. Should an individual believe themselves to be ill-equipped to meet the project objectives, detrimental outcomes could occur. A Chief Executive Officer explained:

> "The other one I guess is more meta, is like kind of systems thinking, and I mean I love it as a systems person because you can't just optimise your [agriculture industry] production because you also need your land to survive and you also need to manage your paddocks and then you have weather and then you've got finances and like, it's just super complex, and so skills that help people like manage that complexity, I think, are really important and, and is also how do you think about your consumer and how do you think about your staff and all of those kind of like systems thinking tech

> skills, that feels kind of squishy, but I think it's really important because if you just solve one piece of the farm or business in any business then you're probably, like, that's probably a risk um because there are so many factors" (Participant H).

This quote exemplifies confidence in attention to detail across business operations, project feasibility and meta-cognition. In this example, the individual has considered multiple factors that interplay and contribute to positive outcomes. Poor attention to detail could undermine project management skills more broadly through a lack of thorough consideration of and accuracy in assessing each influential element to accomplishing the project aim.

The nature of STEM professionals' application of their skills within the agriculture industry often comes with a level of responsibility even outside of an official project management role. These added responsibilities were associated with an expectation to achieve work demands or meet imposed deadlines. An ability to self-manage the prescribed workload during busier periods and optimise off-season periods to catch-up on work is an asset in the agriculture industry. Accordingly, self-confidence to balance workload around seasonal periods is important. One worker captured this concept:

> "We harvest, we have small plot trials so 6 metre by 2 metre trials every year and um so we have 5,000 plots just for our program but there's over 40,000 plots on the site and we also have to take measurements and things um all those plots throughout the year and it's some, yep it's quite um, yeah it's quite time consuming but um I yeah the I mean that's one of the things that we do" (Participant G).

Self-management among STEM professions also often relies on conviction in one's research related skills. Data collection (e.g. "trying to ensure that I get plenty of um yeah plenty of data", Participant E), computing and analysis skills (e.g. "so lots of our um analysis and the designs that we ah put together um are all run using software packages", Participant

B; “developing software, and developing hardware for tools that help”, Participant I; “creating software to interpret images”, Participant J) were mentioned by several interviewees. Written communication in the form of reports or articles (i.e., “then trying to write those up to be um papers”, Participant E) were also considered key skills in the delivery of adequate work outputs.

Additionally, workers indicated that engagement in their work activities involved participation in broader STEM tasks outside of their field of expertise. For example, a scientist said that, “Mechanical skills”, (Participant G) were an area that they initially struggled with when they first undertook their position. While some employees confirmed the basic need for a solid foundation in discipline specific knowledge (e.g., “Um a little bit of the sort of a tech (sic), techy (sic) sort of a mindset I suppose.”, Participant C), one individual said that there was a gap in both the areas of mechanics and technology:

> “but it's also the kind of the technical abilities around like electronics and kind of the new intersection of digital and electronics, so like the Internet of things, sensors and all that kind of stuff. When all that stuff breaks down, you know, in, in a paddock somewhere like who do you call and you wanna (sic) be able to fix that, just like people can fix their tractor or other mechanical equipment, but how do we fix that, kind of, digital high-tech equipment and so I think that's the skills that, that um we're gonna (sic) need more of and that's maybe a gap” (Participant H).

Regardless of the agricultural discipline, a strong foundation in STEM skills were integral to improving outcomes in the profession. High self-efficacy beliefs in applying those skills across work contexts would likely increase employee’s level of engagement in diverse work tasks and persistence in their job as these individuals would perceive the outcome of their efforts to be positive. Poor self-efficacy in this area might decrease productivity and deter the individual from taking on novel projects or continuing within their profession.

4.3.1.1 Summary and measurement of self-efficacy expectations. In summary, this occupational group indicated that a high perceived ability to cope with and perform tasks were important factors at work. While a variety of learning experiences were also found to assist in the development of confidence at work, self-efficacy as defined by SCCT is focused on perceived ability as opposed to the sources of self-efficacy. Therefore, in order to operationalise self-efficacy beliefs in the context of this narrative, a measure of task-specific self-efficacy would best represent most of the key areas in which workers perceived influential to their continued successful work and persistence in the field.

A new scale was developed for the purposes of the current research to measure STEM skilled agriculturalists task self-efficacy. O*NET OnLine was used to develop item content that was relevant to the core task's individuals with science, technology, engineering and mathematics skills and knowledge perform in their work in the agriculture sector. Interview data guided task selection and informed item phrasing. The face validity of O*NET OnLine core tasks which aligned with interview data and subsequent self-efficacy scale items are presented in Table 4c. Quotes from the interviews are provided in the left-hand column which were used to reformulate core tasks retrieved from O*Net OnLine which are outlined in the second column. New self-efficacy items are then listed in the third column.

Table 4c

*Face Validity of O*NET OnLine Core Tasks Aligned with Interview Data and Proposed Task Self-Efficacy Scale Items*

Interview Data	O*NET OnLine Core Task	Proposed SE Item
"we can then assist them with the design of their experiment, … then they go away and do the hard work and conduct the experiment and then after that that's done, they've collected their data, they come back to us and that's when we analyse the data" (Participant B)	Conduct experiments to develop new or improved varieties of field crops, focusing on characteristics such as yield, quality, disease resistance, nutritional value, or adaptation to specific soils or climates. Conduct experiments investigating how soil forms, changes, or interacts with land-based ecosystems or living organisms. Conduct research to determine best methods of planting, spraying, cultivating, harvesting, storing, processing, or transporting horticultural products. Design research studies in collaboration with physicians, life scientists, or other professionals.	Confidence in your current ability to perform the following activities: Design and/or conduct research focusing on agricultural problems, for example planting, spraying, cultivating, harvesting, storing, processing, or transporting horticultural products etc.

“and that we will need new people coming in with new skills. So, how do we best collect evidence, so there’s definitely a statistical science piece, that we need is more ability to analyse data … um data analysis like those things” (Participant H)	Collect information about soil or field attributes, yield data, or field boundaries, using field data recorders and basic geographic information systems (GIS). Analyze data from harvester monitors to develop yield maps. Analyze geospatial data to determine agricultural implications of factors such as soil quality, terrain, field productivity, fertilizers, or weather conditions. Analyze remote sensing imagery to identify relationships between soil quality, crop canopy densities, light reflectance, and weather history. Analyze clinical or survey data using statistical approaches such as longitudinal analysis, mixed effect modeling, logistic regression analyses, and model building techniques. Develop or implement data analysis algorithms. Collect data through surveys or experimentation. Analyze archival data such as birth, death, and disease records.	Collect and/or analyse data to determine agricultural implications of factors, for example soil quality, terrain, field productivity, fertilizers, or weather conditions etc.

“Um a little bit of the sort of a tech (sic), techy (sic) sort of a mindset I suppose.” (Participant C)	Use geospatial technology to develop soil sampling grids or identify sampling sites for testing characteristics such as nitrogen, phosphorus, or potassium content, pH, or micronutrients. Demonstrate the applications of geospatial technology, such as Global Positioning System (GPS), geographic information systems (GIS), automatic tractor guidance systems, variable rate chemical input applicators, surveying equipment, or computer mapping software. Provide advice on the development or application of better boom-spray technology to limit the overapplication of chemicals and to reduce the migration of chemicals beyond the fields being treated. Participate in efforts to advance precision agriculture technology, such as developing advanced weed identification or automated spot spraying systems.	Use, advance and/or design agricultural technology, for example developing advanced weed identification or automated spot spraying systems etc.

	Design agricultural machinery components and equipment, using computer-aided design (CAD) technology.	
"You definitely need to have that spatial data, science" (Participant C)	Use geospatial technology to develop soil sampling grids or identify sampling sites for testing characteristics such as nitrogen, phosphorus, or potassium content, pH, or micronutrients. Demonstrate the applications of geospatial technology, such as Global Positioning System (GPS), geographic information systems (GIS), automatic tractor guidance systems, variable rate chemical input applicators, surveying equipment, or computer mapping software. Identify spatial coordinates, using remote sensing and Global Positioning System (GPS) data. Identify areas in need of pesticide treatment by analyzing geospatial data to determine insect movement and damage patterns.	Demonstrate the agricultural applications of spatial data, for example identify areas in need of pesticide treatment by analysing geospatial data to determine insect movement and damage patterns etc.

“Mechanical skills [laughs].” (Participant G) “Um the current role I’ve got in [place] does have a, a 60% field component in the current formant and so you’ve also got to have the general skills of being able to operate machinery, you know, drive trucks” (Participant A)	Install, calibrate, or maintain sensors, mechanical controls, GPS-based vehicle guidance systems, or computer settings. Test agricultural machinery and equipment to ensure adequate performance.	Use, maintain, test and/or design agricultural mechanical controls or systems, for example food processing plants and related mechanical systems etc.
“Um computer skills as well, so lots of our um analysis and the designs that we ah put together um are all run using software packages um and most of that is a particular software language, um so knowledge in that	Demonstrate the applications of geospatial technology, such as Global Positioning System (GPS), geographic information systems (GIS), automatic tractor guidance systems, variable rate chemical input applicators, surveying equipment, or computer mapping software. Install, calibrate, or maintain sensors, mechanical controls, GPS-based vehicle guidance systems, or computer settings.	Install, maintain and/or use computer software, for example design agricultural machinery components and equipment, using computer-aided design (CAD) etc.

area would definitely be beneficial." (Participant B)	Write program code to analyze data using statistical analysis software.	
"and then trying to write those up to be um papers um I think within ah the [industry] and my project [funding body] um that there is also a really important component um and which is also a component that I really enjoy is like the communicating back to industry and like having that industry connection." (Participant E)	Document and maintain records of precision agriculture information. Prepare reports in graphical or tabular form, summarizing field productivity or profitability. Prepare reports, sketches, working drawings, specifications, proposals, and budgets for proposed sites or systems. Write research proposals or grant applications for submission to external bodies. Prepare articles for publication or presentation at professional conferences Write detailed analysis plans and descriptions of analyses and findings for research protocols or reports. Prepare tables and graphs to present clinical data or results.	Prepare records, reports, articles, sketches, working drawings, specifications, proposals, grant applications and/or budgets.

	Provide information or recommendations to farmers or other landowners regarding ways in which they can best use land, promote plant growth, or avoid or correct problems such as erosion[a]	
"Um, so I suppose other things that would help is being able to communicate, that's a big one, because you, you are a consultant and you need to be able to convey to your clients and to your researchers that you're working with, why exactly something is important and why it needs to be done in a certain way. Um and then also to extend um messages from that research as well, so be that whether or not you're	Communicate research or project results to other professionals or the public or teach related courses, seminars, or workshops. Provide information or recommendations to farmers or other landowners regarding ways in which they can best use land, promote plant growth, or avoid or correct problems such as erosion Conduct educational programs that provide farmers or farm cooperative members with information that can help them improve agricultural productivity Provide biostatistical consultation to clients or colleagues. Teach graduate or continuing education courses or seminars in biostatistics.	Communicate information, research or project results and/or plans to other professionals or the public or teach related courses, seminars, or workshops.

presenting it um, so presenting to a small audience, presenting one on one," (Participant B)	Discuss plans with clients, contractors, consultants, and other engineers so that they can be evaluated and necessary changes made. Meet with clients, such as district or regional councils, farmers, and developers

Note. SE = Self-Efficacy.

4.3.2 Outcome Expectations

This section describes the codes that are conceptually consistent with the SCCT outcome expectations construct. In an occupational context, outcome expectations involve perceptions about the consequences of performing a job. When examining the findings through the lens of SCCT, expectancy relevant information was conceptualised as a) material outcomes, b) social outcomes, and c) self-evaluative outcomes (Lent & Brown, 2006). The inductive coding and subsequent theoretical conceptualisation are summarised in Table 4d.

Table 4d

Theoretical Conceptualisation of Inductive Coding

Theoretical Conceptualisation	Inductive Coding
Material outcomes	1. Financial security, remuneration and work hours
	2. Work conditions, structure and resources
Social outcomes	3. Title, promotions and recognition
	4. Perceived job opportunities and choice
Self-evaluative outcomes	5. Attraction and perceived fulfillment
	6. Perceived emotional and physical isolation
	7. Team relationships, mentoring and role

4.3.2.1 Material outcomes. Material outcomes such as monetary compensation reflect one type of anticipated outcome identified in the social-cognitive literature (Bandura, 1986). In an agricultural work context, the participants valued their a) remuneration package, and b) work structure. For example, STEM professionals indicated that adequate pay was important for them to lead a comfortable lifestyle:

> “I need enough money to sustain myself but I'm not, the money I get paid at [Company] isn't really brilliant. It's enough to live comfortably in [capital city] and

> maintain my lifestyle in [capital city] but I'm certainly on a lot less that I would be if I would have sold my soul and went to [other industry]" (Participant D).

In this excerpt, the participant discussed the expectation that their pay be financially viable to meet their personal needs. Their motivation to persist in an agricultural career, however, is clearly not motivated by monetary compensation alone. There are several other types of valued outcomes that were identified which also had an influential effect on STEM professional perceptions of their job.

A remuneration package can also contain additional material benefits to monetary compensation such as a car, phone, computer or travel allowance. STEM skilled professionals perceived access to such benefits as a reward. This is supported through several excerpts:

> "cars, phones, um laptops all of that - there's no question about, you know, you must park it at home and not use it" (Participant A); "we don't really get bonuses or anything like that … but what we do get is opportunities to go to conferences … they're normally in quite attractive locations." (Participant B); "so, the flexibility of the job is fantastic. Not having any set working hours is a great perk. The impact is a great perk. The travel" (Participant J).

Here the participants have indicated the value of personal vehicle and technology use as well as work-related travel. Therefore, a holistic remuneration package comprised of both monetary and physical reward appear to be a motivational factor in workers persistence within agriculture.

Due to the location of agricultural work sites, STEM professionals might be required to relocate from their hometown to undertake their job. This can cause time and monetary impositions to return home and visit family or friends. For instance, one participant briefly described a time imposition encountered while traveling from their place of work back to

their hometown, “it’s going to you know cost you a day each side because of your travel time. So, I guess there are some disadvantages um as well” (Participant E).

This quote illustrates that there are potential disadvantages of relocating for work purposes. Therefore, adequate financial remuneration is especially imperative for individuals whose travel allowance do not afford them the opportunity to visit return to visit important others such as family or friends.

Interviewees also indicated that beliefs about their work conditions impacted job perceptions. One participant stated: “we got the best working conditions of just about any employer on you know on the whole face of the country.” (Participant C). In this response, the interviewee was referring to their positive perception about the flexibility of their work environment which enabled employees the flexibility to work around family commitments. For example, collect children from school or bring them to work. Work conditions, however, were not always described favourably.

Another participant indicated that unfavourable work conditions could lead to negative job perceptions. In this quote, the interviewee expressed frustration with a lack of access to resources required to fulfil their work role,

> “we can’t get the same services as those people that are on [other place], and you know, just simple things like being able to get reception phone reception within our building which is a like it’s a [price] dollar building that is pretty well brand new and we can’t get phone reception because [audio drop out] won’t pay because it’s not a priority of theirs … it’s such as shame that we’re in agriculture trying to feed the world and produce more with less but that doesn’t seem to be as big in people’s minds as, as in other areas of, of research.” (Participant G).

Therefore, organisational structures that facilitate access to work resources appear to be important for STEM trained professionals in facilitating positive career experiences.

4.3.2.2 Social outcomes. Anticipated social benefits such as approval from others reflect another type of outcome expectation identified in the social-cognitive literature (Bandura, 1986). In relation to social approval, interview data revealed a) opportunity, and b) recognition were important in agricultural occupations. Participants indicated that some STEM skilled professionals sought career advancement. An interviewee reported: “people have sort of said - oh you know do you want to change your name or do this or do that or you haven’t in inverted comas stepped up the tree” (Participant A). The people referred to in this quote were junior staff which provides insight into early career STEM professionals expectations of career progression. While this participant was not actively concerned in a change of job title, they did still indicate an openness to the opportunity. Therefore, career stage appeared to play a role in the expectation of continued job opportunities.

Occupation also appeared to influence the level of recognition sought from STEM professionals. For example, recognition was perceived to be more important in research roles and academia as opposed to technical positions. Participant C, a precision agriculture technician, provided their view on the aspirations of research and academic colleagues:

> “I'm not actually here to glorify myself in that extent. There are a lot of people who, that is what they're trying to do, they’re trying to tread on people’s heads to get places that they want to be but I've never ever really looked at my role is being like that and I'm not out chasing a million research papers or anything like that and um and, you know, I'm not competing with everyone around me which makes my job a hell of a lot more enjoyable than what I see with you know some early career researchers and academics and stuff. Obviously to make a name for themselves, they've gotta (sic), they’ve gotta (sic) be quite competitive in their role”.

The prospect of reaching career milestones, in part, through the completion of academic papers appears to be a motivating factor in facilitating some STEM trained

professionals goal refinement within certain types of agricultural professions. Higher positions or titles were considered prestigious and an accolade for workers to achieve. Although, this quote indicates that there is a certain amount of pressure associated with striving for professional recognition which was something this worker was not concerned with in their technical position. This was, however, an issue for one researcher who stated,

> "the main thing at the moment that everyone in the [organisation] is getting pressure about is writing papers, and I've - yeah, I haven't written one for probably four years. But I was - it is difficult with our work … because a lot of what we develop is commercially sensitive, and we're not allowed to publish that … but I do recognise that there is a requirement just to keep everything - everyone who is in the [organisation] happy and to make sure my career stays on track" (Participant I).

4.3.2.3 Self-evaluative outcomes. Anticipated self-satisfaction has also been described in the social-cognitive literature as an outcome expectation of performing specific behaviours (Bandura, 1986). In relation to self-evaluative outcomes a) fulfillment, b) emotional experiences, and c) relationships were important among the STEM professionals interviewed. The participants indicated that having a sense of fulfillment was crucial in a job. Individuals who feel satisfied about their work are likely to continue within an agricultural role. For example, Participant I reported, "I like research, I like being able to develop my own projects. Yeah, you can design your own project and plan - have your own direction that it goes. It's good as well working with industry and developing things that are important to people, and agriculture is so important, everyone needs agriculture". This point was reinforced in a statement made by Participant D about their motivations to persist in agricultural work:

> "something I feel it's going to make meaningful positive change to a lot of people across the world not, not something and, and no, no offence meant to any of the

> companies I work with, not something which is just gonna (sic) make one subset of farmers life a little bit easier and a little bit [audio drop out]. Like I want to be, if I'm going to devote the time and emotional energy to something, I want it to be something which will shape a lot of people's lives for the better … agriculture in and of itself is, is an interesting, a great interesting means to an end is food which every single human needs to live and there's something really satisfyingly universal about it. Ah It's not something optional, it's not something which is solving a problem for a few people, along with the water industry it's really the two most fundamental industries that human life depend (sic) on. Arguably the health industry in there as well but food and agriculture, well or food and water are the only two industries you can pretty much guarantee every human on the planet is interacting with in some way every single day and there's nothing else out there that you can, something that is going to touch so many people across so many different geographies, different demographics as agriculture".

This quote provides one example of how STEM professionals working in agriculture perceived themselves as performing a meaningful role which provided them with a sense of purpose. A lack of fulfillment might lead a worker to reconsider their work role or occupation.

Workers aspired to experience positive emotions as an outcome of their occupational efforts. Negative emotional experiences would likely lead an individual to reassess their career goals. Yet, physical and emotional isolation was a challenge indicated by the interviewees. Participant E stated that physical and emotional isolation can be a deterrent for STEM skilled professionals to continue in a regionally based agricultural position:

> "getting people to um sort of like remote areas and everything can be challenging and particularly people with families that schooling can be an issue when you've got

> really limited and you've got school aged kids and wanting the best educational opportunities that sort of thing um that can be a challenge … there are a lot of students that have started here and have, have just quit because it's just, it's just too hard, it's just um, it's just too hard to find accommodation, and especially when you're by yourself here and then um and the driving I mean like it's a big drive from here to [capital city], and if they've still got family in [capital city] that's where they are going to want to be. Um, yeah, the isolation and just not having the convenience is, is really hard um and I can, I can understand that that's why people would make that decision" (Participant E).

In this example, it can be inferred that individuals prefer to seek out positive emotional states and physical closeness with important others through their occupational endeavours.

Self-satisfaction with an individual's position, broader team and contribution to mentoring or leadership were also discussed by the participants. Satisfaction with the scope of work role influenced career decision-making. Participant B described this factor as having a primary influence of them and reported, " it's quite awesome really, the breath of that we work on … Um so and then there's soil sciences, there's entomology, there's just, yeah, so many different areas that we work across um which keeps our job very um I suppose interesting in there is always, always something new". Connection with industry was an especially enjoyable aspect of employees work, "a component that I really enjoy is like the communicating back to industry and like having that industry connection. So, ah for my project though it's probably ah maybe the sort of like most important focuses of for yeah what my current job is actually sort (sic) of entailing." (Participant E). This appeared to raise STEM professionals' satisfaction at work, "the satisfaction that I get most is out of the growers um, actually getting (sic) results for them and actually seeing them succeed in a financial aspect to. So, they like seeing the results locally and … you still like to see the best

result that you can and that, that comes as a yield perspective and just seeing the crop come through to harvest maturity." (Participant A). The positive emotions generated from this connection and application of their job facilitates workers persistence in the field, particularly because agricultural research is perceived as meaningful.

The opportunity to work in a team is attractive in this profession. Participants indicated though, that team composition was of high importance, "I would say that one thing that's really, really important for me is the people at work with." (Participant H). Further to this participant C said, "Yeah. Um I think like obviously it's the collegiate sort of environment, you know, where people want to work together and that is, is, is probably one of the most beneficial things in, in this role". Therefore, it appeared as thought the quality of the team and their collaboration were vital to professionals' teamwork motivations. Supervisory relationships for example, can impact employee's well-being at work. Participants E (i.e., "and um enjoyed the relationship that I had with, the um, with my supervisors") and I (i.e., "during my PhD I met some really great supervisors and … and I guess the support of - yeah the help to develop the postdoc research and funding") provided positive examples of this.

Mentoring others at work also appeared to produce positive emotional outcomes for employed professionals. Workers were passionate about helping and educating others, "Um, also one of the things that I'm passionate about is the education of the researchers um in that, I find that very rewarding very rewarding, tiring at the time but I find that very rewarding ,you know, after you finish your workshop or training course and you see those researchers in subsequent years using what you've taught them and going away and doing things themselves um and then coming and asking some of the harder questions." (Participant B). Participant C added, "getting satisfaction from the small things you know. You know getting something working or helping somebody or you know some PhD student that I worked closely with

graduates, all those things give you satisfaction and that and you get no, no kudos or anything for it, it's just a little internal self-satisfaction or fulfillment". These roles appealed to STEM professionals internal reward system and lead to a sense of fulfilment.

4.3.2.4 Summary and measurement of outcome expectations. In summary, this occupational group indicated that physical rewards, social approval and self-evaluative outcomes facilitated their job persistence. While work conditions, opportunity and relationships were found to assist STEM skilled professionals continued engagement in a role within the agricultural sector, renumeration, recognition and fulfilment experienced through positive emotional experiences appeared to be among the most important factors that satisfy their basic financial, social and emotional needs. Therefore, in order to operationalise outcome expectations in this context, two measures of needs satisfaction and state affect were chosen to best represent most of the key areas in which workers perceived influential to their continued motivation to persist in the field. A few items were adapted from the Minnesota Importance Questionnaire to assess financial and social needs satisfaction among STEM professionals working in the agriculture industry. Emotional needs were operationalised using the Survey of Career Exploration and Decision Learning Experiences positive and negative emotion scales (Lent, Ireland, Penn, Morris, & Sappington, 2017). The face validity of the measures is presented in table 4e and 4f.

Table 4e

Face Validity of Survey of Career Exploration and Decision Learning Experiences Positive and Negative Emotion Scales

CEDLE-E	Interview Data	Face Validity Comments
Determined	"but for me the satisfaction that I get most is out of the growers um, actually getting (sic) results for them and actually seeing them succeed in a financial aspect to … you still like to see the best result that you can and that, that comes as a yield perspective and just seeing the crop come through to harvest maturity." (Participant A)	Passionate workers feel determined on the job.
Inspired	"Like we have a fair few younger people working here and um it's really encouraging to see that when um like we, we, we really do put in a lot of effort to teach them, and, and develop their skills and make sure that they're um, you know, that they're the best that they can be within their area of expertise sort of thing. So, I think that taking that time to like, to nurture the ones that are coming through, I think that's really important. More people should definitely do stuff, like …" (Participant G)	Workers are inspired by the impact of the work that they perform on others.
Active	"Yeah. Um I think like obviously it's the collegiate sort of environment, you know, where people want to work together and that is, is, is probably one of the most beneficial things in, in this role." (Participant C)	Workers enjoy actively engaging with one another on the job.

Excited	“Yep. I'm so, I recently um just got a little promotion … so I'll have that opportunity to sort of mentor someone which I've done a little bit off in the past, but I suppose this will just be a little bit more formal.” (Participant B)	Workers are excited by rewards and opportunities.
Upset	“I mean it can be hard to get into a new industry when you're not from it and I think agriculture is especially, kind of guilty of it, because there's this whole, kind of, I’m a seventh-generation farmer and you’re not any kind of farmer but you really wanna (sic) work in ag and think you can be valuable. It almost feels like you're already behind, like you lack that credibility and that can be really frustrating” (Participant H)	Workers can become frustrated at work in conditions where they receive a lack of support.
Nervous	“getting people to um sort of like remote areas and everything can be challenging and particularly people with families that schooling can be an issue when you’ve got really limited and you’ve got school aged kids and wanting the best educational opportunities that sort of thing um that can be a challenge.” (Participant E)	Workers worry about the location of their workplace.
Afraid	“Yeah or you, like if you don’t know where [place] is, then to take on a three-year project there might sort of seem a little bit daunting um or whatever and um” (Participant E)	Workers can feel daunted working in unfamiliar environments.

Overwhelmed	"Yeah, yeah ok. Um I mean the, it's definitely not ah so if, if you ever oh well I've just found whenever I talk to people about roles like this it's not interesting to many people because of the fact the convenience isn't there wherever they are moving to and I have to admit when I did move to [place] it was a huge shock to me and I didn't like the town and they um I really struggled to get involved in the town." (Participant G)	It can be overwhelming to relocate for work.

Note. CEDLE-E = Career Exploration and Decision Learning Experiences Positive and Negative Emotion Scales; State affect is considered both an outcome of work performed and source of self-efficacy beliefs.

Table 4f

Face Validity of Survey of Minnesota Importance Questionnaire Item Parcel

MIQ	Interview Data	Face Validity Comments
I will be 'somebody' in the community	"There are a lot of people who, that is what they're trying to do, they're trying to tread on people's heads to get places that they want to be … what I see with you know some early career researchers and academics and stuff. Obviously to make a name for themselves, they've gotta (sic), they've gotta (sic) be quite competitive in their role." (Participant C)	Some workers aspire to become known within their community. This item requires rephrasing to capture beliefs about work that has already been performed: "I could be 'somebody' in the community"
I will get recognition for the work that I do	"Ooo (sic) um certainly, ah looking for working with the right people, so a collaborate approach with a fair bit of teamwork, and the um yeah the opportunity for career advancement and ah training, so being able to go to conferences um, and, and networking events through, through work umm, to help that career progression." (Participant F)	Some workers seek recognition for their work which can be achieved through networking and or career advancements. This item requires rephrasing to capture beliefs about work that has already been performed: "I could get recognition for the work that I do"

My pay would compare well with that of other workers	"I'd question under 65 is the ah, if it wasn't something, I knew the team and who I would be working for and knew that I would get on well with them um most of, most of the stuff I would be looking is at, is at about yeah starting at about 65, and um, and that's with a um work vehicle, laptop, phone etcetera." (Participant F)	Workers expect decent pay with fringe benefits. This item requires rephrasing to capture beliefs about financial compensation: "My remuneration package would compare well with that of other workers"

Note. MIQ = Minnesota Importance Questionnaire; Prestige Measured variables: Social Status, Recognition, and Authority (item omitted – not relevant).

4.3.3 Environmental Supports and Barriers Proximal to Goals and Actions

This section describes the codes that are conceptually consistent with the SCCT environmental supports and barriers construct. In a work context, contextual affordances concern proximal environmental structures that facilitate or constrain individuals career goal progress. The data were coded as:

- Collaboration, support, networking and guidance;
- High workload, pressures and demands;
- Organisational flexibility and special benefits;
- Perceived professional development opportunities; and
- Workplace culture, investment and value in individuals.

When examining the findings through the lens of SCCT, environmental information was conceptualised as a) proximal supports and resources and b) barriers experienced during goal progress. Codes that were developed during the inductive analysis are provided in the second column and SCCT constructs with which those codes appeared to align with during the deductive phase of the analysis are provided in the first column.

	Inductive Analysis
Deductive Analysis	Codes
Proximal Supports and resources	a) Collaboration, support, networking and guidance; b) Workplace culture, investment and value in individuals; c) Organisational flexibility and special benefits; d) Perceived professional development opportunities;
Barriers experienced during goal progress	e) High workload, pressures and demands

4.3.3.1 Proximal supports and resources. The participants indicated that a variety of supports and resources were useful at work. STEM professionals acknowledged the utility of proximal supports in performing their work tasks, "Sort of working away at it and having like the access to umm, like a varied, like it's quite a big research station out here with um people … like there's a lot of um different research that happening and a lot of different people that you can tap into from a research resource sort of perspective." (Participant E). In this excerpt, the participant highlighted that access to supports was especially important in their experience because they had relocated to undertake their current job which can often be the case in agriculture.

Consideration of the timing of and person approached, however, appeared to be key factors related to how responsive or helpful the perceived support was likely to be in meeting a worker's needs. Another interviewee inferred that for a support to be appropriately activated, workers in this sector may need to be sensitive to other people's availability and who best to ask for assistance, "knowing when or you've got the group that you can ask a question of to try to find an answer … that's a very strong component of what we do" (Participant A). Among the most readily available and helpful people proximal to a worker included "senior members" (Participant B) of their group, and colleagues from the same department, "interacting with academics and stuff around me is the other way to keep in touch with a lot, lot the technology. So, um we've got good linkages with our computer science department, our animal science department, with agronomy and that's where we sit so, so essentially you just immersing yourself in it." (Participant C). In part, the agreeableness of another person to assist appeared to be based upon the role an individual was undertaking in an organisation (e.g., sales versus research). Sharing knowledge of the discipline seemed to be greater in the latter group perhaps due to expectations of collaboration set by employing organisations.

Conversely, a lack of communication with others was believed counterproductive. Such an approach was thought to leave employees doing things on their own that could be completed more efficiently with the help of others, lead to a lack of perspective in an agriculturalist's work due to a failure in knowledge sharing and be of detriment to the discipline generally. This highlights the need for workers to feel comfortable and confident that there are other people in their network who can act as a workplace resource. This point appeared to be reinforced by the following interviewee transcript:

> "the, the most important things are being comfortable with people and being able to build strong relationships with many different people overtime and maintaining those. So that's a big, a really big part of what I do is just having a network of people within the research institutes, within the farming communities, within the service communities who I can pick up the phone and call and ask them for help … with advice on where to go to find something out" (Participant D).

This excerpt inferred that without a network of supportive others to act as resources, that an individual's continuation in an agricultural career may be threatened.

The agriculture industry generally though, appeared to instil a perceived a barrier for participants who did not self-identify as having a farming background. This concern was highlighted in the following text:

> "It's a barrier, I think my experience agriculture tends to be very disparaging to new things and so it's um, they tend to, they tend to need a lot of convincing that something new is worthwhile and so making sure that if they're going to go and talk to an agronomist, they talk to someone who is supportive of new, new ideas" (Participant D).

This is a significant issue for individuals whom could be viewed as most in need of guidance.

A similar barrier was also evident in the connotation of another workers response. Participant H stated,

> "Um I think I've met a lot of really great people who, um, have been happy to, like who I guess have kind of seen that though I don't come from agriculture, I might have something to add to it and have taken I guess a risk or made an investment in working with me or in mentoring me or just kind of um yeah, just talking to me. That's been really helpful, … I mean it can be hard to get into a new industry when you're not from it and I think agriculture is especially, kind of guilty of it, because there's this whole, kind of, I'm a seventh-generation farmer and you're not any kind of farmer but you really wanna work in ag and think you can be valuable. It almost feels like you're already behind, like you lack that credibility and that can be really frustrating. So, I'm really grateful for the people who have not let that be a barrier, you know, who've said, you know she doesn't come from ag, but she might still be really useful and so that, that then plays a big factor in my success".

The perceived negative interpretation of workers breaking into the agriculture sector could, for some professionals, outweigh the support provided and lead to their application of skills within other competing industries. So, as much as other industry professionals can be a useful resource, in some work contexts, communication of the support required appears to need to be well-considered, and a positive response, in part, may depend on one's experience in the agriculture industry.

Direct supervisor or mentor support, in which the boundaries of a professional relationship have been established in some way, seemed to mitigate the potential concern of engaging others as resources. Many of the participants referred to their 'bosses', 'supervisors' or 'mentors' (i.e., Participants B, C, F & G) in a positive light. This was across career levels and included at least one participant without an agricultural background.

Although, employees provided mixed feedback about the organisational structure itself in influencing their persistence in the field. One participant commented on their industry generally, "the structure is very flat, so from me to the top there three steps and that's a (sic) internal manager, our actual overall production supply manager and he goes straight to the top … it's never going to lead well for people to be promoted highly" (Participant A). The perception that there is a lack of career progression opportunities in some agricultural industries appeared to be a concern for workers aspiring to change their work role and title. This was, however, in contrast to other professions within the agriculture sector. A professional from another industry stated, "you can have the postdoc position for 3 years on a research project – the one that I've got and your only allowed to do a maximum of two years and then you need to move onto a research funded position … so I guess it sort of depends on um like what career you sort of end up wanting to do" (Participant E). A lack of organisational and supervisor support or capacity to provide workers with career opportunities to sustain their persistence in the field could be detrimental to the sector. Motivated workers might network with supports from other industries and leave the sector rather than engage in negotiations with their own organisation.

Working with an organisation that demonstrates care for the contributions made by individuals is an important motivator in this profession. Agricultural business owners appeared to gain positive employee impressions as simply as making themselves known to their workers, "I think sometimes in the knowledge of they are not someone that's hiding behind a desk, they are actually getting (sic) out amongst the people, um that, that, that brings a lot of drive within the company from my own personal perspective. Um just, just showing who, who to the individuals and to the groups, that that we are not sitting behind people, you know, well we do sit behind the desk but we want to see what's really going on" (Participant A). On the other hand, organisations perceived to fail in valuing their working professionals

as individuals were considered to fall short of the acceptable standard, “and when people around are noticing your um circumstances and you are being individualised a little bit um that, that's something that's very important in the workplace. Um, you know, big institutions and that probably um from time to time fall short in that area. You know you got people who are doing a similar role and you know nobody actually gets that personal sort of interaction and that from management” (Participant C). This is concerning given the need for STEM skilled staff in the field and the ease of validating staffs value in performing their role communicated via the initial quote.

Further to this, workplace cultures that illustrated investment in staff seemed to encourage workforce persistence. The concept of ‘merit-based’ work was described by a company owner during their interview:

> “Um, I think another one that is increasingly important is like, um kind of workplace culture and one aspect of that from me is the combination of sort of flexibility and merit-based practices. So, I’ll explain that because it’s kind of jargony (sic) and I don't mean it to be like um, I'm happy for you, like one of my colleges is in [overseas country] and she you know is going to work for you know a few hours but also going to this big event in [overseas country] that she wanted to go to and so I love having a company where we can give her that flexibility to go run an actual Ag panel at this conference in [overseas country] and she wants to do it and she gets a good holiday but she’ll also put in a couple of hours work and so as long as the results are there, as long as kind of the outcomes of the project and you know the work is done, I'm happy for that flexibility to be there. I think that's really important and like when I used to have jobs, I wanted to find jobs that I was judged on the output and on the results, not on you know, how many hours I spent in the seat per day kind of thing” (Participant H).

According to their perception, staff members benefit from workplaces that contribute to their well-being by affording them tasked-based opportunities to earn their salary.

Organisations that are flexible in their work offerings are desirable. As Participant C described some of the best aspect of their work involved flexibility, “Yeah. I guess the, the best and the worst thing about this role is the fact that it's based at a [organisation] because obviously all the flexibility and the people and everything is all, you know it's, it's all it's a huge benefit or it's the result of being part of the [organisation] environment.” (participant C). Special organisational benefits beyond that of flexibility also made mention. One participant stated, “we also have some training, um so that could, it’s sort of like train the trainer in a sense, so workshops where we get to develop some of our skills and learn from some experts in other areas or well, within, still within the stats discipline but they um are, sort of, yeah, leading experts in particular areas within that discipline um so that's all so an incentive as well and a bit of a reward as well as a professional development opportunity” (participant B).

Organisationally lead incentives such as training the trainer appeared synonymous to that of individually sought leadership programs which were earlier discussed but with the added benefit of the perceived special organisational assistance in attaining the achievements obtained through the workshop. This leaves little doubt that factors such as flexibility and perceived favours, especially as they relate to career development play a role in job and career persistence.

Organisations that show appreciation for the goals of their workers appear to appeal to professionals who aspire to demonstrate competency in their role. Workers seemed to value career development opportunities and organisations providing these experiences were respected regardless of the perceived likelihood of career progression within the organisations itself. One interviewee stated that professional development was important to them, “the professional development I guess puts you in good stead for opportunities that

come, come along and like I said, it's not necessarily about thinking that I deserve, you know, to be promoted or anything else like that" (Participant A). Participant J added that they liked having some control over their professional development opportunities, "That might be something that becomes available to me in the near future, where I might be in control of some project funds. So, I can go and attend those workshops if I want". This indicates that professionals may change jobs but not be lost from the sector altogether, so long as they have opportunities to develop within the industry. Of course, for organisations that might like to retain their workforce, career development appeared equally appealing, "succession planning … capacity building all the time within the group and around what you're doing is always good for your motivation as well" (Participant C).

Participants generally spoke highly of their learning experiences afforded to them regardless of whether they were undertaken in a work context. For example, leadership courses were reported to be informative and appeared comforting to agriculturalists career outlook. Participant E specifically stated that programs such as these can lead to newfound realisations, "research isn't the only path or particular sort of work like in academia and so it's actually quite a liberating feeling to know that um there are lots of different things that you can take for skills that you pick up in research to be doing". This data supports the importance of the provision of career development opportunities in the retention of workforce personnel.

Workers expressed a desire to develop themselves in content knowledge both within their specific industry as well as related agricultural industries. Conference attendance was considered one appropriate method to achieve this goal. Organisations that support workers in attending seemed to assist in overcoming a sense of job isolation which could otherwise become a barrier for research scientists engaged in a very narrow field of study: "Umm, the isolation in terms of um like it hadn't worried me so much um having to travel, I really enjoy

the travel, I enjoy getting out to conferences and that sort of thing. Um it, I guess I am at a position where I don't necessarily need to worry about the time that its takes um, to get to these places" (Participant E). This participant also indicated that by doing so they had learned new skills, "I like the varied aspect of being able to go away and um and see different things and also (sic) not only like just in [agriculture industry] but also on a wider agricultural um platform as well. So, I also like going to like the [agriculture industry] conferences sometimes or that sort of thing but yeah sometimes it's nice to um get a little bit beyond just [agriculture industry] as well" which contributed to their occupational satisfaction.

There was the connotation that professionals engaged in STEM professions within agriculture valued the opportunity for career progression and professional development above that of financial renumeration. One individual who was interviewed stated, "So the [overseas opportunity], it's, it's a volunteer thing, it's about 15 to 20 grand per year, so it's a bit of an allowance to cover your cost of living and a bit to live okay while you're there, but you are not going to make any money out of that. Um so I'm not looking at that as far as to earn money, I am looking at that as a professional development, ah opportunity" (Participant F). This quote didn't appear to suggest that fair pay and fanatical security were not important factors to their motivations in continuing to work within the industry. Rather it appeared to serve as a reinforcer of the value this occupational group place on professional development opportunities.

It is important that attractive work arrangements are offered within this profession. Organisational roles that afford flexibility appeared to be an integral factor in agricultural job choice among participants: "A 35-hour week is not gonna (sic) break anyone … if I was actually working in commercial agriculture, you know, it would be 7 o'clock in the morning to at least 5 o'clock every afternoon um and without much flexibility. You know, you got crops in the ground, animals to look after and that sort of thing, you know, running feed lots

or you know dealing with clients and that sort of thing. So, it's probably pretty much a 24 hour a day job, so I'm very lucky to be in the flexible conditions that I am in um being at a [organisation]" (Participant C). Again, flexibility was equally important to working parent's persistence in a role, "if we wanted to say, go to a kid's sports day, um provided you can get most of your work up to date. So, you can come in early, stay late the day before, do whatever you want" (participant A). These exerts illustrate the work-life balance goals STEM-skilled individuals seek within their career.

Freedom and choice were also notable observations among this occupational group. In particular, the opportunity to engage in a novel role were regarded by some, "So whereas then for the [overseas] position the 12 month contract is good, so therefore it's a deadline, um everyone knows what's expected, you're expected to be there for 12 months, and that's what it is. If you want to stay for longer there's no doubt there's the opportunity for that but I mean it's a challenging place, it's a totally different climate, totally different work ethic to what we're used to um, and I mean you, you're not making a lot of money over there, it is a volunteer program so you're not expected to stay there forever" (Participant F). Self-determination was regarded by others, "but, but also just um, but also just sort of having the freedom cos (sic) there's so much that needs to be done within the agricultural industry to, you know, to make things better. You do have that freedom to um, you know, to expand your brain and, and just to use it in a way that you wouldn't necessarily do in other industries because you are sort of, are hindered by um, I don't know, just maybe people who just think that it should go a certain way but I don't find that in agriculture, especially in research you, you can do your own thing and I mean you obviously, you always have people who you, that you would run things by and stuff like that but um yeah you have that freedom. I love that that part of it um and also there seems to be, even though there are lots of limitations in certain areas, there doesn't seem to be as many limitations if you um like, if you have

something that you are interested and, and want to do. I think it's just finding, finding that thing that you are most interested in to then yeah follow on with" (Participant G). Participant J added, "Sometimes it's just the freedom to sit down and figure something out. I quite enjoy that. It is reminiscent of undergraduate study where you get an assignment and you just sit there and figure it out. There are occasion windows where there are no other immediate deadlines". In sum, A sense of autonomy gave the impression that it played a role in participants satisfaction with their career development.

4.3.3.2 Barriers experienced during goal progress. Workload perceptions were integral to employee persistence intentions. High workloads were perceived negatively among agriculturalists, the demands of which appeared to be of detriment to employing organisations. Participant A stated, "Um the bigger organisations and or not bigger organisation but self-employed farmers, whatever it is, do have a general terms (sic) of giving probably giving far more hours than what would generally be accepted as the norm. So, um in, in the normal season and, and that's ones on the reason I left the previous company was the hours". The association between larger organisations and number of hours worked has the potential to disadvantage employers offering fair renumeration. Although, this did not appear to be an isolated issue. For example, Participant I reported being, "overworked" and Participant B also said, "Yep, um I suppose the big one would probably be workload. So, um there's not that many of us but then there's a lot of projects that require help. Um so that's something that, yeah, is probably a big one," (Participant B). The previous excerpts indicate that workload-related pressures are a deterrent to career engagement within the industry at present.

This level of workload commitment seemed inevitable to some. The notion that job title or career stage would not exempt early career researchers from undesired workplace pressure was described by at least one participant: "I guess in a sense I can probably be away,

get away with it at this point in time because I'm like not at one of the really high levels of having to be like having all of those pressures and demands. I don't whether that um, whether that changes like I can see in my supervisors that could change like as you move up there more pressures but at the moment its um pretty good and I guess for myself also it's um yeah, something that I try to be really conscious of because I don't want to be one of those people that um where work, I don't want work to be the most important thing um in my life, I think I want other sorts of things to be more important" (Participant E). Therefore, it appears as though STEM professionals would benefit from further support in undertaking the demands of the work engaged in to ensure that people of all career stages feel adequately equipped with the appropriate time available to complete their work tasks without causing disruption to industry.

Participants held several ideas about overcoming workload-related issues. Appreciation for effort, availability of senior staff and openness to collaboration were all cited as supports. Participant G shared an especially positive perspective illustrating some of these concepts: "if you have a great idea, people will get on board and they'll collaborate with you and you'll um, yeah, you'll really succeed. So, and, and young people in agriculture they're, people, sorry so most, most of industry is really um pushing for young people in agriculture, so it's a great time to be involved because, yeah, I mean, yeah, you've got the support of the whole industry. Essentially, male or female [laughs]." (Participant G). In any case, individuals who feel they've been taken for advantage could reconsider their career choice and potentially decide to apply their STEM skills elsewhere.

Work within academia appeared especially difficult to balance. Workers seemed torn between application and generation of reports documenting evidence. For example, Participant C reported, "So that's, that's another sort of I guess a barrier or because you know we're trying to develop these cutting-edge technologies but at the same time we want to use

them and showcase them to people coming through, you know, there's a big trade off there. You know, how blue sky do we go do we want to be, do we want to be developing stuff from the ground all the time or bring technology through so um that already a bit of a, you know, limited or minimal actual research attached to that because you know once, once it's developed and works then, you know, there may be some refinement of it but usually it's all done and dusted move on to the next thing". Pressure to publish written work was also described as a challenge, "but other, other challenge I think just being in an a, you now sort of in a more academic role. Um I didn't realise the pressure to publish and I think that's one of the things that um in my role is really crucial um but also just um in a more general sense" (Participant G). The same worker was concerned about the apparent disconnect between publications and the target audience. She stated that she felt conflicted by the practical value of published works to improving practice, " Well the thing is when we publish, I mean, growers aren't necessarily going to read those journals, and um, and also the, the actual um, ah like write up of it probably isn't going to be what they want anyway, it's not going to be an outcome, it's not going to be, I mean they're so busy anyway all they really want is specific things that they can do, that they can do to improve their practices and yeah. I just think that, that you have to be able to extend your research in one way for the people that really need it in your area and then make sure that you've got some sort of paper to come out of it as well but pretty well across the site is to put the growers first because I mean that's why we are here and yeah our papers always come second [laughs] which is a bit tricky [laughs]." (Participant G).

4.3.3.3 Summary and measurement of environmental supports proximal to goals and actions. In summary, this occupational group indicated that proximal supports and resources facilitated their career persistence. Support, workplace value in individuals, organisational flexibility and special benefits such as professional development opportunities

were important factors in workers continued engagement in goal-directed activity. Conversely, barriers experienced during goal progress which included high workload, pressures and demands hindered progress at goals. The organisation and important others such as supervisors were commonalities across these areas. In other words, the organisation and to an extent the supervisor themselves control levels of support received, degree of care taken in demonstrating value for each employee, amount of flexibility permitted within any one work-role and are the gatekeepers for many career development opportunities. Therefore, in order to operationalise proximal supports and resources in this context, two measures of organisational and supervisor support were chosen to best represent the factors that mitigate threats or barriers to goal commitment and directed activity (See Table 4g and Table 4h). These are the Survey of Perceived Organizational Support and Survey of Perceived Supervisor Support (Eisenberger et al., 1986; Kottke & Sharafinski, 1988).

Table 4g

Face Validity of Survey of Perceived Organizational Support – Short Form

SPOS-SF	Interview Data	Face Validity Comments
1. The organization values my contribution to its well-being.	"and when people around are noticing your um circumstances and you are being individualised a little bit um that, that's something that's very important in the workplace. Um, you know, big institutions and that probably um from time to time fall short in that area. You know you got people who are doing a similar role and you know nobody actually gets that personal sort of interaction and that from management" (Participant C)	Working for an organisation that recognises individuals for their efforts is desirable, although, not all workplaces are perceived as providing this type of positive reinforcement for workers performance.
27. The organization takes pride in my accomplishments at work.	"Um if opportunities come up, you've got that you know that you are going to be in consideration if, if your skill set is what they're looking for and you hope that they actually are willing and, and come with those sorts of questions. Um there's been, there's been one occurrence probably four years ago here, where they um promoted someone form a different department into a role and caused, caused a fair storm amongst the group. Not our group alone um I was one of the	It is important that organisations pride their workers based on skills and experience and recognise those accomplishments accordingly. A lack of communication about or appreciation for a worker's

	people that would've been considered for it and was told I was considered but wasn't suitable and I said - oh that's funny because there was no discussion. Um how do you make that, you know, link without actually having a discussion but ah anyway, I think they got the message on that. Um the, and there are a couple of others within the group who again, wouldn't actually accept the role but it's nice to think that someone's not just doing the process or not doing the due process to, to continue those promotions and that was part of our HR issue at the time [audio dropped out] not anymore. Um seeing some of those things come through you just want the right management and the opportunity should you wish it." (Participant A)	performance may lead to dissatisfaction with the organisation.
4. The organization strongly considers my goals and values.	"So and, and a little bit of um, I guess you wouldn't say um, um sort of succession planning but a little bit of um capacity building all the time within the group and around what you're doing is always good for your motivation as well." (Participant C)	It is motivating to work for an organisation that considers individuals work-related goals. For example, workers who strive for achievement value capacity building opportunities.

25. The organization cares about my opinions.	“um so you do feel somewhat rewarded for that, but I think the biggest thing is the satisfaction so making sure that you’re feeling that your voice is getting heard, that they are actually somewhat appreciating your efforts, what you’re doing. Um you know big organisations always get to a point of having people do feel like they are just a number.” (Participant A)	Workers who believe that their opinions are being heard are more likely to be satisfied working with the organisation.
7. The organization disregards my best interests when it makes decisions that affect me. (R)	“You do have that freedom to um, you know, to expand your brain and, and just to use it in a way that you wouldn't necessarily do in other industries because you are sort of, are hindered by um, I don't know, just maybe people who just think that it should go a certain way but I don't find that in agriculture, especially in research you, you can do your own thing and I mean you obviously, you always have people who you, that you would run things by and stuff like that but um yeah you have that freedom. I love that that part of it um and also there seems to be, even though there are lots of limitations in certain areas, there doesn't seem to be as many limitations if you um like, if you have something that you are interested and, and want to do. I think it's just finding,	It is satisfying to work for an organisation that makes decisions in consideration of workers interests. Within reason, workers value the freedom associated with shared decision-making.

	finding that thing that you are most interested in to then yeah follow on with" (Participant G)	
9. The organization really cares about my well-being.	"If, if we wanted to say, go to a kid's sports day, um provided you can get most of your work up to date. So, you can come in early, stay late the day before, do whatever you want" (Participant A)	Organisations that provide flexible work arrangements enable workers to attend to their needs and through which may contribute to worker wellbeing. It is reasonable to suggest that a worker would be upset if they were not permitted to leave work for an annual school event with their child that they wished to attend.
22. If given the opportunity, the organization would	"Um the bigger organisations and or not bigger organisation but self-employed farmers, whatever it is, do have a general terms (sic) of giving probably giving far more hours than what would generally be accepted as the norm. So, um in,	Workers who perceive that an organisation is making unreasonable requests regarding their workload and when compared to industry

take advantage of me. (R)	in the normal season and, and that's ones on the reason I left the previous company was the hours." (Participant A)	counterparts may be deterred to continue in the role.
23. The organization shows very little concern for me. (R)	"I guess in a sense I can probably be away, get away with it at this point in time because I'm like not at one of the really high levels of having to be like having all of those pressures and demands. I don't whether that um, whether that changes like I can see in my supervisors that could change like as you move up there more pressures but at the moment its um pretty good and I guess for myself also it's um yeah, something that I try to be really conscious of because I don't want to be one of those people that um where work, I don't want work to be the most important thing um in my life, I think I want other sorts of things to be more important." (Participant E)	Organisations can show little concern for assisting workers with high pressures and demands to maintain work/life balance. Entry level workers perceive that work and life balance will become difficult to achieve as they progress in their role.
2. If the organization could hire someone to replace me at a lower salary it would do so. (R)	"Um I think for, for most young, young graduates coming out at the moment they, they probably find it difficult, um they, there's almost this expectation of, you know, I deserve a high salary straight out of Uni. Um and, and that's I think probably a bit unrealistic at times. Um you do have to prove yourself in your work environment." (Participant A)	Organisations hire workers based on their experience and salary expectations. An experienced individual with lower salary

		expectations would more likely be considered for the role.
3. The organization fails to appreciate any extra effort from me. (R)	"But I guess that yeah that would be offset by a lot of the hours that you actually end (sic) up doing." (Participant A)	Organisations fail to appreciate the amount of effort workers exert; additional benefits are offset by overtime.
6. The organization would ignore any complaint from me. (R)	"Um but we can't get the same services as those people that are on main campus, and you know, just simple things like being able to get reception phone reception within our building which is a like it's a [amount] dollar building that is pretty well brand new and we can't get phone reception because [audio drop out] won't pay because it's not a priority of theirs and we can't get student accommodation built and we have all these students come over and they need somewhere to live and its really difficult to bring them from somewhere so far away and into a town where they're not comfortable, so they really do need some type of accommodation on site, which we do have, but it's just in tatters." (Participant G)	Workers become frustrated with organisations that ignore or fail to prioritise their complaints.

8. Help is available from the organization when I have a problem.	“Sort of working away at it and having like the access to umm, like a varied, like it’s quite a big research station out here with um people from [organisation a] and [organisation b], so like you can have, like there’s a lot of um different research that happening and a lot of different people that you can tap into from a research resource sort of perspective.” (Participant E)	Availability of colleagues to help when workers require access to resources facilitates level of perceived support.
17. Even if I did the best job possible, the organization would fail to notice. (R)	“making sure they have the right guidance and networks, so they don’t, they don't in away don’t understand what they’re talking about is really, really important. It’s a barrier, I think my experience agriculture tends to be very disparaging to new things and so it's um, they tend to, they tend to need a lot of convincing that something new is worthwhile and so making sure that if they're going to go and talk to an agronomist, they talk to someone who is supportive of new, new ideas” (Participant D)	While this exert is framed from a broader industry perspective, it is reasonable to suggest that the implications would be similar in an organisational context. It can be discouraging if worthwhile work fails to be noticed. Conversely, it is important that organisations take notice and support workers with worthwhile ideas.

20. The organization is willing to help me when I need a special favour.	"Yeah. Yeah. So, I suppose they'd be a few benefits and, and you know, you get to attend those, um if you've done your job well that's, that's sort of like our reward. Um on top of that we also have some training, um so that could, it's sort of like train the trainer in a sense, so workshops where we get to develop some of our skills and learn from some experts in other areas or well, within, still within the stats discipline but they um are, sort of, yeah, leading experts in particular areas within that discipline um so that's all so an incentive as well and a bit of a reward as well as a professional development opportunity." (Participant B)	While the content of this exert does not necessarily relate to the provision of assistance out of goodwill, it does suggest that organisational decisions to provide special benefits impact workers perceptions. Workers perceive that if they perform well than they may be eligible for additional rewards for their efforts.
21. The organization cares about my general satisfaction at work.	"A 35-hour week is not gonna (sic) break anyone, um that sort of thing is all positives of my role and that all comes from being a part of the uni sector. If I was actually working in commercial agriculture, you know, it would be 7 o'clock in the morning to at least 5 o'clock every afternoon um and without much flexibility. You know, you got crops in the ground, animals to look after and that sort of thing, you know, running feed lots or you know dealing with	While this exert does not explicitly represent the level of care an organisation demonstrates to is workers, it does suggest that workers are satisfied with organisations that provide

	clients and that sort of thing. So, it's probably pretty much a 24 hour a day job, so I'm very lucky to be in the flexible conditions that I am in um being at a University." (Participant C)	conditions aligned with their preferences.
35. The organization tries to make my job as interesting as possible.	"Umm yeah and I like, I like the varied aspect of being able to go away and um and see different things and also (sic) not only like just in [agriculture industry] but also on a wider agricultural um platform as well. So, I also like going to like the agronomy conferences sometimes or that sort of thing but yeah sometimes it's nice to um get a little bit beyond just [agriculture industry] as well." (Participant K)	Workers enjoy organisations that enable them to engage in a variety of activities that are of interest to them.

Note. SPOS-SF = Survey of Perceived Organizational Support – Short Form; Reverse scored items (R).

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Table 4h

Face Validity of Survey of Perceived Supervisor Support Example Item Parcel

SPSS	Interview Data	Face Validity Comments
4. My supervisor strongly considers my goals and values	"I um got in touch with the person that was my manager for the industry placement asking if she wanted to be a referee on a job application somewhere else and um she said Yep more than happy to do that but while you're applying for jobs why don't you have a crack at this one and sent the application for the job for um the position that I have been in for the last for 4 years or so … Um, so um, yeah that would probably be the number one influence I suppose in me um performing the role ah or getting to this point that I am now, that's for sure," (Participant B)	Supervisors who consider other avenues to support workers goals contribute to their persistence.
7. Help is available from my supervisor when I have a problem	"Ah continuing in this line of work for key supports um probably would probably be sort um so like supervisor support and ah in helping to get like pathways um and potentially like in within the organisation as well but I that you would need to have probably like the supervisor support because they can	Supervisors that assist workers overcome limitations contribute to their persistence.

	go in and um within the limitations, like within the organisation to help." (Participant E)	
1. My supervisor values my contribution to the well-being of our department	"I feel like that has led onto my postdoc and then the second postdoc. Um. Did you want more information about those" (Participant E)	Supervisors who reward workers for their prior efforts with further work opportunities facilitate persistence.
6. My supervisor takes my best interests into account when he/she makes decisions that affect me	"I guess um, well the other thing is just good engagement with your supervisors and stuff um and the people making the decisions, you know, at the school and faculty level. Like um, you know, it's um it's obviously easier to get or lose motivation and that when you're constantly going and asking for things and you're constantly getting knocked back but when you don't have to ask for things" (Participant C)	Good supervisors support workers when they make decisions that may affect them which facilitate workers to maintain motivation.
16. My supervisor tries to make my job	"I mean you're just for me I've been in the staff room doing honours which has been good as far as hearing about what other lectures talk about and their ideas and sort of mentorship and other mentors I had within industry" (Participant F)	Supervisors who put in the extra effort to expose workers to

as interesting as possible		interesting work environments are desirable.
8. My supervisor really cares about my well-being	"I did have one particular mentor at that time and he was brilliant, an older fella and um he like, he was heavily involved in research and had impeccable moral values and I just thought that he really um, like he really got me through and helped me just to combat all of the you know silly things that go on in ah um, like yeah in your first job like when you're fresh out of uni and your trying to navigate through things and I, like I, my first year out of uni I um I travelled 75,000 ks (sic) by myself um across all these research trials in northern [State] and southern [State] and um yeah it was a real eye opener being from not having any experience with even just towing a trailer and um you know riding we had to ride quads and things like that. Like really simple things that now I just look back and go why didn't you just do it and like they were really scary for me at that time and yeah, they, just certain people who really push you through" (Participant G)	Supervisors can contribute to workers well-being and persistence by providing help when workers are feeling daunted.

Note. SPSS = Survey of Perceived Supervisor Support; Several items omitted.

4.3.4 Personality

During the interviews participants also discussed important personality attributes required to be successful in these occupations. This information was organised under codes named (a) Willingness to try new things and learn, and (b) Reliable, ethical, empathetic and considerate. These codes are discussed below.

Attitude toward work tasks influence job fit and persistence in the sector. Openness to begin new things and visit new places was a quality many of the participants appeared to possess. One participant initially accepted a pay decrease to experience a new role within the industry. This interviewee stated that the opportunity to do something different through their work was appealing, “that was literally just to try something different, do something different, work with different people and see some different parts of the countryside” (Participant F). Another participant added to this describing their enjoyment of the variety they get through their work, “I really like the variety that it can give” (Participant J). These are examples of proclivity toward variety seeking in an occupational context.

Indeed, several participants indicated that they were curious, open to change and that they sought out new ideas and opportunities to try new things. An individual who reported that they did not have a prior background in agriculture considered curiosity to be a cornerstone of development within the industry and a driver of successful career progression. Participant H said that a sense of curiosity and ability to learn was important in their line of work, “curiosity, and, and the willingness to go learn and talk to farmers and be uncomfortable and like in the environment, like you know, I've never been to a dairy or a feed lot but I’m willing to ask questions and learn”. This attitude promotes continued learning which would increase their self-efficacy in their work domain.

Openness to change is especially important in a sector that is continuously evolving. One participant who exhibited this trait expressed their enjoyment of learning industry

advances. Participant D explained that continual learning was one of the aspects of their work that they most appreciated,

> "something that I really appreciate about the agriculture sector is it's got this really entrenched sort of learning and continual improvement to it, there's field days, extension agents, theirs growers manuals there's all these educational tools that the end users being the farmers are employing to help them improve but I also have access to and continue to learn about the fundamentals of agriculture".

Willingness to take on new ideas as they emerge appeared vital to success in a role. The expectation that workers self-efficacy is continuously being developed was expressed by Participant B, "we could never expect anyone to walk into the job and know 100% of everything". Therefore, eagerness to try new things is important within this profession, for example, "I've put my hand, I have been given opportunities to go to and I've put my hand up and said yes to do" (Participant F).

The interviewees also highlighted a propensity to think and behave in a reliable, ethical and considerate manner were valuable qualities of agriculturalists. Participant A indicated that it was important that workers personality fit with that of their fellow teammates to optimise their performance within the agriculture sector: "Ah so they are more chasing balanced individuals, but I guess the easiest way to put it is, you've got to have to be a bit OCD (sic) in your operation um because the, the smallest mishap or the smallest miss of anything can have very significant … Ah, I think generally um you've obviously got to look at personalities and how they fit within a team and the group … probably just the openness..". In this excerpt that interviewee has specifically highlighted the need for attention to detail in reliably performing the job and openness to working with other personality types on the job. Individuals who demonstrate these characteristics were considered to be more likely to persist in their STEM work within the field.

The STEM qualified professionals interviewed also expressed a need that workers be ethical and considerate people who as part of their work with teammates are open to taking on other people's idea's as necessary. This was apparent in interviewee G's statement in which they described the need for individuals to be considerate of their team members, "you know, be considerate of other people's ideas, … and, and make sure that um you're a team player". Her transcript suggested that this was especially integral when performing a leadership role in that leaders needed to inspire their staff and ensure that they feel their personal needs are taken into consideration, "I think that's so important definitely important these days but also um just to, you know, if they wanted to be in more of a leadership role, to really try to inspire those people that are working for them or, you know, encourage them and make sure that um, that their needs are also their focus if that makes sense".

Furthermore, she described an ideal worker as empathic,

> "Yeah well cause it's a different, I don't know, I find there's a real disconnect between what we do here in an academic roll to what happens in [capital city] main campus. I think that um, yeah I think, I mean we can, we, we publish and everything like that but that the pressure for us is to for the grower, you know, it's for our industry whereas, whereas the academic in [capital city] it's for their own self and I think that yeah there is that big disconnect here and I think that's why we often clash with our [capital city] counterparts because um because we do have that um like ah what do you call it ah we do have that empathy".

These excerpts share the common thread of openness in which those who are willing to be considerate of others may inherently demonstrate empathy for the feelings of their teammates in their work with them.

4.3.4.1 Summary and measurement of personality. In conclusion, while personality traits were not pursued as a direct line of enquiry in the current investigation participants

discussed the integral nature of personality-fit for STEM qualified professionals' persistence in the agriculture sector. The personality characteristics described appear to best align with the openness to experience trait (Table 4i). Consideration of the various ways in which the construct of openness to experience can be operationalised lead to the selection of variety seeking as an additional measure included for the purposes of the current study ("International personality item pool: A scientific collaboratory for the development of advanced measures of personality traits and other individual differences," 2020).

Table 4i

Face Validity of Variety-Seeking Items Similar to Those in the Temperament and Character Inventory

Variety-Seeking Items	Interview Data	Face Validity Comments
Prefer variety to routine.	"Um I, I enjoy how much I learn and that's probably secondary to being in an area I sort of recognise the value of and enjoy the content in argi-food certainly that is the field that I have drive for and the other side is just the constant ability to learn. Its um something that I really appreciate about the agriculture sector is it's got this really entrenched sort of learning and continual improvement to it, there's field days, extension agents, theirs growers manuals there's all these educational tools that the end users being the farmers are employing to help them improve but I also have access to and continue to learn about the fundamentals of agriculture and the evolving fundamentals of agriculture as well." (Participant D)	Trait interest to engage in a variety of experiences at work.
Seek adventure.	"Yeah, yeah, certainly and also, I have been really fortunate with, ah a lot of, through the ah [name] scholarship, and other professional development, um conferences and what have you that's, I've put my hand, I have been	Propensity to engage in unfamiliar work opportunities.

	given opportunities to go to and I've put my hand up and said yes to do." (Participant F)	
Am open to change.	"Um, oh gosh a few things, but I think one of the main ones is just to have an open mind" (Participant G)	Trait open mindedness.
Like to visit new places.	"Um, and I think if you don't have that background then the skill that you need is, is like that kind of curiosity, and, and the willingness to go learn and talk to farmers and be uncomfortable and like in the environment, like you know, I've never been to a dairy or a feed lot but I'm willing to ask questions and learn and be curious and be humble about all of that but that's what you kind of need if you don't have a background in Ag." (Participant H)	Inquisitiveness to explore unfamiliar contexts at work.
Enjoy hearing new ideas.	"but still have that have understanding that they can take other people's ideas on board. I think that's so important definitely important these days but also um just to, you know, if they wanted to be in more of a leadership role, to really try to inspire those people that are working for them or, you	It is important to pay attention to other people's ideas.

	know, encourage them and make sure that um, that their needs are also their focus if that makes sense." (Participant G)	
Like to begin new things.	"Yeah look it's, it's, it's hard to say. I think there's some, I've got a girl in the south whose come out of [Capital City] and out of the, I'll call it the café district sort of jobs and low and behold she ended up in agriculture. Um it's, it's one of those sort of strange ones and completely different in their experiences, you know, their personal life of what had happened previously. Some people may survive, and some don't in the Ag (sic) game but the I guess that's the cut and dry of, of again the personalities" (Participant A)	Appreciation for engaging in diverse work experiences.
Love to think up new ways of doing things.	"I've a got a good background in that but essentially everything comes from the ground up so ah be it, be it plants, be it animals, um the soil is where it starts and that was probably the, the link for me to go back to the plant and soil science." (Participant A)	Interest in the study of science.

4.3.5 Choice Goals and Actions

This subsection discusses the codes and corresponding interview data that were considered evidence of the SCCT construct – Choice Goals and Actions in a STEM of agriculture workforce context. In the career domain, goals and actions involve participation in work related activities that progress an individual's occupational goals. This is conceptualised as a two-part process in which an individual engages in behaviour that supports both their overall career goal and drives their persistence in a job. Interviewees implied that several factors were relevant to goal formation and commitment within an agricultural work context. This data was incorporated under the following codes:

- Positive mind set, determination and drive,
- Motivation for ongoing learning and education,
- Adaption to the work environment and job requirements,
- Challenges and environmental obstacles at work,
- Resilience and coping self-efficacy at work, and
- It is important to switch off and self-reflect.

Positive mindset, determination and drive were considered an influential factor that impacts persistence in this profession. For example, Participant C stated:

> "So, you know it's, I guess so coming back to one of the things that I think, well I think is necessary for someone working in this space, you've gotta (sic) be driven. Like you've gotta (sic), you've gotta (sic) be someone who you know can um, can sort of open your own doors to a certain extent um and, and yeah want to continue doing what you are doing. The day that sort of spark or drive leaves you, then it's time to go looking for something else but, but yeah, I guess I haven't faced that."

This section of the participants transcript suggests that employees who find meaning and purpose in their work are more determined to persist despite challenges faced.

Employees were motivated to learn and engage in further education. Interviewee A reported, “Um I’ve been always wanting a bit further study and, and to be challenged and to continue learning”. Here continued learning and the prospect of future study have been referred to as positive challenges sought by agriculturalists. This point was reinforced by Participant B who said, “but longer term I would like to do a PHD um and um, yeah, go back and, and do some more study and, and yeah get a PHD underway and completed”. Qualified STEM professions working in the agriculture sector were inspired by their job and held long-term educational and career goals to further develop their skills.

Career adaptability was both explicitly and implicitly represented in the interview data. One participant said plainly that successful workers need to, “adapt to fit your environment” (Participant A). This inferred that individuals continuing in their career within agriculture exercise flexibility in meeting the demands of their works tasks. An example, of this was described by another interviewee who said:

> “and um its really amazed me that probably within the first week of landing in the job um that I have at the moment, I had exhausted all of the things that I had learned at University. Um, and you know, all of that was blown out of the water. So, although we say that, you know, you need a thorough understanding of these things’ um and it's critical that you do before you get there, there is so much on the job learning that it's not funny” (Participant B).

The connotation of this excerpt shows that engaged workers are open to persevering with work tasks, even if things aren’t as straight forward as they were first thought to be. Workers who remain in their role are open to novel challenges and exert effort to adapt.

Dedicated workers can overcome reasonable complications and setbacks on the job. Skills development, adoption of new technology, opportunity to engage in challenging work tasks and environmental factors all influence the perceived difficulty of a role. For example,

a degree of challenge could lead to increased self-efficacy in one's role, "Umm yeah, I think that it's been areas where I've been um trying to improve on like in myself particularly like conference presentations and that sort of thing. I think that that's something like that I had worked on" (Participant E).

The larger the challenge without adequate training and industry support, the greater the likelihood that workers either disengage, simply lack the qualifications to act in the position, or encounter industry wide barriers to perform their role to the full potential. Participant H explained that an obstacle in the sector was in relation to the adoption of new technology:

> "nothing would really make me leave Ag. Um, there's lots of challenges, like just things like connectivity, you know, if you don't have the Internet it's hard to adopt some of these digital technologies and, you know, we have lots of policies or, or issues around social license that emerge, you know, are we still gonna (sic) be farming, are we gonna (sic) be farming in the same way"?

The interviewees indicated that a resilient attitude towards more challenging work tasks influences workers well-being. Participant G stated, "but I guess that's at the same time it makes you resilient and you have to find ways to make it better for yourself which is, you know, a learning experience as well and I think that's how a lot of people get through it as well is finding other ways around it". In this excerpt the STEM qualified professional suggests people who perceive obstacles as learning experiences are more likely to be successful in overcoming workplace issues.

Internal resources were viewed as important in coping with job-related challenges. Participant D said, "so I think just sort of being aware that there's more you've just got a grind through some of it and I think that, I take that same philosophy with my hobbies, you know, they're days where you don't feel good and you just gotta (sic) grind through it".

While this participant did not describe the resources required, they eluded to use of personal strategies to sustain energy over a period of time. This was supported by Participant I who stated, “I've been trying to reduce any external stresses”.

Immersion in procedural tasks or work-related reflection more generally can be a productive factor on the job and influential in the career decision making process. One worker described instances on the job where they were permitted time to think about their career goals and indicated this as an opportunity to consider growth within the field:

> “you’ve got to keep yourself driven and motivated in that aspect because there’s no one else there to drive you. Um it might be, you know, driving somewhere, you might be in the car for four or five hours and sometimes you just turn the radio off just to think, you know, you don’t have other voices, you’re watching the country side fly by and, and um sometimes yeah it’s, it’s the best opportunity to just get a bit of self-reflection and, and um try to yeah, get that next step of, of what do I do or um we’ve, we’ve probably, you know, personally and as a family we’ve probably missed a few opportunities because we are on the um conservative side of, of some decisions and um but again if you’re not self-reflecting you’re not growing” (Participant A).

Being actively engaged in one’s own career development strategy at work can promote more in-depth engagement in decision making about a person’s career direction and persistence in a job. While it is useful to engage in self-reflection at times, it is also necessary to maintain appropriate boundaries. If the work-life balance is compromised it can become challenging to separate oneself from the work that they perform altogether. Another individual explained a need to but difficulty in distancing themselves from work outside of operation hours:

> “Not great [laughs] um its um I, I it's generally really good I tend not to because I'm interested in the area and because I'm working with founders the don't switch off I

> tend to make myself more available then I would otherwise like to um and I deliberately make myself much more available to the founders I work with um then my, my colleagues, my direct in the [organisation] team. I get, I get a text on the weekend saying can I have help with my pitch or can I have help this or can I talk to you about this, I'm very happy to talk to them on the weekend but I wouldn't necessarily do something [audio drop out] and I feel there's that sort of, we expect them to me on all the time and be working hard all the time and it would feel very hypocritical if I didn't do the same but during peak periods it's, I'm unemployed four days and it's not unusual that I'll do 60, 70 hours a week during the busiest times. Now is relatively quiet so it's nice to have a breather and sort of step back and reflect on the last 6 months and plan for the next 12 months onwards" (Participant D).

Work-life balance is clearly crucial to maintaining active engagement in one's role. Too involved in performing work tasks outside of requirements, an individual risks burnout, while little time to consider career goals also might impact workforce retention. A healthy level of absorption in the workplace appears appropriate to facilitate intentions to persist while still promoting the opportunity for strong occupational outcomes.

4.3.5.1 Summary and measurement of choice goals and actions. In sum, participants indicated that they had various educational and career-related goals. Workers, however, need to be resilient and engage in effective coping behaviour to overcome obstacles in persisting with their goals. Committed employees described high levels of dedication to their job and absorption in associated work tasks. Although, maintaining energy levels long-term appeared to be heavily reliant on their cognitive flexibility and ability to participant in problem-solving behaviour. Therefore, two measures of problem-focused coping (Table 4j) and work engagement (Table 4k) were selected to operationalise goal commitment and directed activity in the current research (Heppner et al., 1995; Schaufeli et al., 2006).

Table 4j

Face Validity of Problem-Focused Style of Coping Scale – Reflective Style

PFC-RS	Interview Data	Face Validity Comments
14. I get in touch with my feelings to identify and work on problems. (A)	"That's the biggest one for me personally. Um. I think it's very important as well to take breaks, ah especially as an early stage founder be confident, having the confidence, that belief in the team that your building, that you can step away for a little bit and switch off and come back and it's not literally on fire." (Participant D)	Identify and monitor your affect at work and take action where required.
17. I have alternate plans for solving my problems in case my first attempt does not work. (C)	"Um and yeah when you can't give them an actual answer, that's really frustrating (sic), so those sorts of things are probably harder to deal with but having that internal capacity and it is a resilience to." (Participant A)	Openness to develop new solutions.
11. I think ahead, which enables me to anticipate and prepare for problems before they rise. (C)	"Yeah that's right. It's always, it's always hard cos if your intending on maintaining a full-time role, you know, you gotta (sic) be careful that you're not overextending yourself then making it worse by, you know, creating additional work at home. Um so, so yeah again getting, getting that balance right is important." (participant A)	Plan your work and prepare ahead to maintain work/life balance.

4. I identify the causes of my emotions, which helps me identify and solve my problems. (A)	“I definitely see that um; I see that happening in our founders. Um I don’t worry about it in myself but I'm conscious of it. Um at the moment I'm I’m so interested in the things that I'm doing that I don't feel like it's an immediate pressing risk, um but I am I'm very aware of it and I do spend a lot of time with founders talking about how they manage it, how do they offload work, how they build a support network that make sure that they’re not going over the edge and I feel like there's, personally with everyone that I work with, there’s sort of like this threshold that you don’t want to go over, that once you cross you don't recover and if you reach it you need to stop and take a break and recover but there's sort of this threshold which changes with seasons and with your motivation and with stage of the business and with the environment around you, where you want to be very aware of not crossing or not pushing over that threshold for too long because it just sort of, it kind of breaks you for a period.” (Participant D)	Have an awareness of and manage your emotional responses.
I think about ways that I solved similar problems in the past. (C)	“and also confidence in to say hey I don’t know the answer to that but I will find out rather than, than a half arsed answer and not being right, um put your hand up to say you don’t know, I’ll find out and get back to them,” (Participant F)	Confidence to find solutions to problems regardless of whether or

		not a worker has dealt with a similar situation previously.
12. I think my problems through in a systematic way. (C)	"Um and then the other part is being able to um being able to, to not get dragged into the details. You can spend a lot of time with what's the bigger picture here, what's the problem that you're solving, what does it look like when you have this in the world and um working with technologists which is, we sort of, well [organisation] specialises in deep technology and so when you've got the hardcore technologists and so ah it's really important that as a program manager I don't get dragged into the technology, that I'm always able to say yes but what does, who does this solve a problem for or how does it solve the problem and how does this help?" (Participant D)	Use systematic methods to approach problems at work.
6. I consider the short-term and long-term consequences of each possible solution to my problems. (C)	"Um addressing a situation and, and you know, no one likes dealing with conflict necessarily, um yeah, dealing with it upfront I think you don't want to deal with anything while you're in a hostile um mood or, or an aggravated mood. Sometimes you've just got to say - look I am sorry, I'm not willing to discuss this with you right	Set aside immediate reactions to deal with problems that arise at work.

	now, I am going to come back to you, but I need to go away right now. So, having that knowledge within yourself again that there are times when you need to walk away and, and ah that's not walking away from the issue, it's just walking away from the you know immediate reactionary based ah decisions and sometimes they are not clear thoughts. So, you are better off disappearing, and, and not to be rude, not to be anything else, just dealing with what's in front of you." (Participant A)

Note. A = affective items; C = cognitive items; PFC-RS = Problem-Focused Style of Coping Scale – Reflective Style.

Table 4k

Face Validity of Utrecht Work Engagement Scale – Short Questionnaire

UWES-SQ	Interview Data	Face Validity Comments
1. At my work, I feel bursting with energy.	"so I think just sort of being aware that there's more you've just got a grind through some of it and I think that, I take that same philosophy with my hobbies, you know, they're days where you don't feel good and you just gotta (sic) grind through it." (Participant D)	While this exert is inversely phrased, it still captures the core concept that some days feel better at work than others.
2. At my job I feel strong and vigorous.	"and um its really amazed me that probably within the first week of landing in the job um that I have at the moment, I had exhausted all of the things that I had learned at University. Um, and you know, all of that was blown out of the water. So, although we say that, you know, you need a thorough understanding of these things' um and it's critical that you do before you get there, there is so much on the job learning that it's not funny." (Participant B)	Strong workers adapt and persist despite setbacks. (Item replaced with: 'At my work I always persevere, even when things do not go well.'
5. When I get up in the morning, I feel like going to work.	"Um it's also quite hard there's a lot of emphasis on building capability in young people in agriculture, and, and leaders and, that it's also quite daunting … you've been built up, um as yeah you, you've got all this, you've got this, you've got	Workers can find it difficult to engage in work that they believe does not meet other's

	that, but now your sort've (sic) like well yep cool, but I still have to come in and sweep the floors of whatever job I go into so that's also, I find quite hard um yeah." (Participant F)	expectations. (Item replaced with: 'At my job, I am very resilient, mentally.')
3. I am enthusiastic about my job.	"Um if, if you're continually looking over the fence, chances are you're probably not happy where you're at." (Participant A)	While this exert is inversely phrased, the data supports the concept that workers who enjoy the work that they perform are eager to commit to their job. This is as opposed to 'sitting on the fence' in which the worker is more likely to have assumed a neutral attitude toward their job.

4. My job inspires me.	“but longer term I would like to do a PHD um and um, yeah, go back and, and do some more study and, and yeah get a PHD underway and completed.” (Participant B)	Workers who find their job inspiring are dedicated to furthering their skills and knowledge.
7. I am proud on the work that I do.	“and I often think to myself too, you know, I'm giving a big part of my life to working here at the uni um and so I want to make it rewarding for myself as well. So, you know you couldn't just stagnate, I couldn't personally stagnate in my role, I’ve gotta (sic) keep learning and stuff to keep it interesting. Otherwise I just feel like I'm wasting my time.” (Participant C)	People who have pride in their work are driven to maintain a sense of interest in the tasks that they perform.
6. I feel happy when I am working intensely. 7. I am immersed in my work. 8. I get carried away when I am working.	“Not great [laughs] um its um I, I it's generally really good I tend not to because I'm interested in the area and because I'm working with founders the don't switch off I tend to make myself more available then I would otherwise like to um and I deliberately make myself much more available to the founders I work with um then my, my colleagues, my direct in the cicada team. I get, I get a text on the weekend saying can I have help with my pitch or can I have help this or can I talk to you about this, I'm very happy to talk to them on the weekend … during peak	One participant indicated that engaged workers enjoy periods of hard work, will immerse themselves and become overly involved in their work during peak periods.

	periods it's, I’m unemployed four days and it's not unusual that I'll do 60, 70 hours a week during the busiest times.”

Note. Subscales = Dedication, Vigour, and Absorption; UWES-SQ = Utrecht Work Engagement Scale – Short Questionnaire.

4.3.6 Discussion

This chapter outlined the method and results of Study One in which thematic analysis was used to analyse qualitative data obtained through semi-structured interviews. As a result of thematic analysis it was proposed that the SCCT variants be operationalised as: (a) variety seeking as personality; (b) perceived organisational support and perceived supervisor support as environmental supports; (c) task self-efficacy as self-efficacy expectations; (d) needs satisfaction and positive state affect as outcome expectations; (e) problem-focused coping as goal commitment; and (f) work engagement as goal directed activity. The following questionnaires were selected to measure these constructs: (a) International Personality Item Pool Scale ("International personality item pool: A scientific collaboratory for the development of advanced measures of personality traits and other individual differences," 2020) for variety seeking; (b) Survey of Perceived Organizational Support (Eisenberger et al., 1986) for perceived organisational support and Survey of Perceived Supervisor Support (Kottke & Sharafinski, 1988) for perceived supervisor support; (c) a pilot measure for task self-efficacy; (d) Minnesota Importance Questionnaire (Gay et al., 1971) for needs satisfaction and Career Exploration and Decision Learning Experiences Scales for positive state affect; (e) Problem-Focused Coping Scale (Heppner et al., 1995) for problem-focused coping; and (f) Utrecht Work Engagement Scale (Schaufeli et al., 2006) for work engagement.

While there were no questions pertaining to personality in the interview schedule, participants highlighted a need for workers to be open minded and discussed an appreciation for working in diverse contexts. Therefore, the decision was made to include personality operationalised as variety seeking as a variable in quantitative model testing. It was clear that workers also required confidence in performing a variety of STEM tasks within an agricultural work context. Consequently, it was decided to develop a new measure of task

self-efficacy based on the interview data and core tasks retrieved from O*Net to pilot in the quantitative study.

Analysis of the interview data revealed that STEM qualified professionals sought to have their needs met through their work. While thematic analysis supported the use of the Minnesota Importance Questionnaire (Gay et al., 1971) to operationalise this construct. The relevant item parcel required rephrasing to contextualise the questionnaire to the needs described in Study One. Similarly, problem-focused coping was identified as an effective approach to overcoming challenges at work. This interview data appeared to align with the Reflective Style subscale of the Problem-Focused Coping Scale (Heppner et al., 1995), and it was subsequently decided to retain this subscale alone for model testing in Study Two.

Study One has been used to support the applicability of SCCT among STEM trained professionals working in the Australian agriculture sector. The interview data has been used to develop, contextualise and adapt questionnaires to measure the constructs identified as important to agriculturalists career persistence. These questionnaires will be collated in an online survey for the purposes of Study Two. This online survey will be used to collect quantitative data and test the adapted model of career persistence in the second study.

CHAPTER FIVE: STUDY TWO

This chapter outlines the method and results of Study Two, that was the larger of the two studies and aimed to test the effect of SCCT constructs on agricultural career persistence intentions among STEM qualified individuals. Specifically, Study Two was used to answer the 4th research question: What SCCT factors influence scientists, technicians, engineers and statisticians' intentions to persist in agricultural careers? First the research hypotheses developed using the evidence from the literature review and results of Study One will be presented, accompanied by an adapted and contextualised model of career persistence among agricultural scientists, technicians, engineers and statisticians. The recruitment strategy, procedure, measures and analyses will then be discussed. Finally, the results of Study Two will be reported.

Study One informed the instrumentation of Study Two. The proposed operationalisation of SCCT constructs was as follows: (a) variety seeking as personality; (b) perceived organisational support and perceived supervisor support as environmental supports; (c) task self-efficacy as self-efficacy expectations; (d) needs satisfaction and positive state affect as outcome expectations; (e) problem-focused coping as goal commitment; and (f) work engagement as goal directed activity.

5.1 Research Hypotheses

The following hypotheses were formed based on the literature reviewed and results of Study One. Hypotheses pertaining to the unique effects (1A: 1F) of key independent variables on the dependant variable will be presented first followed by several mediation hypotheses (2A: 2I) relating to indirect effects (Table 5a). Theorised direct and indirect pathways between measured variables are depicted in Figure 5.1.

It is noted that these hypotheses have been phrased to align with the analytical approaches available given the current studies final sample size. SCCT hypotheses are

typically otherwise tested using Structural Equation Modelling, that for sufficient power, would have required a much larger sample (e.g., 300). Regression and mediation analyses offer alternative statistical approaches to test direct and indirect effects of variables within the SCCT model for smaller samples. Therefore, original SCCT hypotheses have been reformulated for the purposes of the present research.

Table 5a

Unique Effects and Mediation Hypotheses

	Hypothesis
1A	Variety seeking will account for unique variance in persistence intentions
1B	Perceived organisational support and perceived supervisor support will account for unique variance in persistence intentions
1C	Task self-efficacy will account for unique variance in persistence intentions
1D	Needs satisfaction and positive state affect will account for unique variance in persistence intentions
1E	Problem-focused coping will account for unique variance in persistence intentions
1F	Work engagement will account for unique variance in persistence intentions
2A	Variety seeking will be indirectly related to persistence intentions through perceived organisational support and perceived organisational support
2B	Variety seeking will be indirectly related to persistence intentions through task self-efficacy beliefs
2C	Variety seeking will be indirectly related to persistence intentions through work engagement
2D	Perceived organisational and supervisor support will be indirectly related to persistence intentions through task self-efficacy
2E	Perceived organisational and supervisor support will be indirectly related to persistence intentions through needs satisfaction and positive state affect
2F	Perceived organisational and supervisor support will be indirectly related to persistence intentions through work engagement
2G	Task self-efficacy beliefs will be indirectly related to persistence intentions through needs satisfaction and positive state affect

2H	Task self-efficacy beliefs will be indirectly related to persistence intentions through work engagement
2I	Needs satisfaction and positive state affect will be indirectly related to persistence intentions through work engagement
2J	Problem-focused coping will be indirectly related to persistence intentions through work engagement

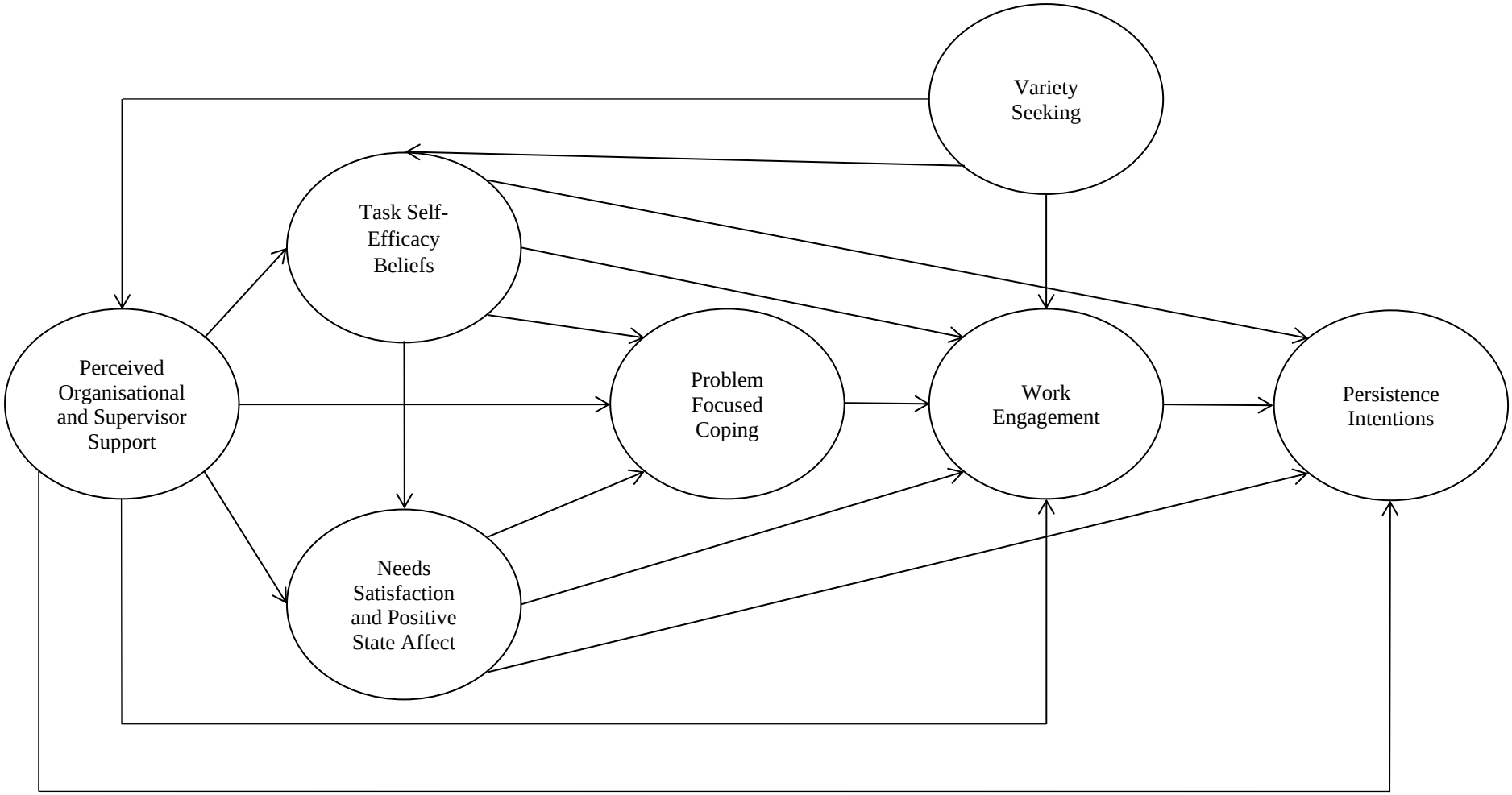

Figure 5.1. An SCCT Model of STEM Professionals Persistence Intentions within the Australian Agriculture Industry.

5.2 Method

An overview of the participants, procedure including measures, and analytical strategy will now be provided in this section. Descriptive statistics will be presented to assist in describing the sample, and the reliability and validity of the measures will be discussed.

5.2.1 Participants

Apart from one participant who entered their age as zero, the final sample of participants were aged between 21 and 71 years ($\mu = 40.4$). An almost even spread of genders was represented within this sample with 58 participants identifying as female (i.e., 50.4%). Most participants reported that their highest level of education was an undergraduate degree ($n = 44$), postgraduate degree ($n = 24$) or Doctor of Philosophy (i.e., PhD; $n = 39$). Just two participants indicated certificate level qualifications and six people said that they had a diploma. The majority of the sample were employed full-time ($n = 72$), followed by fixed term contract workers ($n = 21$), and part-time employees ($n = 10$). The remainder of the sample were either self-employed ($n = 6$), reported another unspecified employment status ($n = 5$) or identified as casually employed ($n = 1$). Most participants identified as working in the agriculture industry ($n = 104$), one of these people also said that they worked in aquaculture, forestry and logging, fishing, hunting and trapping. Fewer participants indicated that they worked in agriculture, forestry and fishing support services ($n = 18$) or environment ($n = 15$). Much of the sample worked in a science-related occupation ($n = 73$), the remainder of the participants worked in technology ($n = 2$), engineering ($n = 7$), or mathematics ($n = 4$) disciplines. Some of the occupations reported were coded as 'other' ($n = 29$) because there was not enough information provided in the description to assign the participant to a STEM subgroup. Only seven participants opted not to indicate their income, the remainder of the sample reported earnings in Australian dollars of $\leq$\$18,200 ($n = 5$), \$18,201 – \$37,000 ($n = 4$), \$37,001 – \$90,000 ($n = 42$), \$90,001 – \$180,000 ($n = 52$) or \$180,001 and over ($n = 5$).

The online survey was started by 213 people, of which 115 completed the series of questionnaires in full (i.e., 53.9%). Several of the 98 partially completed surveys were started but did not include item responses. The majority of the partially completed surveys included item responses to some but not all the questionnaires within the survey. It is plausible that some people who started but did not respond were interested in the research but ineligible to participate in the survey. Similarly, it is likely that people who partially completed the survey dropped off due to the length of the survey (i.e., approximately 15 minutes). This was commented upon in an expert review process wherein a working STEM professional suggested that the survey be shortened to attract a higher response rate. It is also possible that some people who started and/or partially completed the survey experienced poor internet connection, and consequently, were unable to continue with the survey at that time. Regardless of the reason for non-completion, no option was provided for partial completers to return to their survey. Potentially, some partial completers did fully complete the survey at a later time, generating a new participant identification number and essentially duplicating some of the earlier incomplete responses. Therefore, only full responses were included in data analysis.

5.2.2 Procedure

Human ethics approval was sought and approved through the University of Southern Queensland (H17REA176). A survey (Appendix A) was developed that was comprised of several measures selected based on their face validity compared to the interview data collected during Study One. Inclusion criteria for participation was communicated in writing and stipulated that STEM training and Australian agriculture industry work engagement were required to be eligible for the study. Example occupations such as Soil and Plant Scientist, Agronomist, Plant Pathologist, Entomologist, Research Assistant, Precision Agriculture

Technician, Laboratory Technician, Agricultural Engineer and Biostatistician were provided to prospective participants.

Participants were recruited through an online survey that was promoted at several conferences as well as via a local newspaper, some industry newsletters, and the primary researchers Twitter, LinkedIn and Facebook accounts. Organisations and individuals were also asked and agreed to promote the survey with their network. Additionally, LinkedIn and Twitter advertising services were utilised to boost responses. Participation was voluntary and anonymous. Prospective participants were advised about the purpose of the study and a nominal incentive in the form of a one-dollar donation to a charity for each completed survey up to the value of $300 dollars was promoted. Data collection commenced during August 2019 and concluded in February 2020.

5.2.3 Measures

Measured variables were (a) variety seeking, (b) perceived organisational support, (c) perceived supervisory support, (d) STEM task self-efficacy, (e) state affect, (f) needs satisfaction, (g) problem focused coping, (h) work engagement, and (i) persistence intentions. These measures are outlined in detail below.

5.2.3.1 Variety seeking. Personality was operationalised as variety seeking and measured using positively keyed items from a preliminary International Personality Item Pool Scale ("International personality item pool: A scientific collaboratory for the development of advanced measures of personality traits and other individual differences," 2020) in accordance with findings from the Study One thematic analysis. The following instructions were provided to participants, “Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Indicate

for each statement whether it is 1. Very Inaccurate, 2. Moderately Inaccurate, 3. Neither Accurate Nor Inaccurate, 4. Moderately Accurate, or 5. Very Accurate as a description of you.”.

Responses were recorded on a five-point scale which ranged from *very inaccurate* (1) to *very accurate* (5). Participants responses to the 7-item scale (e.g., “Love to think up new ways of doing things”) was summed to calculate a total scale score. Higher scores are indicative of greater variety seeking. The full subscale consisted of both positively and negatively keyed items has showed good ($\alpha = .80$) reliability ("International personality item pool: A scientific collaboratory for the development of advanced measures of personality traits and other individual differences," 2020). In the current study the 7-item Variety Seeking measure showed good internal consistency ($\alpha = .86$).

5.2.3.2 Perceived organisational support. Support was operationalised using the Survey of Perceived Organizational Support – Short Form (Eisenberger et al., 1986). The full measure is comprised of a combination of positively (e.g., Help is available from the organization when I have a problem.) and negatively phrased (e.g., Even if I did the best job possible, the organization would fail to notice) items, of which the latter are reverse scored. The original scale is unidimensional but included statements pertaining to the following: organisational satisfaction with employees; organisational actions that affect employees; employees’ satisfaction and wellbeing.

Negatively worded items are typically included to identify positive response bias. This combination of statements, however, requires more cognitive effort to adjust responses based on the direction of the statement. There is evidence to suggest that these items can also cause confusion for respondents, potentially leading to random selections which could confound results (Chyung, Barkin, & Shamsy, 2018). Additionally, the inclusion of reverse scored item’s increases the time imposition per respondent. In consideration of these factors,

only positively phrased statements were retained for the purposes of the current study. This decision reduced the short form from 16 to 9-tems.

The original directions were: "Listed below and on the next several pages are a series of statements that represent possible feelings that individuals might have about the company or organization for which they work. With respect to your own feelings about the particular organization for which you are now working— [name of organization]—please indicate the degree of your agreement or disagreement with each statement by checking one of the seven alternatives below each statement." These were rephrased in part in consideration of the online nature of this studies survey, Australian context, and lack of prior knowledge about respondents' employers: Listed below are a series of statements that represent possible feelings that individuals might have about the company or organisation for which they work. With respect to your own feelings about the particular organisation for which you are now working please indicate the degree of your agreement or disagreement with each statement by checking one of the seven alternatives below/beside each statement.

Responses were recorded using a seven-point Likert scale from 1 = *strongly disagree* to 7 = *strongly agree*. The sum of participants responses to all 9 items was calculated to provide a total score that could range from 9 to 63. Higher scores are indicative of greater perceived levels of organisational support. Evidence of construct validity (Shore & Tetrick, 1991) and reliability (α = .89 to .94) of the scale has been established previously (Eisenberger, Rhoades, & Cameron, 1999; McDonnald, 2017; Settoon, Bennett, & Liden, 1996). In the current sample, the Perceived Organisational Support 9-item measure was shown to have excellent reliability (α = .97).

5.2.3.3 Perceived supervisor support. The Survey of Perceived Supervisor Support was another measure used to operationalise supports (Kottke & Sharafinski, 1988). This measure was based on the Survey of Perceived Organisational Support, is unidimensional and

comprised of 16-items. Consistent with the decision made regarding reverse scored items in the original scale, negatively phrased items (n =2) were rejected for the purposes of the current study. While Study One only produced data to support the face validity of several of these items (e.g., My supervisor takes my best interests into account when he/she makes decisions that affect me), there is empirical evidence to suggest that the remainder of the statements also be included in the present study.

The instructions used for the Survey of Perceived Supervisor Support were again rephrased to indicate that responses needed to be considered in relation to the respondent's manager or supervisor: Listed below are a series of statements that represent possible feelings that individuals might have about their manager or supervisor for whom they work. With respect to your own feelings about your particular supervisor for whom you are now working please indicate the degree of your agreement or disagreement with each statement by checking one of the seven alternatives below/beside each statement. Responses were again recorded using a seven-point Likert scale from 1 = *strongly disagree* to 7 = *strongly agree*.

The sum of participants responses to all 9 items was calculated to provide a total score that could range from 9 to 63. Higher scores are indicative of greater perceived levels of supervisor support. The scale has previously been shown to be reliable (α = .98) sharing a weak correlation (r = .13) with POS indicating that the two scales are distinct (Kottke & Sharafinski, 1988). The internal consistency of the 9-item measure of Perceived Supervisor Support in the present study was excellent (α = .98).

5.2.3.4 Task self-efficacy. Nine items were developed to assess confidence in performing STEM tasks within the agricultural sector. Item content consisted of occupational tasks identified through O*Net (O*NET OnLine, 2019) across several relevant STEM and agricultural professions that were endorsed in the initial qualitative study. These were:

a) I can design and/or conduct research focusing on agricultural topics (e.g., planting, spraying, cultivating, harvesting, storing, processing, or transporting horticultural products);
b) I can collect and/or analyse data focusing on agricultural topics (e.g., to assess factors such as soil quality, terrain, field productivity, fertilizers, or weather conditions);
c) I can use and/or maintain agricultural technology (e.g., weed identification or automated spot spraying systems);
d) I can demonstrate the agricultural applications of spatial data (e.g., identify areas in need of pesticide treatment by analysing geospatial data to determine insect movement and damage patterns);
e) I can plan, test and/or design agricultural systems or machinery (e.g., irrigation systems, farming equipment and machinery);
f) I can install, maintain and/or use computer software (e.g., design agricultural machinery components and equipment, using computer-aided design);
g) I can prepare scientific and/or project documents (e.g., records, reports, articles, sketches, working drawings, specifications, proposals, grant applications and/or budgets);
h) I can communicate scientific and/or technical information (e.g., about research or project results, plans to other professionals or the public or teach related courses, seminars, or workshops); and
i) I can design agricultural technology (e.g., advance weed identification or automated spot spraying systems).

The following instructions were presented to participants: “Below is a list of tasks involved in several agriculture-related occupations. Consider your current knowledge/skills

to perform these tasks. Rate your confidence level from 1 (not confident at all) to 5 (completely confident)". Respondents indicated their level of confidence by selecting a response option on a five-point rating scale from (1) *not confident at all* to (5) *completely confident* for each item. The sum of participants responses to all nine items was calculated to provide a total scale score that could range from 9 to 45. Higher scores are indicative of greater confidence in performing STEM tasks. Face validity of the items were assessed via Study One. The 9-item STEM Task Self-efficacy scale was found to have good internal consistency (α = .81).

5.2.3.5 State affect. Outcome expectations were operationalised as state affect and needs satisfaction. State affect was measured using the Survey of Career Exploration and Decision Learning Experiences positive and negative emotion scales (Lent et al., 2017). Together these scales comprised of an 8-item list of emotions pertaining to situational affect. The original instructions for these items were: "When you have approached career exploration and decision-making tasks over the past year, to what extent have you felt…". These directions required rephrasing for the purposes of the current study to ensure that respondents understood that they were to draw upon their career experiences when responding to each item. Therefore, the following instructions were provided to participants in the present study: In your approach to your job and work tasks over the past year, to what extent have you felt … .

Responses were recorded using a five-point scale from 1= *very slightly or not at all* to 5 = *extremely*. The sum of participants responses to the four positive and four negative items was calculated to provide two subscale scores that each could range from 4 to 20. Higher scores on the former and lower scores on the later are indicative of more positive work-related experiences. The two-factor structure and weak correlation ($r = -.18$) between the scales have been shown and reliability has been established (α = .81 to .82) previously (Lent

et al., 2017). Both the Positive Emotion (α = .89) and Negative Emotion (α = .84) subscales also had good internal consistency in the current research.

5.2.3.6 Needs satisfaction. Four additional prestige items adapted from the Minnesota Importance Questionnaire were also used to assess outcome expectations (Gay et al., 1971). Items pertaining to social status, and recognition were included, and the authority item omitted due to its' lack of relevance. It is acknowledged that there was an error in the online survey which referred to three as opposed to four statements. The following instructions were provided to participants, "Below are three statements about your work and career, to what extent do you agree …". Responses to questions (e.g., I get recognition for the work that I do) were recorded on a five-point scale from *strongly disagree* (1) to *very strongly agree* (5). The sum of participants responses to all four items was calculated to provide a total scale score which could range from 4 to 20. Higher scores are indicative of greater needs satisfaction. Internal consistency of the 4-item Needs Satisfaction measure was evidence by fair Cronbach's Alpha (α = .70).

5.2.3.7 Problem-focused coping. Problem-focused coping was measured using the Problem-Focused Coping Scale (Heppner et al., 1995). The Reflective Style subscale was selected for inclusion in this study based on item face validity established using the interview data from Study One. The reflective subscale is a 7-item measure which is comprised of a combination of affective (e.g., I identify the causes of my emotions, which helps me identify and solve my problems) and cognitive items (e.g., I think my problems through in a systematic way). The original total scale instructions advised completers that the scale contained "statements about how people think, feel, or behave as they attempt to solve personal difficulties … like feeling depressed, getting along with friends, choosing a vocation. … In considering how you deal with such problems, think about successful and unsuccessful outcomes, and what hinders or helps you in solving these problems." These

instructions were adapted and rephrased for the purposes of the current study. The rationale for this was to remove instructions pertaining to behaviours which were not included in this study and to contextualise examples so that participants of the present investigation understood that they were to draw upon their career experiences when responding to each item.

Therefore, the following instruction was provided to participants of this study: "statements about how people think or feel as they attempt to solve occupational difficulties … like feeling stressed at work or getting along with colleagues. … In considering how you deal with such problems, think about successful and unsuccessful outcomes, and what hinders or helps you in solving these problems." As per the original instruction's participants were also asked: "how frequently you do what is described in each item … respond in a way that most accurately reflects how you actually think, feel, and behave when solving personal problems rather than how you think you should respond." Responses were recorded on a five-point Likert scale where 1 = *almost never*, 2 = *occasionally*, 3 = *about half of the time*, 4 = *often*, and 5 = *almost all of the time*. The sum of participants responses to all seven items was calculated to provide a total scale score that could range from 7 to 35. Higher scores indicate more frequent use of affective and cognitive problem-focused coping.

There is evidence of concurrent and construct validity established with similar constructs such as problem solving skills and satisfaction with problem solving skills (Heppner & Petersen, 1982). The Reflective Style subscale has previously demonstrated fair ($\alpha = .77$) to good ($\alpha = .85$) reliability (Heppner et al., 1995; Heppner & Petersen, 1982). The Problem Focused Coping 7-item measure used in this study also demonstrated fair internal consistency ($\alpha = .71$).

5.2.3.8 Work engagement. Work engagement was measured using the Utrecht Work Engagement Scale – Short Questionnaire (Schaufeli et al., 2006). The shortened version of

this scale includes nine of the original items the constituted the larger 17-item scale and retains all three subscales: Vigour (e.g., When I get up in the morning, I feel like going to work), Dedication (e.g., I am proud of the work that I do), and Absorption (e.g., I feel happy when I am working intensely). The original instructions were: "The following 17 statements are about how you feel at work. Please read each statement carefully and decide if you ever feel this way about your job. If you have never had this feeling, cross the "0" (zero) in the space after the statement. If you have had this feeling, indicate how often you felt it by crossing the number (from 1 to 6) that best describes how frequently you feel that way" (Schaufeli & Bakker, 2003).

The instructions were adapted for the purposes of the current study to reflect the reduced number of items (i.e., 9) and online administration (i.e., select rather than cross). Responses were recorded using a seven-point Likert style scale: 0 = *Never*; 1 = *Almost Never, A few times a year or less*; 2 = *Rarely, once a month or less*; 3 = *Sometimes, A few times a month*; 4 = *Often, Once a week*; 5 = *Very Often, A few times a week*; 6 = *Always, Every day*. The sum of participants responses to all nine items was calculated to provide a total scale score which could range from 0 to 54. Higher scores are indicative of more frequent engagement at work.

Factorial and discriminant validity have previously been evidenced with a measure of burnout (Schaufeli et al., 2006). Reliability of the full scale measure has been established (α = .85 to .92) previously (McDonnald, 2017; Schaufeli et al., 2006) and each of the subscales have demonstrated varying levels of internal consistency (α = .60 to .92) across countries (Schaufeli et al., 2006). The 9-item Work Engagement measure also demonstrated excellent internal consistency (α = .92) in the current study. At a subscale level, both the vigour (α = .874) and dedication (α = .87) subscales were shown to have good reliability, and the absorption subscale demonstrated fair internal consistency (α = .77).

5.2.3.9 Persistence intentions. A single item (i.e., "I plan to remain in a job within this line of work") was used to measure persistence intentions. Participants were provided with the following instructions, "In your job and work over the next six months, to what extent do you agree". Responses were recorded on a five-point scale ranging *from strongly disagree* (1) to *very strongly agree* (5). Higher scores are indicative of greater intention to persist.

5.3 Analytic Strategy

There were three analytic phases in the present research which involved (a) data screening, (b) hierarchical regression analysis, and (c) mediation analysis. Data screening was performed to check assumptions of statistical analyses. Hierarchical regression analysis was then conducted to test the direct effects hypotheses of predictor variables on the outcome measure. Finally, mediation analysis was completed to test the indirect effects hypotheses. The approach to data screening and statistical analyses are outlined in more detail in this section. First, assumptions testing will be discussed, followed by an overview of the rationale for hierarchical regression, and mediation analyses.

5.3.1 Data screening. Linear regression assumptions were tested including normality, linearity, skewness, kurtosis, multicollinearity, univariate and multivariate outliers. First, the Kolmogorov-Smirnov and Shapiro-Wilk tests were checked for normality violations. A non-statistically significant result of $p > .05$ was considered to indicate normally distributed data. Linearity between the independent variables and dependant variable was then assessed by visually inspecting the expected and observed standardised residuals plot for deviations from the Y-line. Large deviations would be considered to violate this assumption. Skewness and kurtosis statistics were also calculated. Absolute values outside of 1 and 3 respectively were considered asymmetrical and non-uniform.

Multicollinearity between the predictor variables was screened by examining the correlation matrix. Correlation coefficients less than .70 would be considered to meet the multicollinearity assumption. Cooks Distance and the range of the standardised residual statistics were checked to assess univariate outliers. Cooks Distance of greater than 1 was considered to indicate the presence of influential cases and standardised residuals that fell outside of -3 to 3 would be considered univariate outliers. Case wise diagnostics were utilised to identify the presence of influential univariate outliers.

Additionally, multivariate outliers were assessed using Mahalanobis Distance. Cases greater than the critical value for the maximum number of predictors were checked for significance at $p < .001$. Significant values would be considered multivariate outliers. In the current study missing data was not expected. Participants were required to enter a response for each item from each questionnaire within the survey. Only full responses were utilised for the purposes of statistical analyses and, therefore, no missing data was observed in the final sample.

5.3.2 Statistical analyses. Frequency statistics were calculated for demographic variables. Descriptive statistics (Table 5c) were calculated for demographic, predictor and dependant variables. Regression and mediation analyses were used to test the research hypotheses. Regression and mediation analyses were selected based on consideration of the modest sample size (i.e., 115). Regression model fit was determined using adjusted R^2 and F statistics at the pre adopted $p < .05$ significance level. This decision was, in part, due to the problematic nature of the R^2 statistic which can inflate results when additional predictors are added into the model. Adjusted R^2 is the better indicator because degrees of freedom are incorporated into its calculation. Additionally, unique contributions to variance in the dependant variable was assessed by examining the significance of the t statistics of the predictor variables at a $p < .05$ level.

Hierarchical linear regression enter input method was chosen to examine the change in the proportion of variance explained by a series of nested models and informed the mediation analyses. The approach to selection of predictor variables at each step was theory driven. Environmental predictors were entered first and psychological predictors entered in later models. The regression analysis sought to determine if the addition of predictors in subsequent models improved goodness-of-fit. However, significant predictors at an earlier step that produced insignificant results at a latter step were considered for mediation analysis to test the potential for indirect relationships.

The process macro version 3.4.1 (Hayes, 2018) was selected and used for the purposes of mediation analyses in which simple mediation model number four was utilised. The number of bootstrap samples was subsequently set to 5000 and 95 percent confidence intervals applied. The total effect model, effect size, and standardised coefficients was also calculated. Completely standardized indirect effects were interpreted. The bootstrapped confidence intervals were also examined to determine significance of indirect effects. If zero appeared between the upper and lower bound of the confidence interval the indirect effect was then considered to be non-significant.

5.4 Results

The current version (i.e., 26.0) of the Statistical Package for Social Scientists (SPSS) was used in data screening and statistical analyses (IBM Corp., Relseased 2019). Descriptive statistics were also calculated for the predictor and dependant variables using SPSS. The correlations, means and standard deviations of these variables are presented in Table 5c.

5.4.1 Results of Data Screening

Results of Kolmogorov-Smirnov (.302, $p < .001$) and Shapiro-Wilk (.781, $p < .001$) tests were statistically significant (i.e., $p > .05$) which indicated that the data was not normally distributed. Visual inspection of the expected and observed standardised residuals

plot revealed that there were no large deviations from the Y-line, therefore the assumption of linearity was considered to have been met. All skewness and kurtosis statistics are presented in Table 5b. Skewness and kurtosis statistics calculated indicated that the distribution of perceived organisational support (Skewness = -1.179), persistence intentions (Skewness = -1.013) and variety seeking (Skewness = -2.224; Kurtosis = 7.141) were asymmetrical, and that the latter was also non-uniform. This pattern is indicative of ceiling effects which would be expected in a highly motivated sample.

Examination of the correlation matrix indicated the presence of one multicollinear relationship (i.e., correlation coefficient > .70) between positive state affect and work engagement (r = .751, p < .001). Therefore, positive state affect was not included in further analyses. Additionally, variety seeking was not included in further analyses due to a lack of theoretical support for the negative association (r = -.203, p = .029) with perceived organisational support. Task self-efficacy (r = .036, p = 703) and problem focused coping (r = -.080, p = .396) were also not included in hierarchical multiple regression analyses due to the lack of support that either would account for unique variance in persistence intentions.

There were no influential cases (i.e., > 1) according to Cooks Distance (.000 - .133), however, one univariate outlier (i.e., > -3 to 3) was detected upon inspection of the expected and observed standardised residuals plot, and range of the standardised residual statistics (Case number 76 Std. Residual = - 3.601). This case (i.e., Response ID = 143) was identified using Casewise diagnostics and was subsequently excluded from the sample. Finally, the Mahalonobis Distance statistics were then compared against the $\chi 2$ value that was determined by the number of predictor variables which in the current study was equal to eight (i.e., 18.47). One case was greater than the critical value and checked for significance (Response ID 88 Mahalonobis Distance = 42.36118, p < .001). This case was found to be a multivariate outlier significant at p < .001 and was subsequently removed from the dataset. Ad hoc power

analysis using G*Power indicated that the final sample size (i.e., 113) still provided sufficient power (i.e., >.80) to detect a medium effect (Faul, Erdfelder, Buchner, & Lang, 2009; Faul, Erdfelder, Lang, & Buchner, 2007).

Table 5b

Skewness and Kurtosis Statistics

	Variety Seeking	Task Self-efficacy	Problem Focused Coping	Work Engagement	POS	Needs Satisfaction	PSS	Positive State Affect	Persistence
Skewness	-2.224	.180	-.338	-.984	-.647	.159	-1.179	-.410	-1.013
SE of Skewness	.226	.226	.226	.226	.226	.226	.226	.226	.226
Kurtosis	7.141	-.781	-.492	1.084	-.550	-.297	.551	-.125	.383
SE of Kurtosis	.447	.447	.447	.447	.447	.447	.447	.447	.447

Note. POS = Perceived organisational support; PSS = Perceived supervisor support.

Table 5c

Correlations, Means and Standard Deviations

	1	2	3	4	5	6	7	8	9	10	*M*	SD
1. Variety Seeking	1	.168	.099	-.078	-.203*	-.087	.011	-.089	.113	-.166	28.76	4.701
2. Task Self-efficacy	.073	1	.235*	.206*	-.019	.136	-.106	.233*	-.060	.036	29.35	6.891
3. Problem Focused-Coping	.295	.012	1	.212*	-.153	-.135	-.148	.139	-.035	-.080	25.61	4.110
4. Work Engagement	.405	.027	.023	1	.487**	.341**	.214*	.751**	-.172	.426**	39.49	8.344
5. POS	.029	.840	.103	.000	1	.583**	.575**	.459**	-.325**	.448**	42.40	14.256
6. Needs Satisfaction	.355	.148	.149	.000	.000	1	.473**	.302**	-.269**	.333**	12.47	3.042
7. PSS	.909	.257	.115	.022	.000	.000	1	.248**	-.311**	.333**	46.89	15.185
8. Positive State Affect	.346	.012	.139	.000	.000	.001	.008	1	-.084	.397**	13.90	3.450
9. Negative State Affect	.228	.524	.709	.066	.000	.004	.001	.373	1	-.264**	8.32	3.856
10. Persistence	.077	.703	.396	.000	.000	.000	.000	.000	.004	1	4.17	.993

Note. Pearson Correlation reported above the diagonal. Probability value reported below the diagonal. * $p < .05$, ** $p < .01$. POS = Perceived organisational support. PSS = Perceived supervisor support.

5.4.2 Results of Statistical Analyses

5.4.2.1 Hierarchical multiple regression results. A hierarchical multiple regression analysis was conducted to test the predictive utility of the remaining variables following data screening; needs satisfaction, work engagement, perceived organisational and supervisor support on persistence intentions. In this analysis perceived organisational support was inputted at the first step followed by perceived supervisor support, needs satisfaction, and then work engagement. Table 5d to 5f and Figure 5.2 visually depict the variables entered at each step of the hierarchical multiple regression model. Changes in R^2 and significance tests were examined to assess the unique contribution of each entered variable on persistence intentions.

The first model in which perceived organisational support was entered as the sole predictor variable of the dependant variable, persistence intentions, was significant F (1,111) = 30.048, p = .001. The second model in which perceived organisational support was entered at the first step, and perceived supervisor support at the second step as an additional predictor of persistence was significant F (2,110) = 16.496, p <.001. Inspection of the t-score values of independent variables revealed that perceived organisational support was the only significant predictor t = 3.277, p = .001 within model two.

The third model in which perceived organisational support was entered at the first step, perceived supervisor at the second step, and needs satisfaction at the third step as an additional predictor of persistence was significant F (3, 109) = 10.921, p < .001. Inspection of the t-score values of the independent variables inputted revealed that perceived organisational support was the only significant predictor t = 2.863, p = .005 within model three. The fourth model in which perceived organisational support was entered at the first step, perceived supervisor support at the second step, needs satisfaction at the third step and work engagement at the fourth step as an additional predictor of persistence was significant F

(4, 108) = 11.533, $p < .001$. Inspection of the t-score values of the predicator variables revealed that work engagement was the only significant predictor $t = 3.242$, $p = .002$ within model four.

Table 5d

Regression Model Summary.

Model	*R*	R^2	Adjusted R^2	SE	Change Statistics					Durbin-Watson
					R^2 Change	*F* Change	*df1*	*df2*	Sig. *F* Change	
1	.462[a]	.213	.206	.849	.213	30.048	1	111	.000	
2	.480[b]	.231	.217	.843	.018	2.530	1	110	.115	
3	.481[c]	.231	.210	.847	.000	.055	1	109	.816	
4	.547[d]	.299	.273	.812	.068	10.511	1	108	.002	2.070

a. Predictors: (Constant), Perceived Organisational Support

b. Predictors: (Constant), Perceived Organisational Support, Perceived Supervisor Support

c. Predictors: (Constant), Perceived Organisational Support, Perceived Supervisor Support, Needs Satisfaction

d. Predictors: (Constant), Perceived Organisational Support, Perceived Supervisor Support, Needs Satisfaction, Work Engagement

e. Dependent Variable: Persistence Intentions

Table 5e

ANOVA Summary.

Model		Sum of Squares	*df*	Mean Square	*F*	*p*
1	Regression	21.669	1	21.669	30.048	.000[b]
	Residual	80.048	111	.721		
	Total	101.717	112			
2	Regression	23.469	2	11.735	16.496	.000[c]
	Residual	78.248	110	.711		
	Total	101.717	112			
3	Regression	23.508	3	7.836	10.921	.000[d]
	Residual	78.208	109	.718		
	Total	101.717	112			
4	Regression	30.445	4	7.611	11.533	.000[e]
	Residual	71.272	108	.660		
	Total	101.717	112			

a. Dependent Variable: Persistence Intentions
b. Predictors: (Constant), Perceived Organisational Support
c. Predictors: (Constant), Perceived Organisational Support, Perceived Supervisor Support
d. Predictors: (Constant), Perceived Organisational Support, Perceived Supervisor Support, Needs Satisfaction
e. Predictors: (Constant), Perceived Organisational Support, Perceived Supervisor Support, Needs Satisfaction, Work Engagement

Table 5f

Coefficients, Correlations, and Collinearity Statistics.

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
		B	SE	Beta	*t*	*p*	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.891	.251		11.523	.000					
	POS	.031	.006	.462	5.482	.000	.462	.462	.462	1.000	1.000
2	(Constant)	2.679	.283		9.477	.000					
	POS	.024	.007	.353	3.277	.001	.462	.298	.274	.602	1.662
	PSS	.011	.007	.172	1.591	.115	.395	.150	.133	.602	1.662
3	(Constant)	2.629	.355		7.410	.000					
	POS	.023	.008	.342	2.863	.005	.462	.264	.240	.496	2.018
	PSS	.011	.007	.167	1.510	.134	.395	.143	.127	.580	1.725
	Needs Satisfaction	.008	.033	.025	.234	.816	.310	.022	.020	.623	1.606
4	(Constant)	1.730	.439		3.943	.000					
	POS	.014	.008	.203	1.666	.099	.462	.158	.134	.435	2.298
	PSS	.012	.007	.194	1.830	.070	.395	.173	.147	.576	1.736
	Needs Satisfaction	-.004	.032	-.012	-.116	.908	.310	-.011	-.009	.615	1.626
	Work Engagement	.034	.011	.299	3.242	.002	.443	.298	.261	.761	1.315

a. Dependent Variable: Persistence Intentions

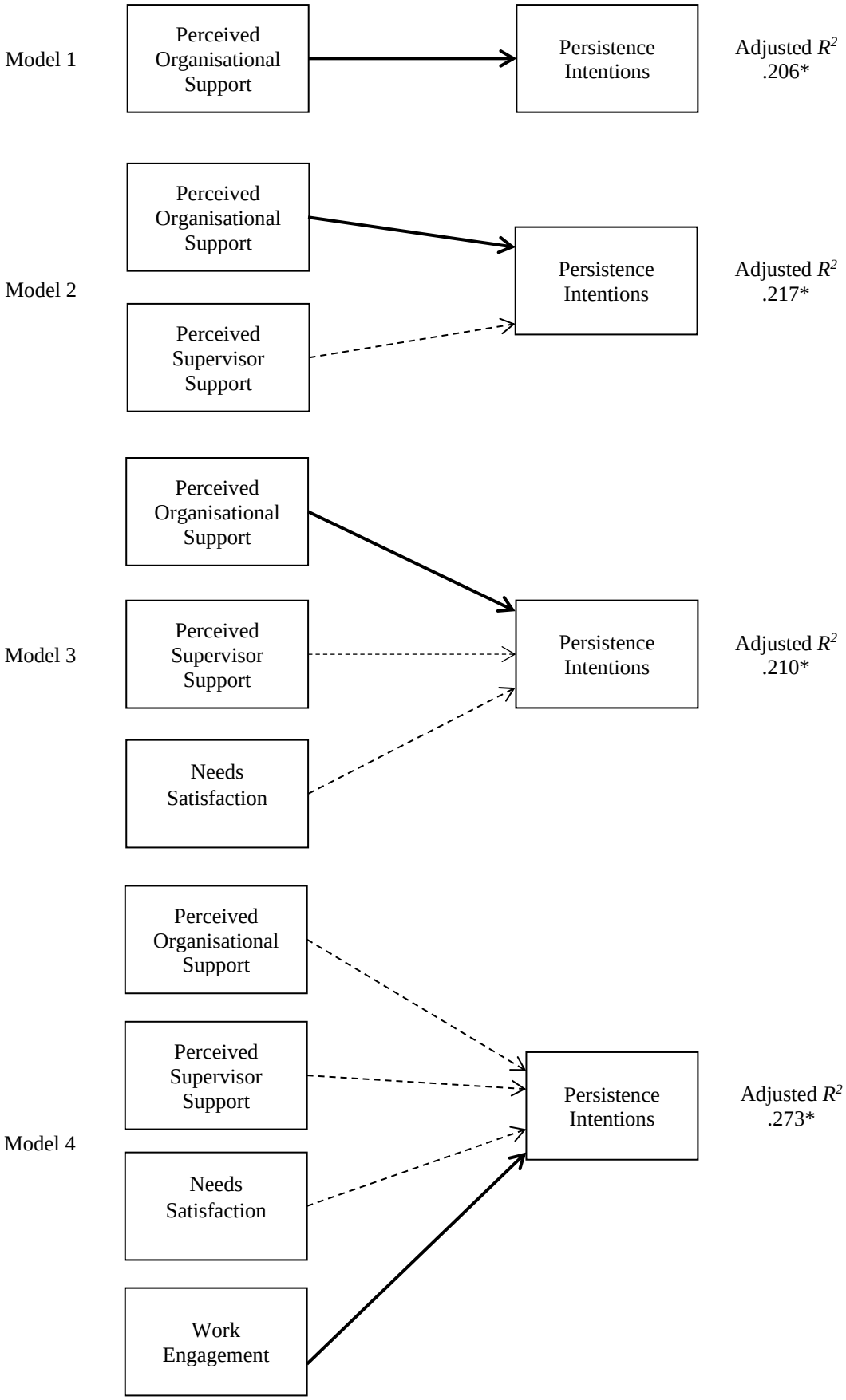

Figure 5.2. Nested hierarchical multiple regression models.

Note. Standardised coefficients are reported on the paths depicted. Significant predictors are denoted by bolded lines. Non-significants predictors are denoted by dashed lines. *$p < .05$.

5.4.2.2 Mediation analysis results. Work engagement was identified as a potential mediator at step four of hierarchical multiple regression analysis. Therefore, a mediation analysis was conducted to test the viable mediation hypothesis and indirect effect of perceived organisational support on persistence intentions through work engagement (Figure 5.3). There was a significant indirect effect of perceived organisational support on persistence intentions through work engagement, b = 0.1373, 95% BCa CI [0.0434, 0.2597]. Table 5g to 5i present the results of mediation analysis.

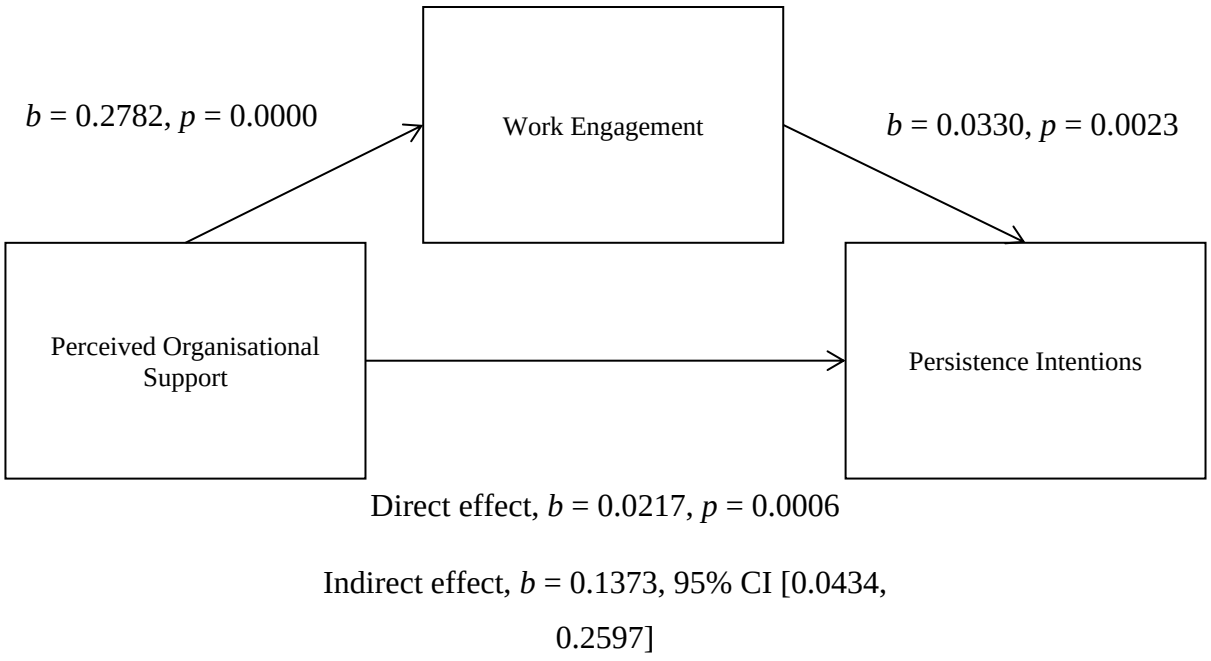

Figure 5.3. Mediation model of the unstandardized effects of the predictor on the mediator, mediator on the outcome, direct and standardised indirect effects of the predictor on the outcome variable.

Table 5g

Model Summary: Work Engagement Outcome Variable.

R	R^2	MSE	*F*	*df1*	*df2*	*p*
.4765	.2271	53.9805	32.6097	1.0000	111.0000	.0000

Model	coeff	se	t	p	LLCI	ULCI
Constant	27.6128	2.1706	12.7213	.0000	23.3117	31.9140
POS	.2782	.0487	5.7105	.0000	.1817	.3748

Standardised coefficients	
POS	.4765

Note. POS = Perceived Organisational Support

Table 5h

Model Summary: Persistence Intentions Outcome Variable.

R	R^2	MSE	*F*	*df1*	*df2*	*p*
.5265	.2772	.6684	21.0902	2.0000	110.0000	.0000

Model	coeff	se	t	p	LLCI	ULCI
Constant	1.9799	.3787	5.2285	.0000	1.2294	2.7303
POS	.0217	.0062	3.5171	.0006	.0095	.0339
WE	.0330	.0106	3.1242	.0023	.0121	.0539

Standardised coefficients	
POS	.3243
WE	.2881

Note. POS = Perceived Organisational Support; WE = Work Engagement

Table 5i

Total, Direct, and Indirect Effects of Perceived Organisational Support on Persistence Intentions.

	Effect	*SE*	*t*	*p*	LLCI	ULCI
Total effect	.0309	.0056	5.4816	.0000	.0197	.0420
Direct effect	.0217	.0062	3.5171	.0006	.0095	.0339

	Effect	BootSE	BootLLCI	BootULCI
Indirect effect	.0092	.0038	.0029	.0178
Partially Standardised	.0096	.0038	.0032	.0182

Completely standardised	.1373	.0555	.0434	.2597

Note. Mediator = Work Engagement

5.5 Conclusion

This chapter reported the method and results of Study Two which tested the adapted SCCT model of STEM persistence intentions within the agriculture industry. A summary of results from data screening, hierarchical multiple regression and mediation analyses were presented. Results will now be discussed in brief.

Data screening revealed that positive state affect was highly correlated with work engagement and was subsequently omitted from further analyses. While positive state affect contributed general information about individuals' affective experiences in their approach to work, work engagement was more informative about the specific affectional experiences at work. In hindsight, this might explain the multicollinear relationship found between the variables.

Inspection of the correlation matrix revealed that variety seeking was either not related to or correlated in the expected direction with other variables. The only notable relationship between variety seeking and another variant was with perceived organisational support. There was a negative association between variety seeking and openness to experience. This unexpected relationship indicates that the operationalisation of the personality factor openness to experience as variety seeking was either not successful or that openness to experience is not a contributor to STEM professionals' persistence within the agriculture industry.

Furthermore, task self-efficacy and problem focused coping were not significantly related with persistence intentions. Consequently, neither appear to add to STEM qualified individuals intended persistence within the agriculture sector beyond the other factors. This result was, in part, not unexpected due to the lack of support for the direct predictive utility of

self-efficacy evidenced in prior tests of SCCT models. That view taken, the finding that problem-focused coping was also not a related factor to the outcome variable is not unsurprising given that self-efficacy has previously been operationalised as problem-solving confidence.

The results of SCCT proposition testing within the current study have been mixed. While some variables directly and indirectly predicted persistence intentions as hypothesised, others did not predict unique variance in the outcome variable. For example, perceived supervisor support was not found to be a significant contributor to persistence intentions beyond the contribution of perceived organisational support. Similarly, needs satisfaction did not contribute to the model.

Testing of the SCCT Model of STEM Professionals Persistence within Australian Agriculture did reveal that perceived organisational support and work engagement were direct predictors of persistence intentions. The first model in which perceived organisational support was entered as the only predictor accounted for 21.3% of the variance in persistence intentions. Examination of the change in R^2 when work engagement was entered into the fourth model showed that work engagement accounted for a further 6.8% of the variance in intended persistence. The inclusion of work engagement as a mediator also demonstrated that the path from perceived organisational support to persistence intentions was mediated by work engagement. Both hierarchical regression and mediation models have provided evidence that the SCCT Model of STEM Professionals Persistence within Australian Agriculture assists in explaining the interrelations of perceived organisational support and work engagement in the predication of persistence intentions. The results from Study Two will now be discussed in the context of the Study One findings in the proceeding chapter.

CHAPTER SIX: DISCUSSION

This chapter discusses the overall results and implications from the two studies conducted. First a summary of results will be provided followed by the limitations. Theoretical and practical implications will then be outlined, and future directions explored within a STEM of agriculture context are discussed.

SCCT has been widely utilised in studies of academic and career choice, and persistence over the past 25 years. Despite the advancements made in the understanding of career decision-making among diverse populations, upon review of the literature a gap in knowledge was found regarding STEM professionals' motivations to persist within an agricultural work context. The present research aimed to bridge this gap through the investigation of a combination of the models of career choice and persistence. This adapted model was contextualised to the Australian STEM of agriculture workforce context and included the following SCCT constructs: a) personality, b) environmental supports, c) self-efficacy, d) outcome expectations, e) goal commitment and f) goal directed activity.

This thesis has contributed to the vocational psychology literature and SCCT by undertaking research in a STEM of agriculture workforce context and contextualising the SCCT models of Career Choice and Persistence among a previously unexplored occupational group. The results of the quantitative study demonstrated mixed support for the SCCT derived hypothesises within the current studies sample. As hypothesised, several conceptual relationships among variables were supported via both direct and indirect pathways. Overall, the findings of this research indicate that further research is justified to explain the personal factors that contribute to STEM professionals' intentions to persist within a role in the Australian agriculture industry. These findings will now be elaborated upon to explain the quantitative results in the context of the qualitative data obtained.

6.1 Research Findings

This thesis examined an adapted SCCT model of STEM persistence within agriculture using qualitative data collected via semi-structure interviews of workers career motivations and experiences. Those interview transcripts from Study One were thematically analysed to answer the research questions and inform the operationalisation of SCCT constructs in a STEM of agriculture workforce context. These qualitative findings were then taken into consideration in combination with the literature reviewed in the decision-making process for the quantitative measure selections. Quantitative data was collected via an online survey using several measures to operationalise SCCT constructs within the context of the STEM of agriculture. Hierarchical multiple regression and mediation analyses were used to test the research hypotheses. The findings of which are further discussed in this chapter.

6.1.1 Variety Seeking

The results of Study One led to the inclusion of personality as a variable. STEM professionals working in the Australian agriculture sector indicated that persistence in the field, in part, relied on personality. The type of personality characteristics described appeared to align with the openness to experience personality dimension. There are many ways in which openness to experience may be operationalised and variety seeking was selected from the item parcels available as the best fit to the qualitative data. In Study Two correlation coefficients between variety seeking and the other measured variables were, however, either non-significant or inconsistent with theory regarding the direction of the relationship.

Variety seeking was associated with perceived organisational support, but not in the expected direction. The relationship between the two variants was negative, indicating that higher variety seeking was related to lower perceived organisational support or vice versa. This was despite most of the variety seeking items relating to a desire for new experiences, and the inclusion of items pertaining to interest, goals and values from the measure of perceived organisational support. It would have been expected that people who seek variety

in their work would respond well to their employing organisation demonstrating care for their interests, goals and values. Additionally, it could have also been implied that those who rate highly on variety seeking would be more likely to endorse greater perceived organisational support simply because they are more open to diverse occupational experiences. Perhaps "curiosity" (Participant H) and an "open mind" (Participant G) are not essential for STEM trained professionals to "survive" (Participant A) in the Agriculture industry as previously thought.

Past SCCT studies that investigated personality have tended to focus on alternative traits such as extraversion, conscientiousness and neuroticism (Cinamon, 2016). While the prior research was not specifically concerned with agriculturalists, the literature paints a telling picture that some personality dimensions are potentially more relevant to decisional outcomes than others. Conscientious is one common example wherein, conscientious workers are more likely to demonstrate better work performance than their counterparts (McIlveen & McDonald, 2019).

6.1.2 Perceived Organisational Support

In the qualitative study participants were asked about perceived supports and barriers. These questions were, (a) How encouraging have you found others to be in pursuing your chosen career?; (b) What do you think are the most useful resources to draw upon to be successful in your career?; (c) Tell me about the conditions and people that you encounter in your work?; (d) What is challenging about your job?; (e) What other things could possibly go wrong in your line of work?; (f) Tell me about some obstacles that you have found can get in the way of achieving work ambitions in your field?; and (g) What other factors have you found stops people enjoying or persevering in their work?

Study One interviewees reported that it was desirable to work for an organisation that considered their goals and took pride in their accomplishments. Supports have previously

been operationalised as perceived organisational support using the SCCT Satisfaction model with Australian agricultural research (McDonnald, 2017). Indeed, perceived organisational support was both a direct and indirect predictor of persistence intentions in the current study. This factor was one of just two predictors in the model that accounted for unique variance in the outcome variable in Study Two. Perceived organisational support was strongly associated to the other unique predictor, work engagement, which also mediated its' relationship with intended persistence. The finding that perceived organisational support indirectly affects persistence through work engagement indicates that higher levels of support facilitate engagement at work, which in turn increase persistence of STEM professionals within the industry. These results are consistent with theory (Lent et al., 2000) and prior research (McDonnald, 2017), and demonstrate the vital role that perceived organisational support plays in both career persistence and job satisfaction within Australian agriculture.

6.1.3 Perceived Supervisor Support

Prior research has found that perceived supervisor support is distinct from perceived organisational support (Kottke & Sharafinski, 1988). While results of Study One suggested that perceived supervisor support was also a contributing factor to persistence intentions, the construct did not account for unique variance in the regression model. These results are inconsistent with theory (Lent et al., 2000), although the significant relationship between perceived supervisor support and needs satisfaction corroborates the results of prior research that found contextual supports were directly related to outcome expectations (Sheu et al., 2010). Due to the association between supervisors and employing organisations, supervisor support may predict intentions to persist but to a lesser extent when compared with organisational support. Organisational support being the broader construct should still account for lessor variance in the model if supervisor support were to be the more important

variable of the two. Therefore, while supervisor support appears to be associated with persistence intentions, it is not a strong predictor of the outcome variable.

The role of the supervisor, while not undervalued, appears to be overshadowed by the level of care the organisation itself demonstrates toward employees. This indicates that the influence of a strong supervisory relationship can be undone by a lack of organisational support for its workers. The notion that an organisation simply exerts its' efforts into hiring and training supervisors, and that the supervisor will in turn take care of the rest is clearly insufficient to retain agriculturalists. This might be an important step in the process, however, organisations that seek to reduce turnover intentions should also consider structural issues that may impact retention.

6.1.4 State Affect and Needs Satisfaction

Several questions were asked of participants in Study One about their expectations as an outcome of performing their work. This line of questioning attempted to assess social, material and self-evaluative types of outcomes people might desire as a consequence of engaging in their job. The questions asked were, (a) How respected would you say your industry is among the community and in your social circles?; (b) How long do you think you will work in this job?; (c) Generally, how do find that people working in the field are rewarded for this commitment?; (d) How attractive do you find the work is to prospective employees in terms of meeting their job expectations or needs?; (e) How personally gratifying have you found your career?; (f) What are some key reasons that you think people enter the agriculture field?; and (g) Tell me about the meaning and purpose involved in doing your job?

Respondents discussed a need for positive work experiences to feel excited and inspired as opposed to nervous or afraid. Interviewees also suggested that they sought social status and recognition for their work. These aspects of their story appeared to align with

positive state affect and a form of needs satisfaction. In the current research neither state affect nor needs satisfaction contributed unique variance to persistence intentions. One of the challenges with operationalising outcome expectations as positive affect was the concurrent measurement of work engagement which also measures positive emotional experiences just within an occupational context. Given the work engagement was the more specific of the two questionnaires, it was retained over positive state affect despite its' correlation with persistence intentions. In hindsight, there was a measurement issue with state affect in that its' domain specificity was not as sensitive to the nuances of the career decision-making process as work engagement (Lent & Brown, 2016).

The predictive utility of negative state affect was not fully explored in the current research, although, prior research has indicted that it may moderate the interrelations among SCCT contextual factors and choice outcomes (Dahling & Thompson, 2010). Negative state affect was measured as part of the broader state affect tool and did yield theory consistent negative associations with perceived organisation and supervisor support. Therefore, negative outcome expectations deserves future attention as an operationalisation of the SCCT variant, Outcome Expectations.

Furthermore, while status or prestige has previously been included in SCCT research (Scheuermann, Tokar, & Hall, 2014), the path from outcome expectations to the dependant variable was fully mediated by interests which was not measured in the present study. There have been prior measurement concerns regarding the operationalisation of outcome expectations (Fouad & Guillen, 2006). While reliability of the item parcel was evidenced in the current study, the validity of an adapted measure of occupational needs satisfaction requires further investigation.

6.1.5 Task Self-Efficacy

Questions asked as part of the semi-structured interviews conducted in Study One explored self-efficacy beliefs in relation to tasks, coping and self-regulation. These questions were, (a) What does a person need to be able to do to be good at your job?; (b) What type of person is successful in fulling the full diversity of work demands?; (c) How did you learn how to perform the role?; (d) What factors are the most useful in overcoming challenging work situations in your field?; (e) How would you describe work life management in your industry?; (f) What motivates you to continue in the work that you do?; and (g) Generally, how motivated are people in the industry to undertake professional development or otherwise improve their work?

Participants in the qualitative study indicated that efficacy in a variety of tasks was required to successfully undertake and continue in a STEM-related job within the agriculture sector. Prior SCCT research focused on satisfaction has operationalised self-efficacy as task-specific within the Australian agriculture sector (McDonnald, 2017). A purpose-built measure of self-efficacy was developed, although, theory consistent relationships among SCCT variants were not found. Due to most workers possessing a high degree of education in STEM domains, self-efficacy measurement could produce ceiling effects within this population. Past educational performance or occupational experience may have also inflated workers ability precepts, in part, due to the transferability of STEM skills across industries and professions. The measure of task-self-efficacy did demonstrate weak but significant relations with work engagement and problem-focused coping but not persistence. So, while task specific self-efficacy may not be a direct predictor of intentions to persist, results do suggest that perceived competency to perform the required tasks are associated with increased active problem-solving efforts and engagement at work.

It is possible that task self-efficacy is a distal rather than proximal factor in the prediction of career persistence outcomes. Meaning that confidence to perform a STEM-related role within agriculture is necessary condition for employment but an insufficient means in explaining employee retention. This is in contrast to SCCT which posits direct effects of self-efficacy on career choice, satisfaction and persistence. Nevertheless, the current scales' face validity was established in Study One and demonstrated good reliability in the quantitative study. Therefore, it appears to possess adequate psychometric properties for future research and practice. Nevertheless, this finding supports prior results in which self-efficacy was not found to be a direct predictor of the outcome variant (e.g., Jiang & Zhang, 2012).

6.1.6 Problem-Focused Coping

It was argued in the literature review that goal commitment could be operationalised as problem-focused coping. In the qualitative study participants indicated that problem-solving skills and coping ability were important in people's persistence within the Australian agriculture industry. Problem-focused coping appeared to capture both of these concepts wherein problem-solving efforts were posited as progress toward goals when faced with minor obstacles or major barriers. That is, those who engage in a problem-focused style of coping are actively working on maintaining goals that are congruent with satisfying their occupational needs.

To reduce the length of the online survey the decision was made to only include the reflective style subscale for the purposes of the current research. Past SCCT research had showed the predictive utility of problem-focused coping for satisfaction which provided some confidence in its theoretical alignment and operationalisation as goal directed activity (Chang & Edwards, 2015). Problem-focused coping was, however, not found to share a significant association with persistence intentions. Notably the measured variable did share weak

relations with task self-efficacy and work engagement. This finding is consistent with theory in that self-efficacy is postulated to directly affect choice goals and choice goals are theorised to directly impact choice actions (Lent, Brown, & Hackett, 1994). It is possible that problem-focused coping indirectly affects persistence intentions through work engagement which was also found to mediator of perceived organisational support. Due to the limited sample size there was insufficient power for structural equation modelling. Nevertheless, it's utility as a mediated variable in the model of STEM professionals' persistence within agriculture may warrant further research.

6.1.7 Work Engagement

Participants in Study One were asked goal-related questions in the interviews to gather data about their career motivations. These questions were, (a) What motivates you to do the work that you do?; (b) What are your career aspirations?; (c) What does a successful career look like to you?; (d) How inspiring would you say being involved in the agriculture industry is?; and (e) What's the most important thing that you want to achieve in your work? Personally? In your current role?

Interviewees described a desire to engage in work that is personally "rewarding" (Participant C) to them. While they were absorbed in their work, the STEM professionals indicated that they needed to be highly committed and maintain a sense of strength to continue "grind" (Participant D) through more challenging periods. This suggests that there are competing priorities even within agriculturalists work engagement in which high levels of dedication protect against low levels of vigour. Work engagement has previously been found to be associated with job satisfaction within the Australian agriculture industry (McDonnald, 2017). Work engagement was found to be a unique contributor to variance in persistence intentions above that of perceived organisational support in the current research. This finding is consistent with theory (Lent, Brown, & Hackett, 1994; Navarro et al., 2019) in that choice

actions are proposed to directly affect the outcome variable. This is an important finding for vocational psychology workforce research that illustrates the influential role of psychological constructs in understanding intentions to persist within a career. Contextual supports provide a strong foundation for career persistence within Australian agriculture, the effect of which are enhanced through a person's engagement in goal directed activity.

6.2 Research Limitations

There are several limitations of this research inherent in the research design, sampling method, sample size and analytical strategy. These factors restrict the strength of the evidence generated and compromise the generalisability of the findings. This section outlines both the weaknesses of the current research and potential future research directions to overcome issues identified and strengthen the rigour of the overarching research design.

First, due to the cross-sectional research design and correlational nature of the data collected cause and effect cannot be established. Therefore, this project relied heavily on theory and the qualitative data collected to explain the relationships cited among variables examined. This is more so a limitation to answering the resulting research questions from the current research project. Nevertheless, future research could employ a longitudinal design and collect data at different time intervals to investigate if SCCT variants predict the persistence of STEM professionals within the agriculture industry overtime.

The second studies sampling method and final sample size (N = 115) were a clear shortcoming of this research in relation to the representativeness the sample and generalisability of the results to the broader population. The online survey was publicly listed and did not utilise measures to prevent repeated participation which may have influenced the outcomes in terms of overrepresentation of some sub-groups from within the target population. Furthermore, anyone with access to the survey link was able to participate which more generally restricted the researcher's ability to ensure that the sample contained

enough participants from each of the STEM sub-groups with the varying characteristics to draw conclusions about the overall STEM population. So, despite efforts made to overcome some of these issues such as removal of partial responses from the quantitative analyses, some drawbacks remained.

STEM professionals working in Australian agriculture are predominantly male and possess varying levels of education which proved challenging in the recruitment of a representative sample. While the sample was representative of the greater number of the higher skilled Australian agricultural workforce with a bachelor's degree (Wu et al., 2019), STEM qualified individuals with diploma level qualifications (n = 6) may have been underrepresented (Office of the Chief Scientist, 2016). Furthermore, given that whopping 84 percent of the STEM qualified people (Office of the Chief Scientist, 2016) and 69 percent of the Australian agriculture workforce are male (Wu et al., 2019) there was an overrepresentation of females in Study Two (i.e., 50.4%). In hindsight it may have been overly ambitious to attempt to recruit a highly representative sample from such a broad population using convenience sampling methods.

It is worth noting though that the Study Two sample was representative of the population in terms of the higher percentage of STEM qualified people working full-time and in science in Australia aged between 35 and 44 years (Office of the Chief Scientist, 2016). Similarly, while the average income reported was over the median Australian agricultural science graduate salary (Wu et al., 2019), the earnings reported were consistent with 48% of STEM qualified people in Australia who earn $41 600 to $103 999 (Office of the Chief Scientist, 2016). Nevertheless, future research of this occupational group would likely benefit from the use of stratified random sampling. This could make use of the potential for more stringent inclusion criteria.

The measures of perceived organisational and supervisor support may also not have been valid measures of environmental support for self-employed STEM professionals. Review of the quantitative survey data found two partial completers dropped-off when the measure of perceived organisational support was introduced, and a further five partial respondents failed to complete the measure of perceived supervisor support. While it could be that these participants did not continue due to the length of the survey considering these were the fifth and seventh measures presented respectively or poor internet connection it is plausible that they may have chosen to withdraw because the questions asked were irrelevant to their terms of employment. This inference is supported by some of the quotes obtained from the open-ended optional Study Two question, for example, "I am essentially me own boss, so for the questions on whether I feel valued by the organisation are a little void" (Response ID 16). Future studies of STEM occupations within Australian agriculture could consider including other types of environmental support to avoid polarising self-employed professionals working in the field.

In addition to issues regarding generalisability, the modest quantitative sample size also limited the choice of statistical analyses available to interrogate the data collected. While hierarchical regression and mediation analyses were justified by the power analysis, a larger sample size would have enabled the researcher to utilise more rigorous statistical methods such as structural equation modelling. Structural equation modelling would have allowed the researcher to regress multiple independent and dependant variables simultaneously as is typically performed in SCCT research. In the present research only changes in variance in a single outcome variable (i.e., persistence) were accounted for and mediation analyses were heavily relied upon to test indirect effects of the SCCT constructs included in the model. This has the potential for increasing the likelihood of a type 1 error

occurring. Structural equation modelling should be considered in future studies focused on testing the utility of SCCT in a STEM of agriculture context when the sample size permits.

Another limitation of this research was that the personality data coding could have been better refined. In hindsight much of the analysis was focused on openness to experience, and more attention and thought could have been provided regarding the interpretation of the reliable, ethical, empathetic and considerate code data. This would have strengthened the qualitative study and may have impacted the selection of measures for study two.

Finally, this research project received mixed responses from the target population. While the individuals who consented to participate in the qualitative study were agreeable, it was difficult to recruit more than 10 people for a 60-minute semi-structured interview. Similarly, while many responses to the optional open-ended question included in the quantitative study were encouraging one Study Two participant stated, “The lack of security in scientific careers is the biggest problem for STEM. The encouragement of science oriented (sic) students towards STEM careers in Australia is a form of abuse” (Respondent 98). This participant reported that they were a research fellow employed on a very short term (sic) fixed term contract. Consequently, the terms of STEM professionals’ employment within Australian agriculture may pose a barrier to the recruitment of participants for the purposes of research focused on increasing STEM engagement in the field. This is especially so due the often-seasonal nature of the work which further increases job insecurity as indicated by Respondent 23, “Ag (sic) related careers are often heavily seasonal, so some responses may be more relevant during the season than the off season” and Respondent 167 “Having lost my funding during the drought and been summarily dumped by the industry, I'd have to say that I don't recommend agricultural science as a sound career decision”. While attempts were made to increase the response rate by extending out the data collection timeframe and promoting

the survey via several means including Twitter posts, a LinkedIn advertising campaign, direct communication with prospective participants and employing organisations, these efforts were not successful in reaching a significantly higher response rate as initially hoped. Therefore, future research on the topic could conduct briefer interviews and invest more time rapport building to foster stronger connections with the target population and more industry partnerships. This issue was considered in the present study, consequently several individuals and organisations requested a summary of the findings, and practical recommendations. So, while the response rate may have been increased with greater persistence on the principle investigators behalf, this research still addressed a gap in knowledge which can assist in informing industry bodies about factors that retain STEM skilled professionals within the agriculture sector.

6.3 Implications for Future Research

In relation to future directions for research the (a) operationalisation of personality, (b) lack of predictive utility of self-efficacy, (c) gender diversity within agriculture and women in STEM more broadly were identified as areas warranting investigation.

In the current study personality did not demonstrate theory-consistent relationships with other SCCT variants. A review of a meta-analysis, however, showed that trait-like variables did predict self-efficacy beliefs via both direct and indirect pathways (Sheu & Bordon, 2016). While personality has been found to account for 35.7% of the variance in self-efficacy (Cinamon, 2016), there appears to be a lack of support for the association between openness and investigative interests (Schaub & Tokar, 2005). O*Net (2020) interest profiles of relevant occupations such as soil and plant scientist revealed that realistic and investigative interests were most closely aligned with this occupation. Analysis of qualitative data obtained through the semi-structured interviews conducted during Study One indicated that participants sought variety in their work experiences and described the personality of

professionals who were likely to persist within the agriculture sector. Consequently, personality became a theme and was operationalised as variety seeking as it was believed to be a motivating factor in career choice and persistence. Further exploration of personality traits may improve the understanding of this occupational groups predispositions and how these contribute to the formation of self-efficacy beliefs. This is especially relevant as statistical power may have been a contributing factor to the non-significant findings in the present research.

There is also the possibility of the argument that personality is a distal factor in career persistence in that it may more strongly contribute to interest development. Interests were not measured in the current study because these were assumed given the aim of the research was to understand the SCCT variants that contributed to career persistence once interest in the field had been established. This was a potential failing of the present research, particularly in consideration of the mediating effect of interests discussed in the literature review. Therefore, further investigation of the indirect effects of personality traits is warranted.

Regarding the predictive utility of self-efficacy, the current research project developed a measure of task self-efficacy that was shown to have good reliability. There was one item that could have been removed (i.e., I can communicate scientific and/or technical information) to improve the scale but this item was validated by the interviews and would have only marginally improved reliability. Whether self-efficacy directly affects career persistence is questionable. Self-efficacy has consistently been shown to relate to academic goals (Lent et al., 2018) and persistence (Navarro et al., 2019), however academic performance is incrementally tested within academic settings. Thus, it is plausible that the quantified feedback provided in educational settings may inflate the relationship among these

variants. In other words, students who receive high grades have more confidence in their ability to pursue their career of choice than their counterparts.

STEM qualified individuals applying their skills within the agricultural workforce have already satisfied these requirements which may lead to a ceiling effect. Consequently, the effect of self-efficacy cited in academic contexts might not be observed among highly skilled working populations due to competency having been attained during formal education. This would also reduce the impact of threats to self-efficacy due to the influence of prior learning experiences and render environmental supports a stronger factor in broader occupational outcome expectations as opposed to efficacy relevant sources of feedback. This notion is supported by the association between perceived organisational and supervisor support and needs satisfaction in the present research. Nevertheless, given that this project neglected to explore efficacy-relevant barriers, further investigation to address this gap in knowledge is required.

While the study of women in STEM was not the focus of this investigation, prior research cited in the literature review has found gender differences in environmental support and STEM engagement. There were no questions included in the semi-structured interviews pertaining to gender inequality because the researcher had not aimed to study this issue. However, at least one female participant of Study One discussed discomfort working in a male dominated industry (Wu et al., 2019):

> “the respect wasn't there as much as, which I can understand, because I was so new and I really had to put myself out there and ah but I, you know, it’s still a very male dominated industry and um, and I went, my first job was, I was the only female working in a um in an office where there was all guys, and, and like I got along so well and it was fantastic but there was always that, that sort of, I mean I never felt quite comfortable um as I do now sort of thing. I like, I don't know if that's, that's

> worth anything but I did have one particular mentor at that time and he was brilliant, an older fella and um he like, he was heavily involved in research and had impeccable moral values and I just thought that he really um, like he really got me through and helped me just to combat all of the you know silly things that go on." (Participant G).

Quantitative data collected in Study Two through the optional open-ended question also provided several examples of gender bias and serotyping. For example, "Promotion opportunities become non-existent when you are a long-term employee, and especially when you're a women (sic). The higher level (sic) positions are all skewed to men holding those jobs and being promoted, not women" (Response ID 14), and "This is a sexist industry. It is changing but reluctantly. The industry is rife with bullying and woman are marginalised in a cynical and systematic way as well as the usual unconscious bias" (Response ID 216). Unfortunately, this problem was not within the scope of this investigation nor was there enough power in the current study to undertake between groups analyses and investigate interaction effects in pursuit of this line of enquiry. Gender diversity within agriculture (Wu et al., 2019) and the pay gap experienced by women in STEM (Office of the Chief Scientist, 2016) is, however, a challenge that has been acknowledged and which is currently being pursued by the Australian Government (Australian Academy of Science, 2017). Nevertheless, future research focused on the STEM of agriculture could explore the experiences of women in STEM within an Australian agricultural workforce context and test gender specific hypotheses considering the incidental data obtained which is consistent with prior research in the area.

6.4 Implications for Future Practice

Due to the lack of power, generalisability and correlational nature of the data practical recommendations should be taken with caution. Despite these limitations several modifiable

factors have been identified that may improve the retention of STEM professionals within the agriculture sector. These are discussed below.

The current research identified that both organisational and supervisor support were associated with persistence intentions and the former contributed to unique variance in the outcome variable. These types of support are facilitated through the provision of practical assistance when required, recognition of accomplishments, demonstration of value in workers interests, goals and satisfaction. Therefore, to reduce turnover intentions, it is important that employing organisations (a) provide help when there is a problem, (b) have adequate systems in place to celebrate employees' achievements, (c) communicate with employees about their career motivations and demonstrate value for their on-going well-being. This could be achieved at an organisational level through the provision of appropriate resources, implementation of career succession planning and supervisor training.

Work engagement accounted for variance above and beyond that attributed to organisational support alone in the quantitative study. It mediated the relationship between perceived organisational support and persistence intentions and added to the vocational psychology of agriculture literature by contributing toward the understanding of psychological variants that facilitate career persistence. In the qualitative study levels of work engagement appeared to be threatened by a lack of vigour to persevere during challenging times at work. Contextual supports aside, in a career counselling context work engagement could be facilitated with dedicated individuals through focused occupational outcome expectations interventions. In other words, those who are absorbed in and dedicated to their profession but whom are struggling with their energy levels might benefit from career goals exploration, and broadening of occupational coping skills to combat the factors that contribute to and or maintain low energy to exert at work. Such interventions may enhance self-understating of career goals and maintenance of goal-congruent progress.

In sum, to contribute to persistence within the field organisations should provide adequate support, and individuals whom seek career counselling may benefit from interventions that clarify their goals and broaden their coping strategies. These are valuable insights as both organisational support and work engagement are malleable factors than can be facilitated with appropriate organisational and counselling practices. This research has identified that;

- Perceptions of employing organisations are key to the practices of STEM qualified individuals,
- These perceptions could potentially be enhanced through strong communication, problem-solving support, and recognition of work achievements,
- Personal experiences are vital to improving career persistence,
- Counselling may contribute via improving knowledge of career goals and coping strategies to persist during emotionally challenging times.

CHAPTER SEVEN: CONCLUSION

This research extends the vocational psychology of agriculture and social-cognitive agendas. Motivation and retention of STEM qualified individuals to the agriculture industry is multifaceted. Workforce retention is important to assist in achieving the Global Sustainability Goals, contributing to a stronger Australian precision and digital agriculture workforce. A combination of contextual and personal factors contribute to persistence in field which can be enhanced through the provision of measures to increase organisational support and/or via career counselling that has the potential for increasing insight into and occupational coping for leading a career that aligns with one's occupational goals. STEM skilled personnel within the agriculture industry's engagement is vital to improving the productivity of Australian agriculture within the current agricultural revolution and assist in reducing the impacts of turnover intentions. Understanding STEM qualified professionals work experiences and persistence intentions are important to prioritising their continued engagement within the field through targeted interventions. Hunger is a significant issue that requires STEM skills and knowledge to assist in overcoming the current challenges faced by the agriculture sector in producing enough resources to feed and nourish the world.

In addition to the practical implications, the current study extended the SCCT models of career choice and persistence by contextualising an adaption of both models to a previously unexplored occupational group. Considering the limitations of the research, several future directions were posited for similar studies of this nature. These included but are not limited to, operationalisation of personality, exploration of self-efficacy, and the role of problem-focused coping.

Such research objectives could be achieved via mixed methods studies in which the qualitative investigation would intentionally seek data around personality, and the quantitative analysis consider the mediating and moderating potential of SCCT variants on

persistence intentions, sample size permitting. Finally, this thesis promotes the development of more resilient regions in Australia through the investigation of vital infrastructure workers that can support regional growth.

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APPENDIX A

STEM Workforce Attraction, Motivation and Retention in Rural and Regional Australia

Welcome Message:

Knowledge and skills in Science, Technology, Engineering and Mathematics (STEM) are currently in demand within the Australian agriculture sector, however, there is a lack of research concerned with the motivating factors that attract and retain working professionals to their job. Therefore, the purpose of this project is to investigate how the beliefs, feelings and needs of agriculturalists ***(i.e. Soil and Plant Scientists, Agronomists, Plant Pathologists, Entomologists, Research Assistants, Precision Agriculture Technicians, Laboratory Technicians, Agricultural Engineers and Biostatisticians)*** *in relation to themselves, their work and organisation contribute to their intentions to persist in their career. The research team requests your assistance because understanding working professionals' beliefs, feelings and needs in their agricultural-related career is important to progress this research and help meet growing workforce requirements. Your participation will involve the completion of an online survey that will take approximately 15 minutes of your time. Please note that a response to each item, except the final question, is required to proceed through the survey.*

Survey data policy checkbox label:

By checking the box, you are indicating that you have read and understood the ethical information and agree to participate in this project

Survey data policy message:

Project Details

Title of Project:	***STEM Workforce Attraction, Motivation and Retention in Rural and Regional Australia***
Human Research Ethics Approval Number:	*H17REA176*

Research Team Contact Details

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Description

Knowledge and skills in science, technology, engineering and mathematics are currently in demand within the Australian agriculture sector, however, there is a lack of research concerned with the motivating factors that attract and retain working professionals to their job. Therefore, the purpose of this project is to investigate how the beliefs, feelings and needs of agriculturalists ***(i.e. Soil and Plant Scientists, Precision Agriculture Technicians, Agricultural Engineers and Biostatisticians)*** *in relation to themselves, their work and organisation contribute to their intentions to persist in their career. The research team requests your assistance because understanding working professionals' beliefs, feelings and needs in their agricultural-related career is important to progress this research and help meet growing workforce requirements. Please note that t*his project is being undertaken as part of a PhD.

Participation

Your participation will involve the completion of an online questionnaire that will take approximately 15 minutes of your time. Questions will include 'I am proud of the work that I do' and 'The organisation cares about my general satisfaction at work'.

Your participation in this project is entirely voluntary. If you do not wish to take part, you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. You will be unable to withdraw data collected about yourself after you have participated in this questionnaire. If you do wish to withdraw from this project, please contact the Research Team (contact details at the top of this form).

Your decision whether you take part, do not take part, or to take part and then withdraw, will in no way impact your current or future relationship with the University of Southern Queensland or any external organisation.

Expected Benefits

It is expected that this project will not directly benefit you. However, it may benefit STEM career development, rural and regional workforce development, and the Australian agriculture sector.

Risks

In participating in the questionnaire, there are no anticipated risks beyond normal day-to-day living.

Privacy and Confidentiality

All comments and responses will be treated confidentially unless required by law. The names of individual persons are not required in any of the responses. Participant's data will be made available for future research purposes and re-identifiable data will be stored securely in accordance with USQ's data management policy. Participants can access a summary of the research results by emailing the research team. Any data collected as a part of this project will be stored securely as per University of Southern Queensland's Research Data Management policy.

This project is funded by the Research Training Scheme.

Consent to Participate

Clicking on the 'Submit' button at the conclusion of the questionnaire is accepted as an indication of your consent to participate in this project.

Questions or Further Information about the Project

Please refer to the Research Team Contact Details at the top of the form to have any questions answered or to request further information about this project.

Concerns or Complaints Regarding the Conduct of the Project

If you have any concerns or complaints about the ethical conduct of the project, you may contact the University of Southern Queensland Manager of Research Integrity and Ethics on +61 7 4631 1839 or email researchintegrity@usq.edu.au. *The Manager of Research Integrity and Ethics is not connected with the research project and can facilitate a resolution to your concern in an unbiased manner.*

By checking the box, you are indicating that you:

- Have read and understood the information document regarding this project.
- Have had any questions answered to your satisfaction.
- Understand that if you have any additional questions you can contact the research team.
- Understand that you are free to withdraw at any time, without comment or penalty.
- Understand that you can contact the University of Southern Queensland Ethics Coordinator on (07) 4631 2690 or email ethics@usq.edu.au if you do have any concern or complaint about the ethical conduct of this project.
- Are over 18 years of age.
- Agree to participate in the project.

Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. **Indicate for each statement whether it is** 1. Very Inaccurate, 2. Moderately Inaccurate, 3. Neither Accurate Nor Inaccurate, 4. Moderately Accurate, or 5. Very Accurate as a description of you.

	Very Inaccurate	Moderately Inaccurate	Neither Accurate Nor Inaccurate	Moderately Accurate	Very Accurate
1.1 Prefer variety to routine	1	2	3	4	5
1.2 Seek adventure	1	2	3	4	5
1.3 Am open to change	1	2	3	4	5
1.4 Like to visit new places	1	2	3	4	5
1.5 Enjoy hearing new ideas	1	2	3	4	5
1.6 Like to begin new things	1	2	3	4	5
1.7 Love to think up new ways of doing things	1	2	3	4	5

Below is a list of tasks involved in several agriculture-related occupations. Consider your current knowledge/skills to perform these tasks. **Rate your confidence level** from 1 (not confident at all) to 5 (completely confident).

	Not confident at all	Slightly confident	Moderately confident	Very confident	Completely confident
2.1 I can design and/or conduct research focusing on agricultural topics (e.g., planting, spraying, cultivating, harvesting, storing, processing, or transporting horticultural products)	1	2	3	4	5
2.2 I can collect and/or analyse data focusing on agricultural topics (e.g., to assess factors such as soil quality, terrain, field productivity, fertilizers, or weather conditions)	1	2	3	4	5
2.3 I can use and/or maintain agricultural technology (e.g., weed identification or automated spot spraying systems)	1	2	3	4	5
2.4 I can demonstrate the agricultural applications of spatial data (e.g., identify areas in need of pesticide treatment by analysing geospatial data to determine insect movement and damage patterns)	1	2	3	4	5
2.5 I can plan, test and/or design agricultural systems or machinery	1	2	3	4	5

(e.g., irrigation systems, farming equipment and machinery)					
2.6 I can install, maintain and/or use computer software (e.g., design agricultural machinery components and equipment, using computer-aided design)	1	2	3	4	5
2.7 I can prepare scientific and/or project documents (e.g., records, reports, articles, sketches, working drawings, specifications, proposals, grant applications and/or budgets)	1	2	3	4	5
2.8 I can communicate scientific and/or technical information (e.g., about research or project results, plans to other professionals or the public or teach related courses, seminars, or workshops)	1	2	3	4	5
2.9 I can design agricultural technology (e.g., advance weed identification or automated spot spraying systems)	1	2	3	4	5

Below is a list of statements about how people think or feel as they attempt to solve occupational difficulties, like feeling stressed at work or getting along with colleagues. **Indicate how frequently you do what is described** in each item from 1 (almost never) to 5 (almost all of the time). Respond in a way that most accurately reflects how you actually think, feel, and behave when solving occupational problems rather than how you think you should respond.

	Almost never	Occasionally	About half of the time	Often	Almost all of the time
3.1 I think about ways that I solved similar problems in the past	1	2	3	4	5
3.2 I identify the causes of my emotions, which helps me identify and solve my problems	1	2	3	4	5
3.3 I consider the short-term and long-term consequences of each possible solution to my problems	1	2	3	4	5
3.4 I think ahead, which enables me to anticipate and prepare for problems before they rise	1	2	3	4	5
3.5 I think my problems through in a systematic way	1	2	3	4	5
3.6 I get in touch with my feelings to identify and work on problems	1	2	3	4	5
3.7 I have alternate plans for solving my problems in case my first attempt does not work	1	2	3	4	5

The following 9 statements are about how you feel at work. Please read each statement carefully and decide if you ever feel this way about your job. If you have never had this feeling, select the "0" (zero) in the space after the statement. If you have had this feeling, **indicate how often you felt** it by selecting the number (from 1 to 6) that best describes how frequently you feel that way.

	Never	Almost Never, A few times a year or less	Rarely, once a month or less	Sometimes, A few times a month	Often, Once a week	Very Often, A few times a week	Always, Every day
4.1 At my work, I feel bursting with energy	0	1	2	3	4	5	6
4.2 At my job I feel strong and vigorous	0	1	2	3	4	5	6
4.3 I am enthusiastic about my job	0	1	2	3	4	5	6
4.4 My job inspires me	0	1	2	3	4	5	6
4.5 When I get up in the morning, I feel like going to work	0	1	2	3	4	5	6
4.6 I feel happy when I am working intensely	0	1	2	3	4	5	6
4.7 I am proud of the work that I do	0	1	2	3	4	5	6
4.8 I am immersed in my work	0	1	2	3	4	5	6
4.9 I get carried away when I am working	0	1	2	3	4	5	6

Listed below are a series of statements that represent possible feelings that individuals might have about the company or organisation for which they work. With respect to your own feelings about the particular organisation for which you are now working please **indicate the degree of your agreement or disagreement** with each statement by checking one of the seven alternatives below/beside each statement.

	Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree
5.1 The organisation values my contribution to its well-being	1	2	3	4	5	6	7
5.2 The organisation strongly considers my goals and values	1	2	3	4	5	6	7
5.3 Help is available from the organisation when I have a problem	1	2	3	4	5	6	7
5.4 The organisation really cares about my well-being	1	2	3	4	5	6	7
5.5 The organisation is willing to help me when I need a special favour	1	2	3	4	5	6	7
5.6 The organisation cares about my general satisfaction at work	1	2	3	4	5	6	7
5.7 The organisation cares about my opinions	1	2	3	4	5	6	7
5.8 The organisation takes pride in my accomplishments at work	1	2	3	4	5	6	7
5.9 The organisation tries to make my job as interesting as possible	1	2	3	4	5	6	7

Below are three statements about your work and career, **to what extent do you agree …**

	Strongly disagree	Slightly disagree	Moderately agree	Strongly agree	Very strongly agree
6.1 I am ‘somebody’ in the community	1	2	3	4	5
6.2 I get recognition for the work that I do	1	2	3	4	5
6.3 My pay compares well with that of other workers within my organisation	1	2	3	4	5
6.4 My pay compares well with that of other workers within my field more broadly	1	2	3	4	5

Listed below are a series of statements that represent possible feelings that individuals might have about their manager or supervisor for whom they work. With respect to your own feelings about your particular supervisor for whom you are now working please **indicate the degree of your agreement or disagreement** with each statement by checking one of the seven alternatives below/beside each statement.

	Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree
7.1 My supervisor values my contribution to the well-being of our department	1	2	3	4	5	6	7
7.2 My supervisor strongly considers my goals and values	1	2	3	4	5	6	7
7.3 Help is available from my supervisor when I have a problem	1	2	3	4	5	6	7
7.4 My supervisor really cares about my well-being	1	2	3	4	5	6	7
7.5 My supervisor is willing to help me when I need a special favour	1	2	3	4	5	6	7
7.6 My supervisor cares about my general satisfaction at work	1	2	3	4	5	6	7
7.7 My supervisor cares about my opinions	1	2	3	4	5	6	7
7.8 My supervisor takes pride in my accomplishments at work	1	2	3	4	5	6	7
7.9 My supervisor tries to make my job as interesting as possible	1	2	3	4	5	6	7

In your approach to your job and work tasks over the past week, **to what extent have you felt**…

	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
8.1 Determined	1	2	3	4	5
8.2 Inspired	1	2	3	4	5
8.3 Active	1	2	3	4	5
8.4 Excited	1	2	3	4	5
8.5 Upset	1	2	3	4	5
8.6 Nervous	1	2	3	4	5
8.7 Afraid	1	2	3	4	5
8.8 Overwhelmed	1	2	3	4	5

In your job and work over the next six months, **to what extent do you agree** …

	Strongly disagree	Slightly disagree	Moderately agree	Strongly agree	Very strongly agree
9.1 I plan to remain in a job within this line of work	1	2	3	4	5

Please **provide your demographic information** below.

	Response format
10 Age	Only numbers may be entered in this field.
11 Gender	Please choose only one of the following: Female; Male
12 Highest level of education attained	Please choose only one of the following: certificate, diploma, undergraduate degree, postgraduate degree, PhD, other _____
13 Residential postcode	Only numbers may be entered in this field.
14 Current occupation	Please write your answer here.
15 Current terms of employment	Please choose only one of the following: full-time, part-time, casual, fixed-term contract, self-employed, other _____
16 Workplace postcode	Only numbers may be entered in this field.
17 Industry	Check all that apply: Agriculture; Aquaculture; Forestry and logging; Fishing, Hunting and Trapping; Agriculture, Forestry and Fishing Support Services; other _____
18 Industry subtype/s (e.g. Grain, Cotton, Poultry, Meat and Livestock etc.)	Please write your answer here.
19 Income	Please choose only one of the following: 0 – $18,200; $18,201 – $37,000; $37,001 – $90,000; $90,001 – $180,000; $180,001 and over; Prefer not to say
20 Is there anything else that you would like to leave a comment	Please write your answer here.

about (e.g. how your responses should be interpreted, further explanation about the motivators for STEM trained professionals to persist in an agricultural-related career)?	

End message:

Thank you for taking the time to help with this research project.

Submit your survey:

Thank you for completing this survey.

APPENDIX B

University of Southern Queensland

Participant Information for USQ Research Project Interview

Project Details

Title of Project:	STEM Workforce Attraction, Motivation and Retention in Rural and Regional Australia
Human Research Ethics Approval Number:	H17REA176

Research Team Contact Details

Principal Investigator Details

Ms Kristen Lovric
Address: USQ Toowoomba Campus, West Street TOOWOOMBA QLD 4350
Email: Kristen.Lovric@usq.edu.au
Telephone: (07) 4631 2375

Supervisor Details

Associate Professor Peter McIlveen
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Email: Peter.McIlveen@usq.edu.au
Telephone: (07) 4631 2375

Description

This project is being undertaken as part of a PhD Project.

The purpose of this project is to investigate the personal career-related factors, such as interests, confidence, goals, and expectations, that attract and retain individuals into Science, Technology, Engineering, and Mathematics (STEM) occupations (e.g., agricultural science and engineering), specifically in rural and remote regions. Identification of these factors may contribute to efforts to raise potential job candidates and important influencers' (e.g., parents, teachers, peers) awareness of, knowledge about, and interest in these occupations and industries, and their relevance and attractiveness to those individuals as career pathways.

The research team requests your assistance because these STEM occupations and industries are seen as drivers of economic and social development; however, the number of individuals deciding to take a career pathway in science, technology, engineering, and mathematics industries is insufficient to meet projected demands. How to attract individuals into these professions is currently an issue of international interest for educational institutions, government, and industries. This problem is compounded by the challenges of attracting and retaining individuals into occupations and industries located in, or related to rural regions. The knowledge generated by this research will be a contribution to solving the workforce problem.

Participation

Your participation will involve taking part in an interview that will take approximately 60 minutes of your time.

The interview will take place during business hours (9am – 5pm) on a weekday at a time and public venue, such as a library or workplace that is convenient to you. You can participate via phone, teleconference or zoom.

Questions will be related to your beliefs about being able to perform a certain behavior. Examples include; 'How confident are you in your ability to successfully perform to the demands of your work?', and 'To what degree do you believe you are able to manage work life roles?'

The interview will be audio recorded.

Your participation in this project is entirely voluntary. If you do not wish to take part you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. You may also request that any data collected about you be destroyed. If you do wish to withdraw from this project or withdraw data collected about you, please contact the Research Team (contact details at the top of this form).

Your decision whether you take part, do not take part, or to take part and then withdraw, will in no way impact your current or future relationship with the University of Southern Queensland or any other foreseeable external organisation.

Expected Benefits

It is expected that this project will not directly benefit you. However, it may contribute knowledge to solving the problem of attracting and retaining science, technology, engineering and mathematics professionals in rural occupations/industries. In a small way, this research is in an effort to address a key objective of the Food and Agriculture Organisation of the United Nations to overcome structural supply-side bottlenecks holding back growth. It is argued that the contributions of these occupations play a vital role in the efficient cultivation of food products and other resources, innovative design of advanced production machinery and, in the exportation of goods. Therefore, it is expected that this research would inform educational policy and programs, and human resources strategies.

Risks

There are minimal risks associated with your participation in this project. These include time-imposition (freely giving your time to participate) or the slight risk that disclosure of information about your career may trigger some difficult emotions. If you do find the interview distressing then it will be terminated. If you experience any adverse reactions to the interview questions, please contact Lifeline on 131114 or see your medical practitioner

Privacy and Confidentiality

All comments and responses will be treated confidentially unless required by law.

As audio recording of your comments will take place, no verification will be sought of your responses prior to final inclusion. The recording will not be used for any other purpose, only the principle investigator, supervisor and associate research team member will have access to the recording. It is not possible to participate in the project without being recorded.

The project is partially funded by a Research Training Scheme.

Any data collected as a part of this project will be stored securely as per University of Southern Queensland's Research Data Management policy.

Consent to Participate

If you would like to take part in the project, we ask that you sign a written consent form (enclosed) to confirm your agreement to participate. Please return your signed consent form to a member of the Research Team prior to participating in your interview. You can do this in person before your interview, by handing it to the researcher, or via email or post to one of the research team, whose contact details are provided at the top of this form.

Questions or Further Information about the Project

Please refer to the Research Team Contact Details at the top of the form to have any questions answered or to request further information about this project.

Concerns or Complaints Regarding the Conduct of the Project

If you have any concerns or complaints about the ethical conduct of the project you may contact the University of Southern Queensland Ethics Coordinator on (07) 4631 2690 or email ethics@usq.edu.au. The Ethics Coordinator is not connected with the research project and can facilitate a resolution to your concern in an unbiased manner.

Thank you for taking the time to help with this research project. Please keep this sheet for your information.

University of Southern Queensland

Consent Form for USQ Research Project Interview

Project Details

Title of Project:	STEM Workforce Attraction, Motivation and Retention in Rural and Regional Australia
Human Research Ethics Approval Number:	H17REA176

Research Team Contact Details

Principal Investigator Details

Ms Kristen Lovric
Address: USQ Toowoomba Campus, West Street TOOWOOMBA QLD 4350
Email: Kristen.Lovric@usq.edu.au
Telephone: (07) 4631 2375

Supervisor Details

Associate Professor Peter McIlveen
Address: USQ Toowoomba Campus, West Street TOOWOOMBA QLD 4350
Email: Peter.McIlveen@usq.edu.au
Telephone: (07) 4631 2375

Statement of Consent

By signing below, you are indicating that you:

- Have read and understood the information document regarding this project.
- Have had any questions answered to your satisfaction.
- Understand that if you have any additional questions you can contact the research team.
- Understand that you are free to withdraw at any time, without comment or penalty.
- Understand that you can contact the University of Southern Queensland Ethics Coordinator on (07) 4631 2690 or email ethics@usq.edu.au if you do have any concern or complaint about the ethical conduct of this project.
- Are over 18 years of age.
- Agree to participate in the project.

Participant Name	
Participant Signature	

Date	

Please return this sheet to a Research Team member prior to undertaking the interview. Contact details are at the top of this form.