University of Derby

A Circular economy model for measuring the circularity readiness of UK Manufacturing SMEs

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Abstract

Purpose

The circular economy has been attracting more interest over the years with academics, industry, and the wider society. The idea of a transition from a linear economy to a circular economy is well understood in academia and simplistic by nature. However, the challenges and barriers to this transition at all levels, macro, meso and micro are fundamentally complex and have wide consequences largely on the economic front but also on the method by which business is creating value propositions and generating revenue. Moreover, it is a huge shift in the way business is conducted and requires new ways of thinking and delivering products and services. It requires a paradigm shift in our intellectual capital to imagine new methods of maintaining a standard of living through products and services, whilst respecting the natural/finite resources, the natural world and social context. This research concentrates on the micro level and focuses on SMEs' transition to circular economy, by developing a model of readiness. This verified model aims to measure the level of readiness of manufacturing SMEs on their journey to circularity from the human side of the organisation rather than the capacity of the organisation to make the change.

Design/methodology/approach

The conceptional model and instrument were developed from previous research associated with organisational change in other areas such as Lean, Six Sigma, and TQM and contextualised to circular economy through known barriers sought from the research. Due to the nature of the application to SMEs, it was specifically designed to be as unintrusive, simple to disseminate and as time efficient as possible. Experience working in SMEs for many years influenced the decision to avoid anything complex, time-consuming, and requiring huge effort to operationalise. This conceptual model and instrument (questionnaire) have been verified using a Delphi survey technique. It was conducted through two iterations of the survey. Experts from academia and industry were participants in the study and through anonymous feedback helped to shape and verify the conceptual model and instrument, thus

modifying and making changes along the way. This verified model and instrument, (diagnostic) were then entered into the validation process.

Findings

It has emerged that there are many barriers for SMEs in consideration of opting to use the instrument and diagnostic. The first issue is where SMEs are on their journey to circularity and their leaders' current level of understanding. Even the terms and language used in the instrument (diagnostic) were questioned as to "what it means", by organisations' leaders. The second barrier to validating the model and Instrument, (diagnostic) is an SME being aware of the value proposition and being persuaded of the value in use, co-creation of value through applying the diagnostic and realising the benefits of doing so.

Practical implications

Leaders who see merit in assessing attitudes and beliefs associated with the barriers and common aspects of organisational change will understand the challenges of a journey to circularity. The benefits of using this diagnostic will enable leaders and business owners to develop a strategy of change based on perceived readiness from the evaluation. They will be able to conceive change interventions such as enhanced communication, training, coaching, and recruitment depending on how they perceive their feedback. Having the commitment and belief to use the diagnostic and energy and resilience to take action are key to value co-creation.

Originality/value

The proposed model and instrument are relevant as a strategic diagnostic tool for SMEs to disseminate easily and for a relatively small amount of effort, be able to ascertain feedback that will be helpful in terms of making strategic choices around their continued approach to circularity. There is no other diagnostic that measures attitudes and beliefs about the journey to circularity that aids strategic planning.

Dedication

Dedicated to my children Keelan and Callie and my wife Adele.

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Chapter 1 Introduction

The first chapter of this thesis will start with an introduction and then the background to the research why this topic was chosen and a rationale as to why this research is necessary right now. It will also include the research, aims and objectives and an overview of the key aspects including the identification of the research gap and subsequent contribution to knowledge. There will be an overview of the structure of the research and how it is intended to be carried out. It will then begin to break down the steps of the research strategy to progress this body of work to a conclusion. It will also discuss the contribution of each chapter of the thesis.

1.1 Background to the Research

The issue of sustainability has been at the forefront of research for many years. The Earth's natural resources, including materials, water, energy and fertile land, are the basis for our life (SERI, 2009). According to Ellen MacArthur Foundation, (2013), there are growing signs of resource depletion evident from the volatility increases across the global economy and, the call for a new economic model is getting louder. There is a continuing anxiety that business are falling well short of expectations to address the critical concerns relating to sustainability, i.e., over-use of natural resources and a lack of response to the issue of global warming (Murray, et al, 2017). Humanity's rapidly increasing consumption of these resources is causing severe damage (SERI, 2009). Whilst there is a need to continually increase food production globally to feed around 9 billion people by 2050 (Gil *et al.*, 2019), our climate continues to change, resulting in shrinking freshwater reserves, fish stocks, forests and fertile land.

During the 20th century, population growth led to an increase in the extraction of construction materials, ores and minerals and more fossil fuels. Experts suggest the global population will reach around 9 billion by 2050. Due to this prediction in population growth, there is also a forecast for increased demand for natural resources, such as raw materials, water, energy, and fertile land (Govindan and Hasanagic, 2018). The world economy today consumes approximately 30% fewer resources to

yield one Euro or Dollar of GDP than 30 years ago; however, overall resource use is still increasing and is expected to continue to rise due to the growing world population creating more demand for natural resources (Lieder and Rashid, 2016; SERI 2009). Furthermore, population growth adds additional pressure on the environment. Developments elevate the usage of raw materials for residential construction such as roads, bridges, dams, railways, sewages, and the need for transport (Govindan and Hasanagic, 2018).

Plastics and plastic packaging are an integral part of the global economy. Plastic production has surged over the past 50 years, from 15 million tonnes in 1964 to 311 million tonnes in 2014 and is expected to double again over the next 20 years (Ellen MacArthur Foundation, 2017). “However, the problem is that all these plastics end up as waste. In 2014, Europe produced 25.8 million tonnes of post-consumer plastics waste: 29.7% was recycled, 39.5% was incinerated with energy recovery, and 30.8% was landfilled. Landfill of plastic waste may cause environmental problems, as plastics are often not biodegradable” (Huysman *et al.*, 2017 p46).

Jurgilevich *et al.*, (2016) suggest our habits of food production and consumption are unsustainable at present. Significant inefficiencies in the food economy mean the loss of productivity, energy, and natural resources, and more pollution and greenhouse gases are created because of these inefficiencies.

The industry we rely on for the production of goods and our environment do not operate in isolation and the environmental impacts have incrementally increased pressure on industrial businesses. Historically, whilst mass production of goods was enabled by new manufacturing methods resulting in products with high availability and low costs, there has also been a huge consumer demand for such products, resulting in a staggering growth in industrial activity. There is an increasing severity of emissions to the environment, solid waste generation and landfill challenges (Lieder and Rashid, 2016). The world is in a perilous situation as we continue to abuse finite materials through extraction, processing, manufacturing and use activities, with a vast majority of end-of-life products/materials having no viable alternatives to landfills (Jawahir and Bradley, 2016).

These challenges are not new. Boulding E. Kenneth, (1966) first referred to the Earth as a spaceship, as a closed system and argued that the problems which the spaceship Earth is going to present, need much more attention in the present and are not all in the future. Since that time, there have been numerous sustainable concepts and policies to support and encourage sustainable activity.

The idea that knowledge and action are interdependent has transformed governance and how people think about the Earth's environment (Miller and Wyborn, 2018). Sustainability should be a strategic part of any business today and should be addressed through transformative management. However, companies often respond to these challenges by using conventional management practices, leading to incremental, rather than fundamental, changes, often insufficient (Lahtinen and Yrjölä, 2019).

Amongst many other models for sustainability, the circular economy (CE) has emerged as an interesting approach in terms of academic research and industry application in the transition to a more sustainable future and economic paradigm. It arguably replaces the linear 'take-make-dispose' model and by design is restorative and regenerative (de Jesus and Mendonça, 2018).

CE comprises diverse areas, such as sustainable production-consumption systems; closed-loop supply chains, and product-service systems. It is still considered a rather underspecified notion and difficult to describe (de Jesus and Mendonça, 2018). Kirchherr, et al, (2017) gathered 114 definitions of CE that were published in peer-reviewed papers and other renowned policy papers and reports. There are different interpretations of CE and what it means for society. The author has a strong background in delivering business improvement and organisational change to Small to Medium Enterprises (SMEs) and has identified an interest in what CE means for manufacturing SMEs in the UK.

1.2 Rationale

It has been long recognised that the Earth's resources are finite, and the current

economic linear model of take, make and dispose is no longer fit for purpose.

> The large energy inputs which we have obtained from fossil fuels are strictly temporary. Even the most optimistic predictions would expect the easily available supply of fossil fuels to be exhausted in a mere matter of centuries at present rates of use. If the rest of the world were to rise to American standards of power consumption, and still more if the world population continues to increase, the exhaustion of fossil fuels would be even more rapid
>
> (Boulding E. Kenneth, 1966, p6).

According to Govindan and Hasanagic, (2018), materials consumption worldwide will increase eightfold during the 21st Century which will demand a much higher utilisation of natural resources. This higher utilisation of resources will increase pressure on the environment.

The concept of CE has evolved to the extent that policymakers, academics, and the business community progressively acknowledge the need to move towards a new economic model, where materials are reintroduced into the economic system (Rizos *et al.*, 2016). Industrialised countries should focus on well-being instead of increased production and consumption by using new business models, but this will require rethinking the role of economic growth and the relationship between resource use, quality of life and happiness (SERI, 2009). Such new business models must have extra economic added value but tempered with lower resource depletion and environmental pollution (Scheepens, et al, 2016). Jawahir and Bradley, (2016) assert that CE is not an option, but inevitable for continued economic prosperity.

CE operates at three different levels, the micro-level (products, organisations, consumers), the meso-level (eco-industrial parks) and the macro-level (city, region or nation), to achieve sustainable development (Kirchherr, et al, 2017). For this thesis, CE is defined as

> "an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is

enabled by novel business models and responsible consumers" (Kirchherr, Reike and Hekkert, 2017, p229).

This research will focus on the micro level, the organisational level of (SMEs) and individuals within those organisations. According to de Jesus and Mendonça, (2018a), globally, there are hard barriers to adopting CE, such as the availability of technical solutions and financial factors. Furthermore, even when CE solutions are already technically feasible, economic and market limitations limit or prohibit their practical implementation. Holzer *et al.*, (2021) argue many actors are resisting this transition to CE because they have few incentives despite public awareness increasing in recent years. Ghenţa and Matei, (2018) cite 5 reasons as barriers to SMEs adopting circular practice: lack of human resources, lack of expertise to implement these activities, administrative or legal procedures, difficulties in accessing finance and cost of meeting regulations and standards. These barriers concur with research by (Rizos *et al.*, 2016) who add such aspects as the supply and demand network, lack of capital and government support. Interestingly, the company culture is seen as both a barrier and an enabler of a circular economy. Whilst these barriers and the general market condition are fundamentally the same for all SMEs, they are not performing the same in their circularity journey. If the conditions externally are the same for all players in the manufacturing market, why do some actors adopt circular practices and others do not? This performance difference is a crucial gap in the research.

In today's business environment and the ensuing onset of CE to meet the sustainability needs of the planet, ongoing and successful change is necessary for SMEs to survive, be effective and sustain a competitive advantage. Implementing organisational and individual changes is a widely studied challenge and the need for readiness to change is paramount to their success (Holt and Vardaman, 2013; Vakola, 2013; Rusly, et al, 2012). Organizational change efforts often run into some form of human resistance, which essentially is the opposite of readiness. Whilst experienced managers may be all too aware of this fact, remarkably few plan the organisational change to assess readiness for the change initiative (John P. Kotter and Leonard A. Schlesinger, 1979). The energy, inspiration, leadership and support must come from within the organisation and not from an external perspective (Armenakis, et al, 1993). Readiness essentially reflects the extent to which an individual or group of individuals are "cognitively and emotionally inclined to accept, embrace, and adopt a particular plan

to purposefully alter the status quo" (Holt *et al.*, 2007, p235). It is an individual or collective attitude that is tempered by what is being changed, how the change is implemented, the context and circumstances where the change is taking place and the attributes of those being asked to change (Holt *et al.*, 2007). This research endeavours to understand why some SMEs will adopt CE practices and some will not regardless of being similar by nature of their business.

1.3 Research Problem

Adopting CE practices in SMEs is challenging as these firms continually encounter resource constraints in terms of finance, human resources, and infrastructure and are often not even aware of green and sustainable practices that need to be followed (Mishra, et al, 2022). A serious issue for adopting CE is the speed of this transition. However, this change is a lengthy process, resisted by many economic agents, resulting in the need to change mentalities, paradigms, and processes, but will not always occur autonomously, without intervention or guidance (Neves and Marques, 2022). Barriers to change and SMEs adopting CE have been well documented in the research.

However, "for over 30 years, interest in change readiness has been growing among researchers and practitioners of organisational change" (Caldwell, 2013, p19). Whilst most change is often a result of external forces and pressures, internal change has to deal with these pressures to shape the organisation's response (Neves, 2009). Armenakis, et al, (1993, pp 681-682) Define readiness for change (RFC) as "the cognitive precursor to the behaviour of either resistance to, or support for, a change". "Both readiness to change and work engagement are important aspects of a successful organisation" (Matthysen and Harris, 2018, p 2). Therefore, this research aims to develop a conceptual model of readiness to facilitate an SME's preparedness for adopting CE practices.

Therefore, it is apparent that overcoming these barriers to CE is associated with an organisation's ability to prepare for readiness for a CE. For this research, the term readiness is defined as "the cognitive precursor to the behaviour of either resistance

to, or support for, a change" Armenakis, et al, (1993, pp 681 - 682) and that readiness has often been explained in conjunction with reducing resistance. Such terms as individual attitudes, beliefs about the organisation, individual acceptance and participation have been associated with readiness (Haffar *et al.*, 2017). This concept of organisational change readiness will be further discussed in detail in Chapter 3.

Rizos *et al.*, (2016) aim to improve knowledge and understanding of barriers experienced by SMEs when realising CE business models. They use a sample of SME case studies from the GreenEcoNet web platform financed by the European Commission and developed by six European research organisations with the objective of showcasing examples of SMEs that have successfully made a change towards a green business model. The barriers from this body of work were categorised into clusters and are discussed in Chapter 2. Rizos *et al.*, (2016) conclude that the success of SMEs in transitioning to a circular business model depends on a company culture with a "green" mindset, a local or regional network with other SMEs and the benefits of having a "green" image and being recognised as a "green" supplier by customers.

Ormazabal *et al.*, (2018) use empirical research to advance knowledge of CE implementation within Spanish SMEs. They outline and analyse the degree to which SMEs have implemented CE, their willingness to work in a symbiotic relationship with other organisations, and the barriers they face. Their findings revealed a lack of belief CE could promote profitability and sustainability in the market and limited resources, short-term vision, and lack of time in daily activities imply that SMEs do not see CE as a priority. However, they conclude SMEs are still focused on practices such as the reduction of materials and the reduction of energy usage. Their paper does not address the resistance to overcoming such barriers to CE or indeed what readiness for an SME might look like in terms of adopting circular activity.

Rather than barriers to CE, Gusmerotti *et al.*, (2019) argue five different levels of adoption of CE practices, which are driven by economic benefits, regulatory pressure, environmentally conscious leaders or being dependent on scarce natural resources. They add future research could analyse how the CE principles are internalised within the routines and daily practices of an organisation (Gusmerotti *et al.*, 2019).

This idea of internalised routines and daily practices requires awareness, mindfulness, knowledge and a favourable attitude towards a new paradigm, a new way of thinking. This concept can be captured as the readiness of the organisation to adopt CE. Whilst this paper discusses the likely drivers towards a Manufacturing SME adopting circular activity, it does not consider the readiness of an organisation to prepare for such activity and Gusmerotti *et al.*, (2019) concede that circularity should include the entire business.

Law and Gunasekaran., (2012) identify key motivating factors for the adoption of sustainable development strategies. CE is effectively the next generation of sustainable practice and will therefore add to the challenges already presented to SMEs. Law and Gunasekaran, (2012) also discuss a model (MIE) Management, Internal and external factors and summarise that internal factors and management policy have a significant influence on sustainable development and the adoption of CE. Strategically, managers and leaders from SMEs must be able to identify strategic competitive advantages associated with investment into changing products and processes to realise benefits. To address human or internal barriers, actions within the organisations must be stimulated, focusing on increasing the awareness and importance of CE as being vital to long-term sustainability (Ormazabal *et al.*, 2018a). In addition to the challenges and barriers, just two papers alluded to the notion of organisational readiness for CE, which they both also related to barriers.

So to summarise, Singh, Chakraborty and Roy, (2018) consider the intention of the manager/owner in terms of readiness and Lopes de Sousa Jabbour, (2018) considers more macro factors in terms of the environment, organisation and tools. These papers are an important contribution to CE readiness but are limited to gauging awareness and intention on the first hand and higher order actions associated with understanding the environment, organisational change and tools and frameworks on the second paper. They do not get into the details of what a competent circular workforce would look like! As Gusmerotti *et al.*, (2019, p. 323) stated, “The new challenge of the circular economy can also be addressed only by integrating its principles in all business functions: from logistics to procurement, from operations to marketing.” A more detailed discussion can be found in Chapter 2.

1.4 Aim and Objectives

To propose a model of readiness to support Manufacturing SMEs' preparation for transition to a circular economy.

1. Identify the research gap in terms of CE organisational readiness.
2. Develop a comprehensive readiness model for the Circular economy.
3. Verify a model of readiness for Manufacturing SMEs to adopt a Circular Economy.
4. Validate the model for application in Manufacturing SMEs.

1.5 Research Questions

- What drives the micro-behaviours necessary for overcoming barriers to CE transition?
- What change readiness theory applies to a transition to CE?
- To what extent do an individual's position in the organisation and their mindset influence CE readiness?

1.6 Conclusion and Contribution to Knowledge

This research endeavours to build a model that is different from existing models in that it will focus on the skills, knowledge and competence of the entire organisation as well as addressing barriers to CE notwithstanding the attitude, beliefs, and intention of the leader, senior management, and employees. Currently, there is no comprehensive holistic approach to SME readiness for CE as identified in a systematic literature review. This research aims to contribute to the knowledge by first developing a conceptual model from the literature surrounding barriers to CE utilising readiness models borrowed from eco-innovation, Lean TQM etc. More importantly, to research and develop a methodology for developing and designing conceptual models. This model will be verified by utilising a Delphi methodology with experts in both industry

and academia. Verification refers to the evaluation of the conceptual model and instrument and its perceived completeness. It refers to the mechanisms that contribute to the reliability and rigour of the study, in this case, using Delphi. Validation refers to whether the Readiness Model / Diagnostic would meet the end user requirements in the real world. This validation criteria is justified through research. This Readiness Model (or instrument/diagnostic), whose terms will be used interchangeably throughout this thesis, can be used to assist SMEs in understanding if they are ready, how ready they are to embrace CE, or where they may need to make changes or interventions within their organisation to enable full preparation. In reality, the Readiness Model is the entire proposed work, the whole experience with strategic outcomes and results through applying the Readiness Model. The instrument is the questionnaire and its facilitation, and the diagnostic is the application of the instrument. This diagnostic will act as an indicator of readiness highlighting potential weak spots or entire gaps within their organisation. This definition of readiness will test the ability of the organisation to be both willing and able to embrace and implement CE. It is different from any other model/diagnostic of readiness for SMEs relating to CE because it will address the readiness level of an SME against the barriers for SMEs to adopt CE, in terms of beliefs, attitudes and intentions, which therefore fills the knowledge gap. This model will illuminate an SME's limitations in readiness and allow further action such as upskilling of key staff, recruitment of expertise, culture change or individual transformation. This Readiness Model will allow better planning and preparation for SMEs so that time can be saved in the longer term, preventing false starts, slow starts, loss of impetus, loss of morale support from employees and frustrated attempts resulting in loss of belief for the leaders.

From this research, a gap in the knowledge has been highlighted. There is no overarching model for Manufacturing SMEs' readiness for CE. Whilst two papers present models or frameworks for readiness, it does not cover readiness in its entire context. Singh, Chakraborty and Roy, (2018) developed an extended theory of planned behaviour to examine two additional factors, environmental commitment, and green economic incentives. Conversely, Lopes de Sousa Jabbour, (2018) discusses macro levels of analysis such as market environment, organisational changes and tools and frameworks. Whilst they discuss strategies for CE implementation and argue their research paper is practical guidance to assist managers, there is no

comprehensive readiness model for manufacturing SMEs that covers the entire organisation and relates directly to the barriers to CE as defined in the literature. A more detailed summary of this systematic literature review can be seen in Chapter 2.

1.7 Research Outline

Chapter 1 is the introduction and develops the idea for the thesis. It provides the background and motivation for the research as well as the rationale. It presents the research problem, the gap in the knowledge and the aim and objectives of the research and outlines the entire approach to the research.

Chapter 2 provides a general review of sustainability, some associated strategies, and the concept of CE, in terms of definitions, enablers, scope and methods of implementation. It specifically includes a summary of findings from a systematic literature review in terms of the readiness of SMEs for the adoption of the CE. It identifies the gap in the literature relating to SME readiness.

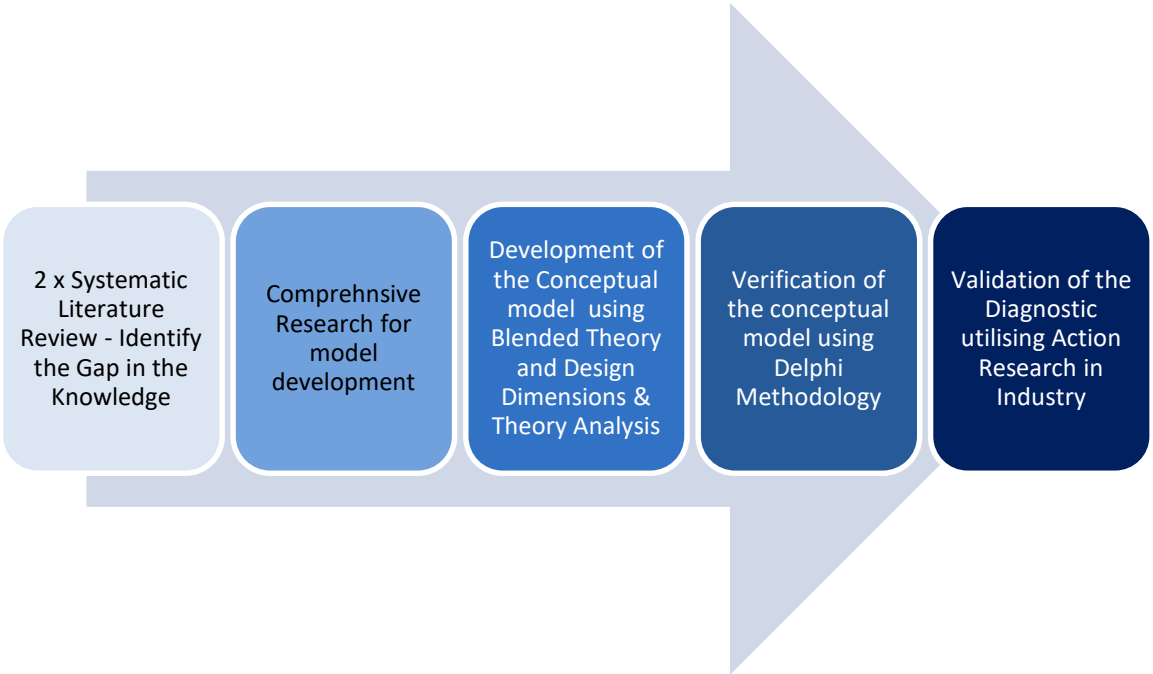


Figure 1. 1 Depicting the research methodology.

This process flow above illustrates the steps required to facilitate this research. The research scoping and systematic review have been produced and have subsequently

identified a gap in the knowledge. Further research will enable the development of a conceptual model of readiness for SMEs' transition to CE. The verification of this conceptual model will utilise the Delphi methodology and incorporate input from expert academics and industrialists in the field of CE. This Readiness Model will be validated in industry creating empirical evidence.

Chapter 3 investigates the concepts of why dynamic environments require ongoing organisational change and specifically what impacts the success or failure of a major change event. It explores the human side of an organisation in terms of change to better understand what factors enable effective change. It specifically deals with the concept of change readiness, its relationship to resistance and why it is fundamental to successful change outcomes.

Chapter 4 constructs a conceptual model of change readiness that is built from a combination of change readiness models and concepts in the literature, contextualised by the barriers for SMEs adopting a circular economy. It justifies the choice of models from the literature and how they form and develop this new conceptual model. It discriminates between other sources of change readiness literature.

Chapter 5 presents an overview of research philosophy and the development of theories to align this study to an appropriate approach. It sets out the approach to the research, the methodology and the justification for the choice of methods chosen. It details the steps taken to first identify the gap in the knowledge and subsequent steps to develop a relationship between the aim and objectives of the thesis with methods for verification and validation of a practical outcome.

Chapter 6 designs and develops the verification of the conceptual model and instrument. It also discusses the operational aspect of the model in practice. It discusses and justifies the use of a Delphi survey for this verification process.

Chapter 7 validates the verified model through application into the industry. It considers a strategic approach to engage third parties from the industry to an event for leaders to share the model and instrument and its perceived value. It then continues to validate the verified model using partial validation of the diagnostic as to

the value, benefits, and outcomes of applying the tool/model. Essentially, this is the level of impact that the research carries.

Chapter 8 concludes the findings from the research. This includes feedback from participants and organisations as to the value gleaned from applying the model. The overall impact and what it might mean in terms of commercialisation. The limitations of the research. It also provides ideas for future research and concluding comments on the merits of the model / diagnostic.

Chapter 2 Literature Review

2.1 Introduction

Chapter two starts with a general overview of sustainability and how Circular Economy, from here on referred to as (CE), relates to sustainability. The objective of this review is to explore the wider context and broader concepts and principles of sustainability and explore associated terminology and similar concepts as well as the definitions and perspectives. A common vocabulary with shared meanings is imperative to foster an effective integration of disciplines (Sauvé, et al, 2016). Therefore, this brief overview of sustainability and different strategies that are associated with sustainability are explored to include the concept of CE.
Objectives of this chapter.

1. A general understanding of CE and associated terminology and similar concepts.
2. Carry out a Systematic Literature review (SLR)
3. Identify a gap in the knowledge relating CE to Manufacturing SMEs through a second (SLR).

Additionally, CE becomes the main focus and reviewing frameworks for understanding and implementing CE are also explored to better appreciate how academics are suggesting the operationalisation of CE in practical terms.

The first (SLR) uses specific search strings to narrow down the area of research. This approach utilises steps outlined by Xavier *et al.*, (2017) firstly, being used to formulate the research question and specify the scope and purpose of the research. The next step is establishing the location of studies and identification of key search criteria based on the scoping of this research. The selection and evaluation of studies detail what will be included and excluded from the research. Thematic analysis is used for synthesis from the study to identify themes in research to date. The purpose of this chapter is to provide a sound understanding of themes around (CE) and what this

means for Manufacturing SMEs. This chapter also incorporates aspects of a second systematic literature review (SLR), of Small to Medium enterprises' (SMEs), readiness for CE. The objective of this second (SLR) was to identify the gap in the knowledge. This chapter also discusses the challenges barriers and enablers of (CE). Key articles are evaluated in terms of barriers to (CE) and SME readiness for (CE). A gap in the knowledge is identified as a foundation for continuing research.

2.2 Sustainability

Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). This definition is widely accepted amongst scholars and academics. The 17 Sustainable Development Goals and 169 targets are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social, and environmental, with CE at the heart of this challenge (Ortiz-de-Montellano, Samani and Meer, 2023). The pursuit of the SDG agenda and sustainability of the planet relies on the simultaneous and combined attainment of targets at the national, regional, and global levels (Gil *et al.*, 2019).

In terms of business Lahtinen and Yrjölä, (2019) suggest many organisations operate a strategy that uses a business-as-usual approach when sustainability calls for a radical fundamental change, a paradigm shift in thinking. They continue to assert that a truly sustainable business shifts its focus from reducing its negative environmental and social impacts to realising how it can produce a major positive impact on the challenges facing society. The positive impacts have been theorised for decades and developed into different strategies, often with similar content and using different terminology. Sauvé, et al,. (2016) explored the terminology of environmental sciences, sustainable development, and CE to ascertain the differences in concept and understanding. They argue that the concepts (to an extent) overlap, and researchers, guided by any or all of them, can certainly contribute to the protection and improvement of the environment. However, they found the CE concept to be gaining momentum due to the fact it gives a clear angle of attack to help solve environmental problems.

(CE) is not the first key strategy in the transition to a more sustainable economic paradigm. There have been other strategies that complement the notion of attaining a more sustainable economic system. Some of these complementary and associated philosophies are outlined below.

2.2.1 Eco-innovation

Eco-innovation is any form of innovation aiming at significant and demonstrable progress towards the goal of sustainable development. It is achieved through reducing impacts on the environment or achieving a more efficient and responsible use of natural resources. Associated analytical tools for such transformation have been developed in the field of environmental management, namely within frameworks such as eco-efficiency, industrial ecology, design for environment, eco-effectiveness, natural capital, and biomimicry. Most commonly eco-innovation refers to new technologies that reduce the environmental impact caused by consumption and production activities, regardless of whether the main motivation for their deployment is environmental or not (Carrillo-Hermosilla, et al, 2010).

Eco-innovation is essential to overcoming “hard” technical aspects associated with a transition to (CE). Such challenges as solid waste issues, air pollution, water contamination and noise require technical solutions. For example, technological developments in chemistry may involve the development of non-toxic or biological materials capable of substituting oil-based plastic packaging (de Jesus and Mendonça, 2018a). Eco-efficiency strategies concentrate on preserving the value of economic output while concurrently reducing the impact of economic activity upon ecological systems and aim to decouple the relationship between economy and ecology (Braungart, et al, 2007).

2.2.2 Cradle to Cradle

The Cradle-to-Cradle Framework (C2C) that articulates this conceptual shift is a science and values-based vision of sustainability. C2C designs industrial systems to be commercially productive, socially beneficial, and ecologically intelligent (McDonough, William, et al, 2003). When discussing Cradle to Cradle concepts Kopnina, (2019) uses CE/C2C interchangeably and suggests they both aim to avoid take-make-waste production by substituting harmful or wasteful materials with the types of materials that can be used endlessly in an industrial cycle.

To achieve a sustainable world based on the C2C philosophy, products should be beneficial in health, environmental and economic terms. The C2C design paradigm consists of these three main principles, namely, all materials should be seen as nutrients for other product lifecycles either in a biological metabolism or technical metabolism only sustainable energy sources should be applied and the use of diversity to improve a system's resilience (Toxopeus, et al, 2015). Although the C2C vision sets a course for what to do, McDonough, William et al, (2003) develop 12 Principles of Green Engineering to guide realising this vision by suggesting ways that designers and engineers can optimise products, processes, and systems but argue the greatest returns often come from redefining the problem. A crucial characteristic of the C2C design framework is, what is considered the "up-cycling" concept, i.e., increasing the value of materials by improving the quality of recycling and recycled material (Niero and Olsen, 2015). Similar to (CE), within the Cradle to Cradle philosophy mere recycling is not enough (Toxopeus, et al, 2015).

2.2.3 Closing and Extending Loops

Closing resource loops through recycling, the loop between post-use and production is closed, resulting in a circular flow of resources (Bocken, et al, 2016). Closing the loop is closely associated with (CE) in that it aims to keep materials at their highest value. It is closely associated with C2C philosophy in that closing the loop is the maximising of recycling (Mestre and Cooper, 2017). According to Winkler, (2011) an

organisation cannot implement and effectively run a closed CE on its own, but by working together, the reused or recycled materials can be increased up to 80% by closing process loops (instead of 1% with unclosed process loops) in the supply chain. As well as closing loops, Bocken, et al, (2016) argue slowing resource loops through the design of long-life goods and product-life extension, such as repair, and remanufacturing, the utilisation period of products is extended, resulting in a slowdown of the flow of resources. Of course, recycling represents another means by which the throughput of materials can be slowed down.

This concept of closing loops through recycling is biomimetic (discussed below), which regards all materials that circulate within industrial and commercial processes as ‘nutrients’ under two primary categories, biological and technical.

Biological nutrients are organic materials that, at the end of life can be carefully returned to the biosphere as 'food' for other forms of life. Technical nutrients are inorganic or synthetic materials that can be recycled many times and kept at their highest value but possibly degraded to less value (Mestre and Cooper, 2017).

2.2.4 Blue Economy

The “Blue Economy” is concerned with the Ocean, life within it and those who depend on it. The term ‘Blue Economy’ or (BE), according to Lee, et al, (2020) has been used interchangeably with similar terms such as “ocean economy” or “marine economy” but originated from the United Nations Conference on Sustainable Development held in Rio de Janeiro in 2012. The Earth’s population depends upon the ocean for its very existence, and the ocean controls our climate, weather, and the generation of half of the planet’s oxygen (Spalding, 2016). As Blue Economy policies and critical frameworks appear, identifying the scales, policies, actors, and stakeholders is necessary for understanding the underlying industries of the Blue Economy (Graziano *et al.*, 2022). However, Fusco *et al.*, (2022) suggest there is now a broad agreement among countries that these blue economies should be sustainable and fair, but there is no agreement on what this means in practice.

2.2.5 Biomimicry

Biomimicry is the mimicry of natural systems in the human-designed world which seeks sustainable solutions to human challenges by matching nature's patterns (Helmrich *et al.*, 2020). Biomimicry would be supportive of C2C frameworks in that it is a process for developing technological solutions to overcome a human design problem and is inspired by nature or biological systems (Qureshi, 2020). According to Hayes, et al, (2020), there are three levels of Biomimicry; to imitate natural form, biological processes, and patterns of ecosystems. In short, it refers to taking nature as a model to meet the challenges of sustainable development through interdisciplinary design approaches. Understanding systems evolution over time is imperative for environmental performance analyses and for future policy planning and management of eco-industrial parks (EIPs) (Wang and Li, 2006). This idea further links the concept of CE with biomimicry is that, mimicking the circularity of biological processes to ensure nutrients and raw materials used in production processes and products are recycled at the end of their lives (Ruggieri *et al.*, 2016).

2.2.6 Circular Economy Concept

CE emerged as an umbrella concept and is often seen as a means to achieving sustainability (Pieroni, et al, 2019). However, Kirchherr, et al, (2017) identified and analysed 114 definitions of CE alone. The concept of CE has recently become popular with academics, industry, and policymakers (Geissdoerfer *et al.*, 2017). This concept has since evolved such that today policy-makers, academics, and the business community increasingly recognise the need to move towards a new economic model whereby materials and energy from discarded products or by-products are reintroduced into the economic system (Rizos *et al*, 2016; Kirchherr, et al, 2017; Ghisellini, et al, 2016). According to Ruggieri *et al.*, (2016) CE has emerged as a strategy within the scope of sustainability which seeks to enhance the concept of sustainability. One of the key differences between sustainability and CE is that sustainability has been operating within a linear economy of take, make, and dispose of. A significant difference between the circular economy and the linear economy is

that sustainable development when applied through the linear model, may focus on waste reduction, recycling, and reduction of pollution. Still, products that are recuperated through recycling efforts are too often orphaned, lacking value reverse supply chains that are simply not in place (Sauvé, et al, 2016a). Sustainable development delivered through CE requires a reverse supply chain to ensure no waste goes unused and all waste becomes an input into another system. The main conceptual similarities and differences between sustainability and the CE are summarised by Geissdoerfer *et al.*, (2017), but they go on to suggest they are often being used in similar contexts and interchangeably as the similarities and differences between these concepts have not been made explicit in the literature, therefore blurring the line between the two. It could be argued that sustainability has a better chance of success using a CE rather than a linear one.

Sauvé, et al, (2016) argue that the term sustainable development is fundamentally grounded in the three R's reduce, reuse, recycle, and is firmly embedded in a linear economy. "Since the first use of the concept of the CE, the terminology around the "CE" has been diverging rather than converging and the terms closed loop and CE are often used in parallel" (Bocken, et al, 2016). What is both interesting and pertinent to all of these approaches to sustainability, regardless of what the strategy is called is that it is fundamentally about doing something different. It is about change.

2.3 Definitions and applications of CE

For generations, our industrial economy has operated and largely continues to operate in a linear economy of take, make, and dispose of. Throughout its evolution and diversification, our industrial economy has never moved beyond this fundamental characteristic of a linear model of resource consumption (Ellen MacArthur Foundation, 2013). The consistent failure of the linear economy to meet the needs of the Earth's sustainable challenges has led to a new economic model, rushing to the forefront of the minds of academics and industrialists alike (Bradley *et al.*, 2016). "A circular economy is an industrial system that is restorative or regenerative by intention and design" (Ellen MacArthur Foundation, 2013, p7). This definition has been cited many times and variations on this theme also exist. For instance, CE is an industrial

economy that is restorative by design and mirrors nature in actively enhancing and optimizing the systems (Jurgilevich *et al.*, 2016). The CE model considers factors that can reduce waste and monitor the consumption of resources decreasing the need for new, effectively closing the loop (Govindan and Hasanagic, 2018). CE is an industrial model that can decouple sales revenues from material input (Ellen MacArthur Foundation, 2013). Whilst attempts over the years to respond to challenges of resource scarcity, environmental impact, and economic benefits have been made by governments and industries there has been a lack of a systematic approach and therefore the CE approach appears inevitable (Lieder and Rashid, 2016).

Based on this extensive research Geissdoerfer *et al.*, (2017 p759) define (CE) as a "regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling." According to Jurgilevich *et al.*, (2016) CE means reuse, repair, refurbishing, and recycling of existing materials and products; what was earlier considered to be waste becomes a resource.

Yongtao, (2015) suggests the CE is based on the fundamental principle of environmental ecology, which requires a change in the economic system, to achieve the reduction and recycling in all aspects of social production, and promote sustainable development. Kirchherr, et al, (2017) analysed 114 definitions of CE and provided the first quantitative evidence that CE means many different things to different people. The most common conceptualisation of CE is a combination of reduce, reuse, and recycling, the 3R framework and practitioners frequently neglect 'reduce' in their CE definitions.

Kirchherr, et al, (2017 p229) define CE as:

> an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling, and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks), and macro level (city, region, nation, and beyond), to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity, and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers

According to Moldavanova and Goerdel, (2017), the literature on the approaches to sustainable development are typically a macro-level societal concept or a meso-level organisational concept. CE, according to Ghisellini, et al, (2016) has implementation at different scales (micro, e.g., company or consumer level; meso, e.g. eco-industrial parks level; macro, e.g. city, province, region, nation). According to Masi *et al.*, (2018) when analysing the practical implementation of CE principles, initiatives are generally identified into three levels the micro-level of firms, the meso-level of networks, and the macro-level of policy and regulations. The author argues here that all change, whether at the Macro level, Meso level or at any level starts with an idea, a thought, a vision, or a meeting of minds. Individual mindsets are all driven by attitudes, beliefs, and values and those individuals are within those societies, communities and organisations.

Although specific definitions of sustainability vary Geissdoerfer *et al.*, (2017) state most macro-level scholars recognise three interconnected dimensions of sustainability; environmental, economic, and social. In terms of CE from an organisational perspective, the emphasis is inspired by the rapidly growing corporate social responsibility (CSR) and the idea of the triple bottom line (Moldavanova and Goerdel, 2017). At micro the level, the move towards CE suggests the adoption of cleaner production methods and eco-design, to take into account all the environmental impacts of a product and the improvement of material and resource use (Geissdoerfer *et al.*, 2017). It is clear, that for CE to be successful, it must be addressed at all three levels, Macro, Meso, and Micro.

For example, in 2014, the global production of plastic was 311 million tonnes of which Europe was responsible for 20% of the world production. Europe also produced 25.8 million tonnes of post-consumer plastics waste, of which 30.8% was landfilled. To monitor plastic waste management, suitable indicators are a requirement. Whilst there are significant indicators at the macro-economic level (countries, regions) there are fewer indicators at the micro-level (products, companies) (Huysman *et al.*, 2017). To improve this situation at the micro level, indicators/measurements and actions must be taken at that micro level. You cannot improve what you cannot measure! Dealing with the issue of plastic packaging is better to deal at source rather than waiting for it

to reach the Oceans, whether this is re-designing, or recycling. In general, the tighter the circles are, the larger the savings should be in the embedded costs in terms of material, labour, energy, and capital (Ellen MacArthur Foundation, 2013). This above example of a Macro, Meso and Micro problem of plastic waste must first be addressed in the human mind. There are no silver bullets to solve this issue and more than one strategy is required to make a difference. It will take many actors playing a part in the solution. However, to make the changes necessary, and change behaviour, the intention to act first comes from an individual and collective mindset. To better understand how to implement CE at different levels many frameworks and models have been created in the literature to act as a guide for turning a philosophy into a set of measurable actions. Some of the key frameworks are discussed below.

2.4 Frameworks and Implementation for CE

Theories, models, and frameworks may be classed as distinct concepts, however, the terms are often used interchangeably in implementation science (Nilsen, 2015). This section reviews some of the key models and frameworks that have significantly enhanced our understanding of CE.

According to Nilsen, (2015), theoretical approaches used in implementation science have three predominant intentions: describing and/or guiding the process of converting research into practice (process models); understanding and/or explaining what influences implementation results (determinant frameworks, classic theories, implementation theories); and evaluating implementation (evaluation frameworks). Below is a summary of several key theories, models, and frameworks that support CE.

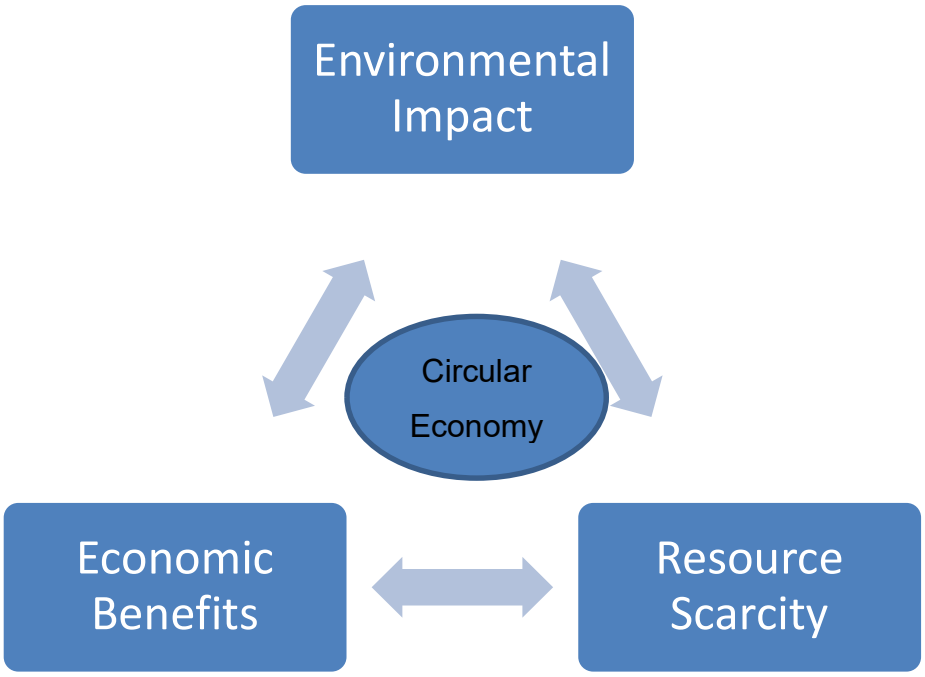


Figure 2.1 A CE framework illustrated by Thorley adopted from (Lieder and Rashid, 2016)

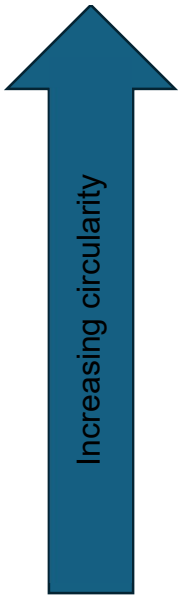
This framework emphasises a combined perspective of resource scarcity, environmental impact, and economic benefits including their relationships. Resource scarcity - the fact that the earth's resources are finite and underlying factors in this context concern the circularity of resources, material criticality, and volatility of resources in the light of global geo-political activities. Environmental impact - in minimum environmental impact is a desirable state of nations, governmental bodies, and individuals around the globe. The reduction of solid waste, landfills, and emissions through activities such as reuse, remanufacturing, and/or recycling. Economic benefits – every organisation endeavours to gain economic benefits to secure profits and competitive advantage, which requires an integrative approach toward new business models, product design, supply chain design, and choice of materials (Lieder and Rashid, 2016). This is a determinant framework, that explains what influences the implementation results.

REgenerate	• Shift to renewable energy and materials • Reclaim, retain and restore health of eco-systems • Return recovered biological resources to the biosphere
Share	• Share assets (e.g. cars, rooms, appliances) • Reuse / second-hand • Prolong life through maintenance, design for durability, upgradability etc
Optimise	• Increase performance/efficiency of the product • Remove waste in production and supply chain • Leverage big data, automation, remote sensing and steering
Loop	• Remanufacture products or components • Recycle materials • Digest anaerobically • Extract biochemicals from organic waste
Virtualise	• Dematerialise directly (e.g. books, CDs, DVDs, travel) • Dematerialise indirectly (e.g. online shopping)
Exchange	• Replace old with advanced non-renewable materials • Apply new technologies (e.g. 3D printing) • Choose a new product/service (e.g. multimodal transport)

Figure 2.2 The ReSOLVE Framework was adopted from (Ellen MacArthur, 2015).

The ReSOLVE framework outlines six actions to guide the transition towards a CE:

1. Regenerate 2—share 3. Optimise 4. Loop 5. Virtualise 6. Exchange as seen above can be applied to products, buildings, neighbourhoods, cities, regions, or even entire economies (ARUP, 2016). The intention here is to convert research into practice, essentially a process framework.



Strategy		
Smarter product use and manufacture	R0 Refuse	Make product redundant by abandoning its function or by offering the same function with a radically different product
	R1 Rethink	Make product use more intensive (e.g. by sharing product)
	R2 Reduce	Increase efficiency in product manufacture or use by consuming fewer natural resources and materials
Extend the lifespan of the product and its parts	R3 Reuse	Reuse by another consumer of discarded product which is still in good condition and fulfils its original function
	R4 Repair	Repair and maintenance of defective product so it can be used with its original function
	R5 Refurbish	Restore an old product and bring it back up to date
	R6 Remanufacture	Use parts of a discarded product in a new product with the same function
	R7 Repurpose	Use discarded products or its parts in a new product with a different function
Useful application of materials	R8 Recycle	Process materials to obtain the same (high grade) or lower (low grade) quality
	R9 Recover	Incineration of material with energy recovery

Figure 2.3 A Hierarchy of strategies, adopted from, (Kirchherr, et al, 2017).

Kirchherr, et al, (2017) consider the core principles when analysing the 114 definitions of CE and distinguish between two types those relating to the R frameworks and the systems perspective. They suggest various R frameworks have been used in academia as well as by practitioners for decades and many authors view the various R frameworks as the 'how-to' of CE and thus a core principle of it. The most prominent features of the R in these types of hierarchies are reduce, recycle, reuse, and recover. Some frameworks have the 3R, 4R, 6R, and even 9R, but they all tend to share a hierarchy as their main feature with the first R (which would be 'reduce' in the 4R framework) viewed to be a priority. Again, this type of framework is very much a process model or framework.

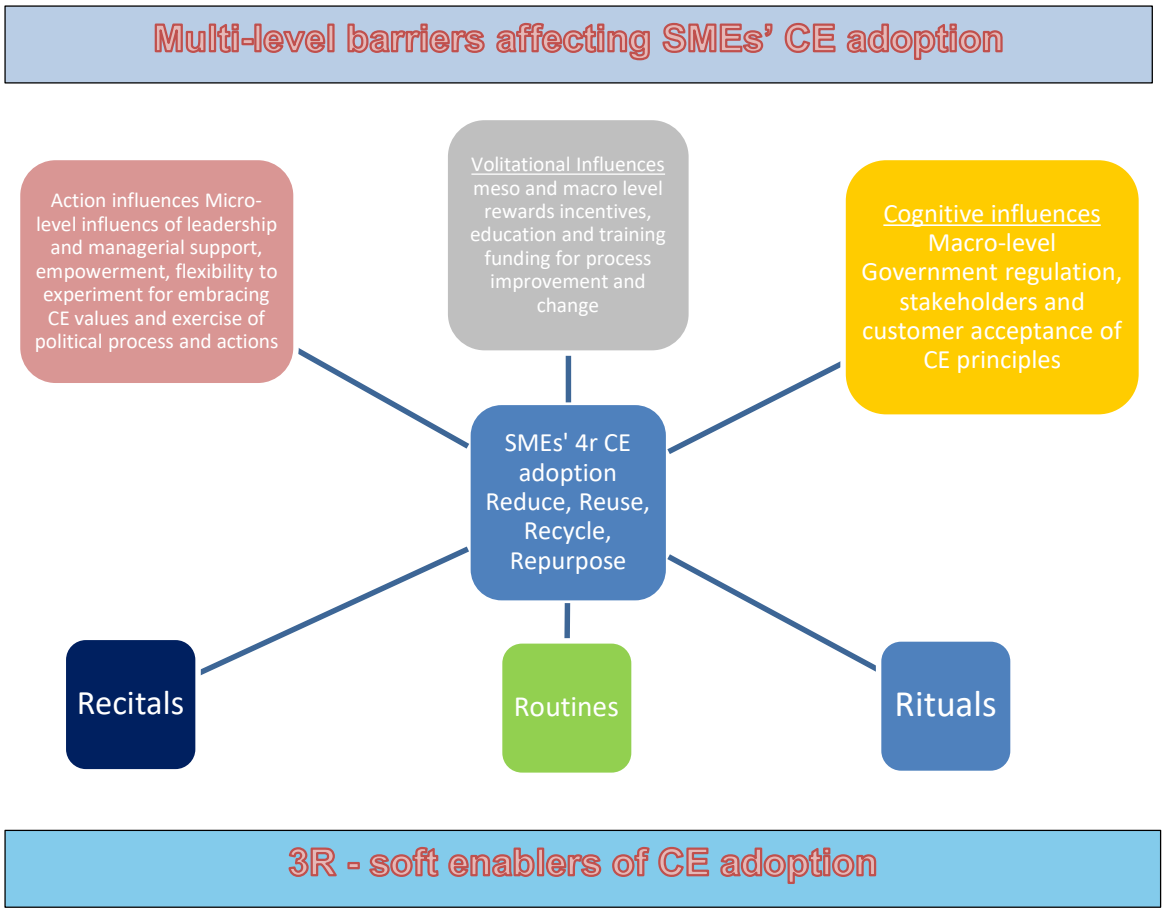


Figure 2.4 A 7-R conceptual framework of CE adoption by SMEs: Barriers and enablers, adopted from (Malik et al., 2022).

The top part of the framework considers the multi-level barriers affecting SMEs' adoption of CE, classified into three categories: cognition, volition, and action barriers. They suggest on a closer examination, that the barriers exist on a continuum encompassing at macro-, meso- micro-level (Malik *et al.*, 2022). At the macro level, a perceived lack of Government Incentives and Regulatory Framework and a legitimate need for change, rendering all CE activities voluntary. This message arguably reinforces the discrepancies of leaders who believe there is no need to change. In addition, at the meso and micro-levels, there requires a business case, training, and development for employees, and businesses need support and awareness of the key concepts as well as leadership, and management, extending support, flexibility, and empowerment to employees of SMEs to promote CE values (Malik *et al.*, 2022).

The lower part of the framework refers to the three intangible factors (routines, rituals, and recitals) that must adopt the 4R CE principles. First, SMEs must develop new

ways of working, (routine behaviours) and embed these in their daily activities, such as the processes, resources, and knowledge sharing, essentially, an SMEs' new culture Malik *et al.*, (2022), also noting, the requirement for constant recitals and changing the rituals by the change champions. This is essentially the essence of this research, the changing of habits. Habits are often at the subconscious level and are acted out (without thinking). Collective habits shape a culture of expected behaviour and ways of doing things that are considered normal and correct. This reinforces a culture to be more rigid, essentially a deep structure that is difficult to change. Whilst these types of frameworks can help practitioners to understand what influences CE, how implementation could be approached and evaluate progress, it is innovative circular business models that enable an organisation to develop a value proposition by finding economically viable ways to continually reuse products and materials, using renewable resources where possible (Bocken, et al, 2016). However, developing new business models requires a new way of thinking, new routines, and rituals. Whilst these routines and rituals can be enablers as stated by Malik et al., (2022), they can also be barriers if change and the transition to CE are not addressed. Again, scholars have introduced new business model ideas for others to adopt. Even if the idea is compelling to some people, making it a reality requires several actors to think the same way. Making a success of a new business model requires different behaviour from many actors. These actors will vary in terms of their attitudes, beliefs, values, and emotions towards such ideas. Therefore, making a new business model a reality must consider such micro-behaviour.

2.5 CE Operationalised through business models

The recent embracing of new business models that encourage design for reuse and improve materials recovery replaces historic production and consumption systems (Genovese *et al.*, 2015). New economic ways to continually reuse products and materials, from renewable resources where possible, use circular business models to enable CE (Bocken, et al, 2016).

“CE paradigm introduces a new perspective to look at the industrial ecosystem, where the economic growth is decoupled from resource consumption and pollutant emissions as end-of-life materials and products are conceived as resources rather than waste” (Elia, et al., 2016, p2742). The traditional business model is to focus on the incentive to maximize the number of products sold, thus boosting turnover, market share, and profits (Tukker, 2015). However, new business models that support CE, operate differently and therefore require new thinking.

The literature describes business models as how a firm does business and how the company will convert resources and capabilities into economic value, including assumptions about customers, their needs, and the behaviour of revenues, costs, and competitors (Bocken *et al.*, 2014). “Implementation of the CE concept is a challenging task given the prevailing linear mindset and structures in industry and society. While the benefits for the natural environment are simple to grasp and understand, the economic benefits in the context of CE are more complex to envisage” (Lieder and Rashid, 2016, pp46-47). According to Ellen MacArthur Foundation, (2013) improvements in material selection and product design through standardisation and modularisation of components and design for easier disassembly are central to CE.

Innovative business models, especially changing from ownership of a product to performance-based payment models, which are essentially paying for the service, are instrumental in transforming products for reuse into attractive value propositions (Ellen MacArthur Foundation, 2013). The transition to CE requires new business models to be developed and these business models must have extra added value compared to the current market competition combined with less resource depletion as well as less environmental pollution (Scheepens, et al, 2016). Essentially, Bocken *et al.*, (2014) define a business model using three main elements: the value proposition, (the product and service offering to generate an economic return as well as ecological and social measurements), value creation and delivery, (seizing new business opportunities, new markets and new revenue streams), and value capture, (is about considering how to earn revenues).

The archetypes are categorised from research, which describes the main type of business model innovation according to Bocken *et al.*, (2014), Technological, Social,

and Organisational oriented innovations. They act as a guide for innovative ways for leaders to consider new business models towards CE.

Technological			Social			Organisational	
Maximise material and energy efficiency	Create value from waste	Substitute with renewables and natural processes	Deliver functionality rather than ownership	Adopt a stewardship role	Encourage sufficiency	Repurpose for society/environment	Develop scale-up solutions

Table 2.1 The Sustainable business model archetypes source (Bocken et al., 2014).

Lewandowski, (2016) extended and adjusted the circular business model canvas developed by Osterwalder, Pigneur and others. It has eleven components or building blocks that allow the designing of a business model according to the principles of CE.

<table>
<tr>
<td rowspan="3">Patterns
• Cooperative networks
• Types of Collaboration</td>
<td>Activities
• Optimising performance
• Product Design
• Lobbying
• Remanufacturing, recycling
• Technology exchange</td>
<td rowspan="3">Value Proposition
• PSS
• Circular products
• Virtual service
• Incentives for customers in take-back system</td>
<td>Customer Relations
Customer Relations
• Produce on order
• Customer vote (design)
• Social-marketing strategies and relationships with community partners 2.0</td>
<td rowspan="3">Customer Segment
• Customer types</td>
</tr>
<tr>
<td></td>
<td>Channels
• Virtualisation</td>
</tr>
<tr>
<td>Key Resources
• Better performing materials
• Regeneration and restoring of natural capital
• Virtualisation of materials
• Retrieved Resources (products, components, materials)</td>
<td>Take-back system
• Take-back management
• Channels
• Customer Relations</td>
</tr>
<tr>
<td colspan="3">Cost Structure
• Evaluation Criteria
• Value of incentives for Customers
• Guidelines to account the cost of materials flow</td>
<td colspan="2">Revenue streams
• Input based
• Availability-based
• Usage-based
• Performance-based
• Value of retrieved resources</td>
</tr>
</table>

Adoption Factors

- Organisational capabilities
- PEST Factors

Figure 2.5 A framework of the circular business model canvas adapted from (Lewandowski, 2016; Osterwalder, A.; Pigneur, Y 2010).

This business model canvas can be used to support the process of designing a business model but does not indicate how the principles of CE or the business actions implementing CE are related to components of the business model and is arguably more useful for explanatory purposes than for supporting practitioners in designing business models (Lewandowski, 2016). Some of the more popular business models are aspects such as Product Service systems (PSS), take-back systems, and creating value from waste.

"A Product-Service System (PSS) is an integrated bundle of products and services which aims at creating customer utility and generating value" (Tukker, 2015, p87). In terms of (PSS), the value proposition is focused on the delivery of the service rather than ownership of a product. The responsibility for service and maintenance is that of the manufacturer or retailer (Bocken, et al, 2016). Therefore, firms will have the incentive to prolong the service life of products to optimise revenue incomes by being paid for the service offered. There is also an incentive to maximise the use of the material products and consumables that play a role in providing the service, to make them cost-effective and extend the life of material throughout and at the end of the product's life (Tukker, 2015). Essentially, Beuren, et al, (2013) suggest the ultimate PSS objective is to increase an organisation's competitiveness, and profitability and reduce the consumption of products, whilst seeking a balance between environmental, economic, and social concerns.

A take-back system is where material loops underpin the idea of CE. With a "take back" system, there is an assumption that products and their components can be reused/redistributed, remanufactured/refurbished, or recycled which requires reverse logistics for collecting back products and components from the consumer. This principle of CE applied to reverse logistics is related to take-back management.

However, reversed logistics may require different partners, channels, and customer relations to operationalise (Lewandowski, 2016).

Creating value from waste is the concept of waste being eliminated by turning waste streams into a useful and valuable input to other production or products and making better use of under-utilised capacity Bocken *et al.*, (2014), and suggests this approach has similarities with the natural world. In the natural world, the concept of waste does not exist because all 'waste' products become food stock for another system as taken from the world or biomimicry.

Ellen MacArthur Foundation, (2013) goes on to suggest CE is based on a few simple principles, of which the first, at its core, is to 'design out' waste and that products should be designed and optimised for a cycle of disassembly and reuse. CE changes the role of design in all industries to consider society and the environment and designers should not only create objects and components but be solution providers to enhance circular thinking (De Los Rios and Charnley, 2017). However, having access to "how to" frameworks and "innovative business models" does not appear to be enough to enable a smooth transition to CE from a linear mindset.

Enablers to improve cross-sector performance require changes at a systems level including higher transparency, alignment of incentives, and the establishment of regulation and industry standards for better collaboration. Access to financing and risk management tools and education are required to create the skill base to drive circular innovation (Ellen MacArthur Foundation, 2013).

Another challenge is the lack of empirical data as well as a methodology to develop suitable requirements for developing consumer-oriented PSS. Certain customers and consumers accustomed to possessing goods may refuse to accept the consumption of products without ownership. Knowing what to charge and competing with old linear business models may present uncertainty for providers wanting to be competitive and supply innovative products (Beuren, et al, 2013). Sustainability pressures emphasise the importance of collaboration between organisations and that value is no longer created by Companies acting alone but by firms acting together with external stakeholders using informal or formal alliances (Bocken *et al.*, 2014).

Whilst design targets are changing due to the necessity to innovate for CE, there are design skills required to achieve resource optimisation ranging from deeper knowledge of material science, engineering techniques, and operational processes, to proficiencies in service design and deep knowledge of human behaviour. The need for a change in legislation to reflect this shift has also been outlined (De los Rios and Charnley, 2017).

Whilst there are many challenges to the implementation of CE, one of the greatest challenges is how organisations can effectively come together to tackle sustainability issues. Collaboration creates benefits from differences in perspectives, knowledge, and approaches to solving shared problems. Collaboration requires an exchange of information and coordination of activities across interdependent organisational units, which may lead to a sense of vulnerability and the safeguarding of important and unique resources Information. Whilst the benefits of collaboration include the ability to optimise both financial and human capital, better access to markets, and enriched creativity, there are disadvantages. Collaboration may lead to less efficient decision-making, additional coordination costs, and trade-offs as to who gets the benefits and how to split the gains (Witjes and Lozano, 2016). However, the transition from the current linear model to that of a CE approach will not be easy, predominantly due to certain stakeholders having vested interests much to lose and will go to extreme lengths to explain why such a transition is not feasible (Schulte, 2013). This predominant mindset from stakeholders at all levels will create resistance. The sense of loss experienced by any stakeholder is a contributing factor to bolstering resistance to change.

Industrial ecology and industrial symbiosis are often used interchangeably with CE (Gregson *et al.*, 2015). “The ability to understand how parts influence one another within a whole, and the relationship of the whole to the parts, is crucial” (Ellen MacArthur Foundation, 2013, p23). As a result of CE frameworks and new business models to enable a CE, the concept of industrial symbiosis (IS) has emerged which is based on the physical exchanges of waste and materials, as inputs or raw materials for another organisation or industry (Efrain, A., et al, 2022). Agudo *et al.*, (2022)

define industrial symbiosis through the analysis of IS definitions and incorporate the enablers factors as follows.

> Industrial Symbiosis is an economic exchange of water, energy, material, and waste, in a complex and collaborative network, with the use of physical infrastructure among independent and co-located companies, whose exchange process is enabled by: i) the level of trust in establishing partnerships with new and previous members of the network, ii) the capacity to access and share information, and iii) the existence of incentives, in the form of financing and subsidies, and regulatory requirements, towards a circular economy and sustainable development
>
> (Agudo *et al.*, 2022, p918).

Industrial activity can no longer be viewed in isolation, but instead as a larger system of interconnected industries or processes with the essential core of industrial symbiosis as the cooperative sharing of resources such as energy, material by-products, wastes, and water (Wadström, et al, 2021). Witjes and Lozano, (2016) suggest collaboration between procurers and suppliers will promote the development of more business models which can reduce raw material usage and waste generation.

There is an inherent assumption that industrial synergies result in advantageous and positive outcomes for all parties. However, this is extremely unlikely as developing industrial symbiosis involves managing conflicting interests and compromises leading to both positive and negative outcomes. It is most probable, when it comes to cost/benefits that different industrial symbiosis relationships will have different sets of winners and losers (Wadström, et al, 2021). Factors such as cost, benefits, trust, information sharing, potential conflict and risks associated with outcomes are particularly challenging and present barriers in terms of change. It is how individuals perceive these aspects that determine their level of readiness or indeed resistance. “People resist change when they do not understand its implications and perceive that it might cost them much more than they will gain” (Kotter J. and Schlesinger L. A., 1979 p 4). Poor communication between stakeholders may lead to divergent levels of trust between partners. Trust must be upheld through basic principles among actors, such as values, objectives, and implicit governance, to help establish trust (Efrain A. et al., 2022).

2.6 Systematic Literature Review

Having completed the general overview of CE there was a better understanding of the wider context and broader concepts and principles of CE and its relationship with other similar concepts and terminology. However, a further Systematic Literature Review (SLR) was conducted to explore the relationship between manufacturing SMEs and CE. The decision to carry out this additional (SLR) is to ascertain a complete understanding of the research that had been conducted around CE and readiness for change for manufacturing SMEs. The intention here was to identify the gap in the knowledge, by developing a full understanding of what specifically is missing from the research base. This SLR is based on a systematic research method that endeavours to capture all material concerned with the research area. It will consider a variety of search strings and combinations to investigate the territory systematically and rigorously. "Systematic reviews differ from traditional narrative reviews by adopting a replicable, scientific, and transparent process, in other words, a detailed technology that aims to minimise bias through exhaustive literature searches of published and unpublished studies and by providing an audit trail of the reviewer's decisions, procedures and conclusions (Tranfield, Denyer and Smart, 2003). Grant and Booth, (2009) argue that gathering research, removing sub-standard contributions and summarising the best of what remains captures the essence of the science of systematic review. This systematic review intends to minimise bias and capture different areas of research associated with the context of the aim of this research. This will enable the author to identify a gap in the research knowledge and develop a research strategy to add new knowledge to this area of study. A systematic search starts with the identification of keywords and search strings, which are developed from scoping the study, the literature, and discussions within the review team. The reviewer or author should then decide on the search strings that are most appropriate for the study. The search strategy should be conveyed in sufficient detail to ensure that the search can be replicated (Tranfield et al, 2003).

Although often taking considerable time, and almost always requiring perseverance and attention to detail, a systematic review has been deemed to provide the most efficient and highly effective method for identifying and evaluating extensive literature

(Mulrow, 1994; Tranfield, et al, 2003). The steps that will be taken are based on a Systematic Literature Review (SLR) technique as follows as stated by (Xavier, et al, 2017):

1. formulation of the research question.
2 locations of studies.
3 selection and evaluation of studies.
4 analysis and synthesis and
5 Reporting and use of research results

The steps that were taken for inclusion and exclusion for this SLR were as follows:

Search String Themes	Keywords, synonyms and alternatives
Circular Economy	None chosen
Frameworks	Frameworks or Models
Small to Medium Enterprise	SME OR manufacturing OR production

Table 2. 2 shows the key word and search strings for the Systematic Literature Review.

Criterion	Included
Scope for the search	Elsevier (sciencedirect.com), EBSCO (Business Source Premier), Emerald (emeraldinsight.com), Taylor & Francis Online (t&fonline.com), IEEE Xplore (ieeexplore.com), Google Scholar
Source	Peer-reviewed journal articles
Search parameters	Keywords from the search string appearing in the title
Language	English
Period	All years to 2017
Relevance	Literature focusing on frameworks to enable a circular economy in SMEs

Table 2. 3 shows the scope of the literature review detailing inclusive criteria.

The inclusion and exclusion criteria were applied to each paper, to determine whether they were relevant to the review (Briner and Denyer, 2012). The author used only the material that includes all of the search criteria in the main body of the text, as the first filter. Any article that appeared to be a hit with just one criterion matched was dismissed from the study. The remaining article abstracts were reviewed for context and a further filter was applied.

This systematic literature review (SLR) addressed the question, “What impact will the CE have on SMEs’?” The thematic analysis produced from this study identified nine themes. The main themes from this research were business models and frameworks, followed by performance measures.

	Author	Title	Database	Journal
1	(Ghisellini, Cialani and Ulgiati, 2016)	A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems	Google Scholar	Journal of Cleaner Production
2	(Bocken, Bakker and Pauw, 2016)	Product design and business model strategies for a circular economy	T & F	Journal of Industrial and Production Engineering
3	(Niero and Hauschild, 2017)	Closing the Loop for Packaging: Finding a Framework to Operationalize Circular Economy Strategies	Elsevier	Journal of Industrial and Production Engineering
4	(Rizos *et al.*, 2016)	Implementation of Circular Economy Business Models by Small and Medium-Sized Enterprises (SMEs): Barriers and Enablers	Google Scholar	CEPS
5	(Kirchherr, Reike and Hekkert, 2017)	Conceptualizing the circular economy: An analysis of 114 definitions	Elsevier	Resources, Conservation, and Recycling
6	(De los Rios and Charnley, 2017)	Skills and capabilities for a sustainable and circular economy: The changing role of design	Elsevier	Journal of Cleaner Production
7	(Ruggieri *et al.*, 2016)	A Meta-Model of Inter-Organisational Cooperation for the Transition to a Circular Economy	Google Scholar	Sustainability Switzerland
8	(Huysman *et al.*, 2017)	Performance Indicators for a circular economy: A case study on post-industrial plastic waste	Elsevier	Resources, Conservation, and Recycling
9	(Elia, Gnoni and Tornese, 2016)	Measuring circular economy strategies through index methods: A critical analysis	Elsevier	Journal of Cleaner Production

10	Geissdoerfer, M. *et al.* (2017)	The Circular Economy – A New Sustainability Paradigm	Elsevier	Journal of Cleaner Production
11	(Hobson and Lynch, 2016)	Diversifying and de-growing the circular economy: Radical social transformation in a resource-scarce world	Elsevier	Futures
12	Lewandowski, M. (2016)	Designing the business models for circular economy towards the conceptual framework	Google Scholar	Sustainability Switzerland
13	(George *et al.*, 2015)	A circular economy model of economic growth	Elsevier	Environmental modelling software
14	(Franklin-Johnson, Figge, and Canning, 2016)	Resource duration as a managerial indicator for Circular Economy performance	Elsevier	Journal of Cleaner Production
15	(Niero and Olsen, 2015)	Circular economy: To be or not to be in a closed product loop? A Life Cycle Assessment of aluminium cans with the inclusion of alloying elements	Elsevier	Resources, Conservation, and Recycling
16	(Sauvé, Bernard, and Sloan, 2016a)	Environmental sciences, sustainable development, and circular economy: Alternative concepts for trans-disciplinary research Sébastien	Elsevier	Environmental Development
17	(Lieder and Rashid, 2016)	Towards circular economy implementation: a comprehensive review in the context of manufacturing industry	Elsevier	Journal of Cleaner Production
18	(Jawahir and Bradley, 2016)	Technological Elements of Circular Economy and the Principles of 6R-Based Closed-loop Material Flow in Sustainable Manufacturing	Elsevier	Procedia CIRP
19	(Witjes and Lozano, 2016)	Towards a more Circular Economy: Proposing a framework linking sustainable public procurement and sustainable business models	Elsevier	Resources, Conservation, and Recycling
20	(Leino, Pekkarinen and Soukka, 2016)	The role of laser additive manufacture method of metals in repair, refurbishment, and re-manufacturing – enabling circular economy	Elsevier	Physics Procedia
21	(Korse *et al.*, 2016)	Embedding the circular economy in investment decision-making for capital assets – a business case framework.	Elsevier	23rd CIRP Conference on Life Cycle Engineering

Table 2. 4 shows all-inclusive articles from the systematic literature review

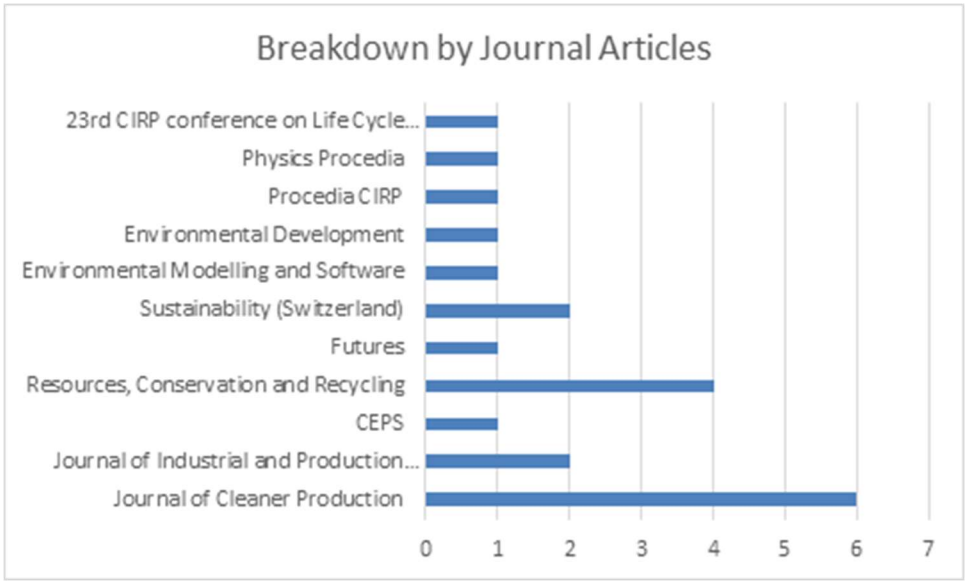


Figure 2.6 shows the spread of contributions by journals.

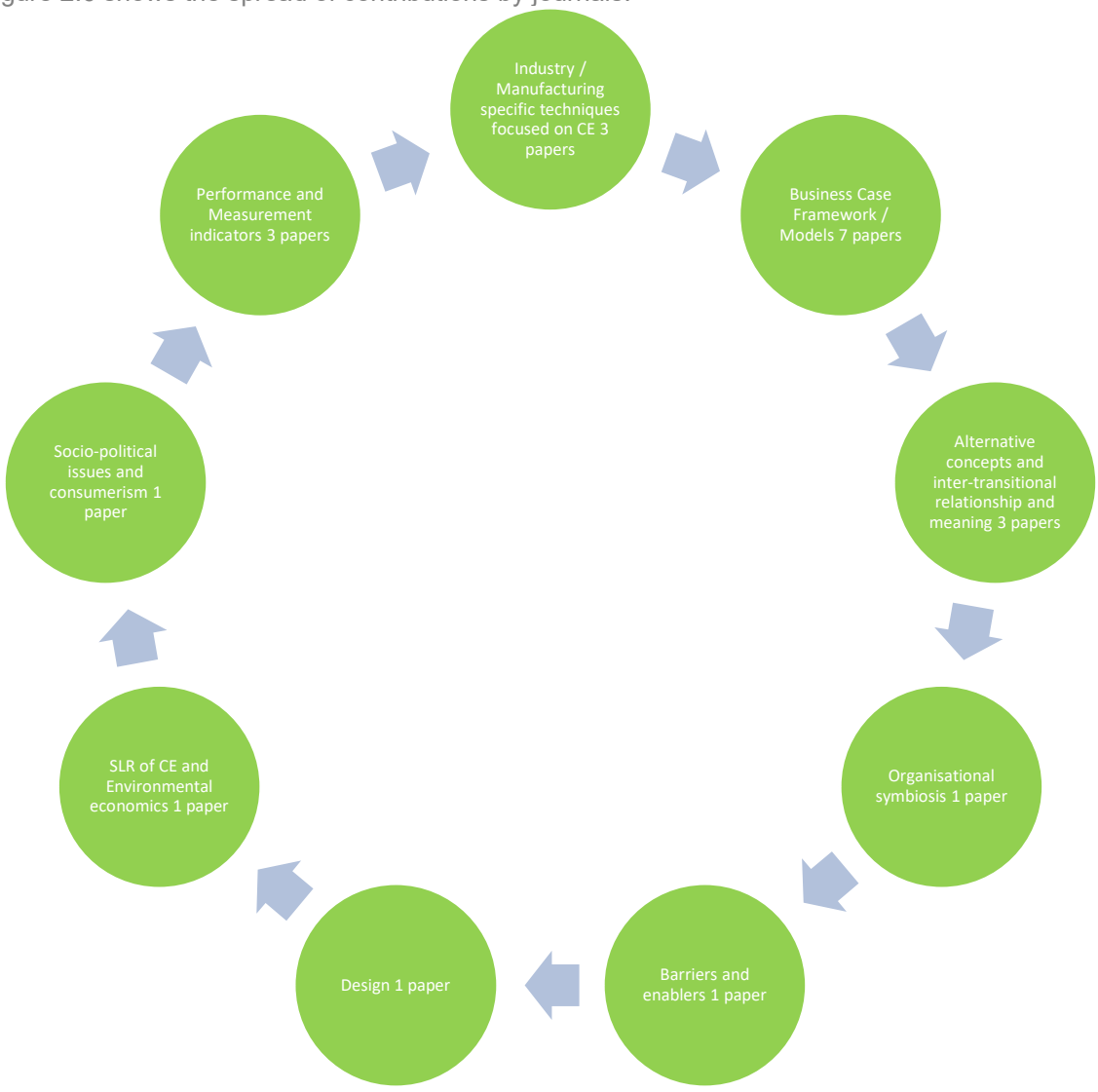


Figure 2. 6 shows a thematic analysis from the first SLR

This systematic literature review was developed into a conference paper for the Wessex Institute Waste Management 2018, 9th International Conference. This research paper was well received and subsequently published in Wessex Institute of Technology WIT Transactions on Ecology and the Environment, Vol 231, 2018 Wit Press. This systematic literature review was instrumental in the formulation of the research question. The research and thinking were further developed from this initial (SLR) and led to a further research question, “are there any frameworks or models for measuring the circularity readiness of UK Manufacturing SMEs?” This information enabled a second SLR to be carried out to help identify the research gap.

2.6.1 Systematic Literature Review (2) Circular Economy Readiness

A second (SLR) was carried out based on a systematic research method that endeavours to capture all material concerned with the research area. It considered a variety of search strings and combinations to investigate the territory systematically and rigorously. “Systematic reviews differ from traditional narrative reviews by adopting a replicable, scientific, and transparent process, in other words, a detailed technology that aims to minimize bias through exhaustive literature searches of published and unpublished studies and by providing an audit trail of the reviewer’s decisions, procedures and conclusions by Cook.” (Tranfield, et al, 2003 p209).

“Although sometimes taking considerable time, and almost always requiring perseverance and attention to detail, a systematic review has been argued to provide the most efficient and high-quality method for identifying and evaluating extensive literature” Mulrow (quoted in Tranfield, Denyer and Smart, 2003 p215). This second SLR takes the same form as the first SLR based on a Systematic Literature Review (SLR) technique as follows as stated by quoted in (Xavier *et al.*, 2017):

1. formulation of the research question.
2. location of studies.
3. selection and evaluation of studies.
4. analysis and synthesis and
5. reporting and use of research results

2.6.2 Formulation of the research question

It is evident in the research question that three key terms require investigation; Circular Economy; SME and Readiness. Whilst this research may refer to an SME outside of the UK, it is the general intention to apply any learning and new knowledge to SMEs inside the UK. For the sake of this research, the terms sustain* will not become part of the string search terms. Although there is much overlap with these terms, there is also a fundamental difference. Sauvé, et al, (2016) argue that the term sustainable development is fundamentally grounded in the three R's reduce, reuse, recycle, and is firmly embedded in a linear economy. As the CE suggests, its ideology is based on the maximisation of materials and not the linear practice of using virgin raw materials.

2.6.3 Location of studies

A decision was taken to use the technique of (SLR) to ensure as much data as possible is captured and ensure that this research is both thorough and replicable. "A systematic search begins with the identification of keywords and search terms, which are built from the scoping study, the literature, and discussions within the review team.

Search string themes	Keywords synonyms and alternatives
Circular economy	Cradle to Cradle, Eco-design, Closed Loop
Readiness	Preparedness
	Small to Medium Enterprise

Table 2. 5 Keywords and search strings for the Systematic Literature Review

2.6.4 Selection and evaluation of studies

Next, the inclusion and exclusion criteria need to be applied to each paper and study

found to determine whether the paper is relevant to the review (Briner and Denyer, 2012). Only the material that includes all the search criteria in the abstract will be used. Any article that appears as a hit with just one criterion matched will be dismissed from the study. With the articles that remain, their abstracts will be reviewed for context and a further filter will take place.

Criterion	Included
Scope for the search	Elsevier (sciencedirect.com), Scopus, Emerald (emeraldinsight.com). IEEEexplore (ieeexplore.com) Google Scholar
Source	Peer-reviewed journal articles
Searching parameters	Keywords appearing in the title and abstract.
Language	English
Period	2006 to 2018
Relevance	Literature focused on readiness for enabling Circular Economy in SME's

Table 2. 6 The scope of the literature review detailing inclusive criteria

2.6.5 Analysis and synthesis reporting and use of research results

This analysis intends to identify how the research areas can be categorised and the terminology used within these research areas. It will identify the trend in publications in this research area to the present year. It will use thematic synthesis, which is essentially a method to display what the research areas show from this qualitative study of literature.

The intention and purpose of a (SLR) is not to present advice but to provide researchers with a sound understanding of the knowledge of the research area and gaps within. In terms of CE and readiness of an SME to make this transition, there is little research found that supports this endeavour. From the (SLR) that was conducted, 16 articles had some significance for SMEs, readiness, and the circular

economy. Table 2.5 lists all 16 articles by author, title, database, and journal.

	Author	*Title*	*Database*	*Journal*
1	*Yongtao, W. (2015)*	*SMEs in the Circular Economy Development Strategy*	*Google Scholar*	*Management of Science and Engineering*
2	*Prendeville, S., O'Connor, F. and Palmer, L. (2011)*	*Barriers and benefits to ecodesign: A case study of tool use in an SME',*	*IEEE*	*Proceedings of the 2011 IEEE, ISST*
3	*Gusmerotti, N.M. et al. (2019)*	*Drivers and approaches to the circular economy in manufacturing firms*	*Elsevier*	*Journal of Cleaner Production*
4	*(Talbot, 2007)*	*Closed-loop supply chain activities and derived benefits in manufacturing SMEs*	*Emerald Insight*	*Ship Technology Research*
5	*(Bassi and Dias, 2019)*	*The use of circular economy practices in SMEs across the EU*	*Elsevier*	*Resources, conservation, and Recycling*
6	*Ormazabal, M. et al. (2018)*	*Circular Economy in Spanish SMEs: Challenges and Opportunities*	*Google Scholar*	*Journal of Cleaner Production*
7	*(Short et al., 2012)*	*Manufacturing, sustainability, ecodesign, and risk: lessons learned from a study of Swedish and English companies*	*Scopus*	*Journal of Cleaner Production*
8	*Van Hemel, C. and Cramer, J. (2002)*	*Barriers and stimuli for ecodesign in SMEs*	*Google Scholar*	*Journal of Cleaner Production*
9	*(Le Pochat, Bertoluci and Froelich, 2007)*	*Integrating ecodesign by conducting changes in SMEs*	*Google Scholar*	*Journal of Cleaner Production*
10	*Lopes de Sousa Jabbour, A.B. (2018)*	*Going in circles: new business models for efficiency and value*	*Google Scholar*	*Journal of Business Strategy*
11	*(Woolman and Veshagh, 2006)*	*Designing Support for Manufacturing SMEs Approaching Ecodesign and Cleaner Production - Learning from UK Survey Results*	*Google Scholar*	*13th CIRP Conference on Life Cycle Engineering Leuven*
12	*Rizos, V. et al. (2015)*	*The Circular Economy: Barriers and Opportunities for SMEs*	*Google Scholar*	*CEPS*
13	*de Jesus, A. and Mendonça, S. (2018)*	*Lost in Transition? Drivers and Barriers in the Eco-innovation Road to the Circular Economy*	*Google Scholar*	*Ecological Economics*
14	*Rizos, V. et al. (2016)*	*Implementation of circular economy business models by small and*	*Google Scholar*	Sustainability Switzerland

		medium-sized enterprises (SMEs): Barriers and enablers		
15	*William McDonough, Michael Braungart, Paul T. Anastas, J.B.Z. (2003)*	*Applying the principles of engineering green to Cradle-to-Cradle*	*IEEE*	*Environmental Science and Technology,*
16	*Singh, M.P., Chakraborty, A. and Roy, M. (2018)*	*Developing an extended theory of planned behaviour model to explore circular economy readiness in manufacturing MSMEs, India*	*Elsevier*	*Resources, conservation, and Recycling*

Table 2. 7 shows all-inclusive articles from the systematic literature review

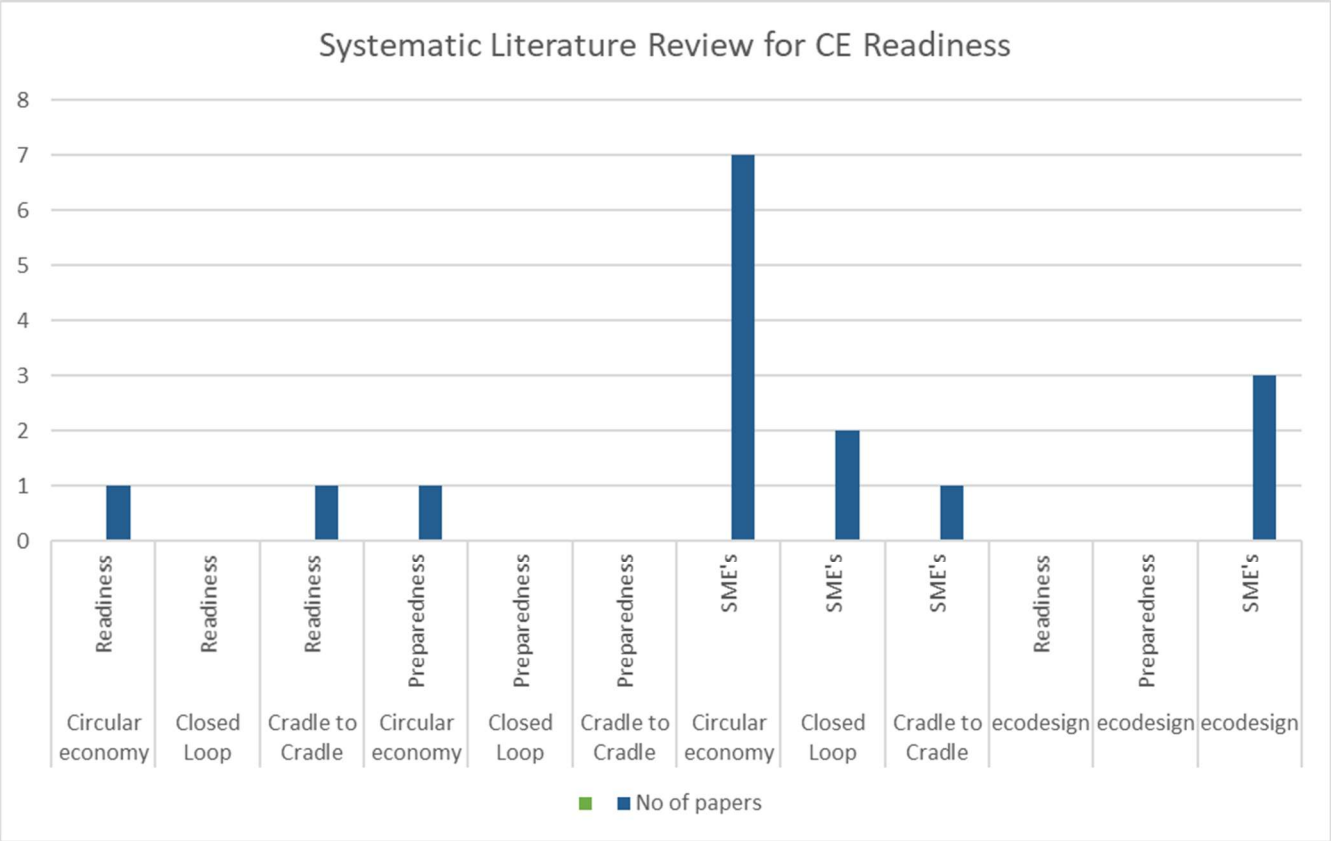


Figure 2. 7 shows the number of articles relevant to the different search criteria

From the (SLR), there were just 16 relevant papers to be discussed and summarised using the thematic analysis below. Figure 2.8 above illustrates the proportion of articles by the research criteria. Figure 2.9 below illustrates the analysis by theme from the researched articles.

2.6.6 Findings and Discussions

Thematic analysis produced 5 key themes; Closed Loop Supply Chains, Factors contributing to the adoption of CE, Barriers and stimuli for Eco-Design, Barriers and Challenges for CE, and CE readiness in SMEs as illustrated below in Figure 2.9.

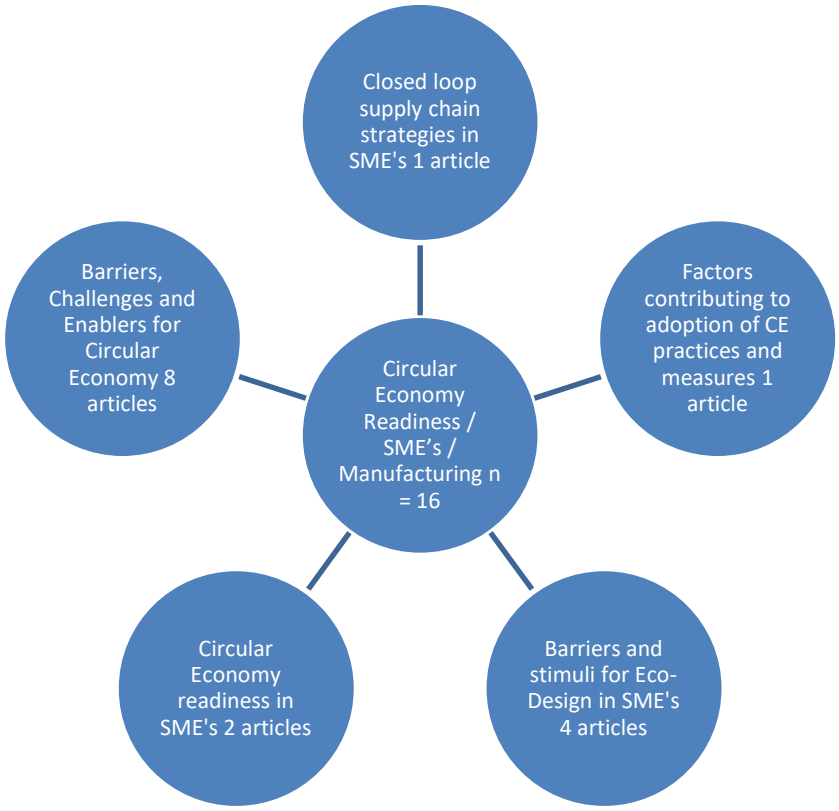


Figure 2.8 shows a thematic analysis from the systematic Literature Review

It is evident from the thematic analysis that 75% of the articles from the sample discuss barriers and challenges whilst only 2 papers from the 16 (12.5%) discuss SME readiness for a CE. However, one of the articles discussing readiness makes a direct link to barriers, which increases the relevance of the barriers and challenges. For this reason, more emphasis and rigour are aimed at summarising the findings from the eight articles on barriers and challenges, the four articles on barriers to Eco-Design, and the two about SME readiness. The link between Eco-Design and Circular Economy was made earlier in the research. From these summaries, it can be argued that whilst there are many barriers and challenges for SMEs to make a transition to CE, there is little in terms of readiness models. Lopes de Sousa Jabbour, (2018, p. 01) "presents an analytical framework to understand how organisations can enhance their readiness for the circular economy". They discuss different concepts of adopting

circular practices such as new business models, improving the circularity of materials, and closing, slowing, and narrowing loops. They discuss successful cases in circular adoption such as Dell and Phillips but little mention of SMEs. Three levels of analysis are discussed, the market environment, likely organisational changes, and means for starting the journey, which are largely macro aspects reviewing previously designed tools such as RESOLVE by the Ellen MacArthur Foundation and taking advantage of regulatory and fiscal frameworks and business support schemes. This paper presents a collection of options to start the journey and select strategies as they emerge. There is no reference to the context of SMEs' and there is no readiness model or framework. The work tends to suggest adopting a range of tools and techniques that are already published pieces. Singh, Chakraborty, and Roy, (2018) alternatively offer an extended theory of planned behaviour specific to small and medium enterprises around readiness toward a CE. They argue environmental commitment and green economic incentives better explain CE readiness. They were specifically conducting a survey using attitude, social pressure, and perceived behavioural control as well as an organisation's environmental commitment and response to green incentives. The respondents varied from Business owners, Directors, Managers, and senior-level employees and supervisors. Whilst this information is significant in terms of identifying positive influence for leadership towards a CE, it does not consider other elements of the organisation such as culture, skills, and knowledge and does not address the barriers to a CE as identified in the literature. It is these micro-behavioural aspects of individuals within SMEs that will be explored in terms of how they relate to any Readiness model and how they contribute to a successful transition to CE. Therefore, there is an opportunity to complete the knowledge gap by combining other readiness models with aspects associated with the extended theory of planned behaviour to include the entire organisation as well as all the barriers identified in the research. The barriers to CE and specifically to SMEs' transition to CE are reviewed, discussed, and summarised below.

2.6.7 Barriers challenges and enablers for a circular economy

Ellen MacArthur, (2015) identifies four categories and fifteen key barriers to adopting CE. They also offer six policy interventions at the highest level that they suggest would make an impact on removing or resolving the barriers. Understandably, these barriers

or variations on them are supported through research at all levels of CE implementation.

Economics	Not profitable
	Capital
	Technology
Market Failures	Externalities
	Insufficient goods / Infrastructure
	Insufficient competition/markets
	Imperfect information
	Split incentives (agency problem)
	Transaction costs
Regulatory Failures	Inadequately defined legal frameworks
	Poorly defined targets and objectives
	Implementation and enforcement failures
	Unintended consequences
Social Factors	Capabilities and skills
	Custom and habit

Table 2. 8 The barrier to CE implementation, source (Ellen MacArthur, 2015).

When discussing barriers to CE, de Jesus and Mendonça, (2018a) discuss eco-innovation with ecological and social concerns and cite hard and soft drivers and barriers to either facilitate or constrain the transition to CE. They suggest technical and economic factors are impacted by hard drivers and barriers and that institutional and social factors are impacted by soft drivers and soft barriers. Typically, hard barriers are inappropriate technology, lag between design and diffusion, lack of technical support and training, large capital requirements, significant transaction costs, high initial costs, asymmetric information, uncertain return, and profit. However, soft barriers are misaligned incentives, lack of a conducive legal system, deficient institutional framework, and rigidity of consumer behaviour and business routines.

Govindan and Hasanagic, (2018) identified 39 barriers to CE, in their perspectives framework which encompasses 5 perspectives, Government, Societal, Consumers, Organisational and Suppliers. Within this framework are drivers and practices and 39 barriers to an enterprise adopting CE in the supply chain. Their model demonstrates interrelationships between the perspectives, barriers, practices, and drivers for CE. They further select each of the barriers which are then classified into eight clusters as follows:

• Governmental issues: this cluster refers to the lack of standard systems for performance assessment, recycling policies that are ineffective in obtaining high quality, new laws that are passed with insufficient coordination, and existing laws that do not support the circular economy.

• Economic issues: this cluster includes financial and economic barriers related to the implementation of the circular economy in a supply chain.

• Technological issues: this cluster refers to the barriers regarding technological limitations, managing uncertainty at the end-of-life phase for products, managing product quality through the lifecycle of a product, design challenges to create or maintain durability, etc.

• Knowledge and skill issues: this cluster includes the lack of reliable information, lack of public awareness, lack of skills, and the lack of consumer awareness of the value of refurbished products.

• Management issues: this cluster refers to the lack of support from top management; other issues have a higher priority in enterprises and within the organisational structure.

• CE framework issues: this cluster includes the CE framework issues; other solutions might be more favourable than the CE framework.

• Culture and social issues: this cluster refers to the lack of enthusiasm towards enacting the circular economy, consumer perception towards reused products, and the thrill of purchasing a new product.

• Market issues: this cluster includes considerations such as externalities that prevent companies from taking advantage of refurbished products, regulations around ownership, and no industry standards on refurbishment products (Govindan and Hasanagic, 2018).

Ghenţa and Matei, (2018) carried out research into Romanian SMEs reviewed activities associated with the CE, and identified five main barriers to the development of circular activities:

1. Lack of human resources
2. Lack of expertise to implement these activities.
3. Complex administrative or legal procedures
4. Cost of meeting regulations or standards
5. Difficulties in accessing finance

According to Rizos *et al.*, (2016, p. 02) “Research on SMEs has shown that they are becoming increasingly aware of the benefits of improving resource efficiency even though, they do not often link them well to the concept of a circular economy.” This SLR indicates there is significant research into the challenges, barriers, and enablers for SMEs to adopt circular practice/activity (Rizos *et al.*, 2016; de Jesus and Mendonça, 2018; Rizos *et al.*, 2015; Hemel Van and Cramer, 2002; Ormazabal *et al.*, 2018; Prendeville, et al, 2011).

Rizos *et al.*, (2016, p. 01) aim to “increase knowledge and understanding about the barriers and enablers experienced by SMEs when implementing circular economy business models”. A sample of SME case studies from the GreenEcoNet web platform financed by the European Commission and developed by six European research organisations with the objective of showcasing examples of SMEs that have successfully made a change towards a green business model. The barriers from this body of work were categorised into clusters and are listed in order of magnitude for the percentage of SMEs mentioning the barrier:

Lack of support supply and demand network

Lack of capital

Lack of government support

Administrative burden

Lack of technical know-how

Lack of information

Other barriers

Company environmental culture

They conclude that “it may open the way to a better academic understanding of the mechanisms underlying barriers and the resistance to the uptake and propagation of the circular economy, and of better ways to address and lower these barriers.” So, whilst this work uncovers barriers to circular activity, it does not address why an SME might resist the change to adopt such practices. Nor does it address what this adoption of circular activity means to an SME. For instance, if “administrative burden” is the barrier, then what would an SME need to have in place to overcome such a barrier?

Ormazabal *et al.*, (2018) use empirical research to advance knowledge of CE implementation within Spanish SMEs and the subsequent barriers. The methods used vary across the research cluster. This paper concludes that SMEs are still focused on environmental management practices such reduction of materials and the reduction of energy usage (Ormazabal *et al.*, 2018a). Their results found SMEs are most concerned with law compliance and corporate image. They failed to see any link between environmental issues and profit or competitiveness. They argue another factor was two different categories of barriers. Hard barriers and Human-based barriers. Whilst this paper cites a lack of commitment on the part of organisations’ leaders, this is not synthesised in the summary. It could be argued that this oversight is hugely significant in that the leaders’ willingness and readiness are indeed a soft barrier and are fundamental to the readiness of any organisation to adopt a circular practice.

Van Hemel and Cramer, (2002) categorise their research with external stimuli, internal stimuli, and barriers. They go on to discuss the 10 ten most successful eco-design principles. “The research discussed here showed that internal stimuli seem to have a greater influence than external stimuli on eco-design decision-making in the companies investigated. This result does not correspond with prevailing research on environmental management in SMEs which decrees that external drivers are the most influential” (Van Hemel and Cramer, 2002, p. 452). The typology of definitions of

drivers and barriers to a CE de Jesus and Mendonça, (2018b) is split into “Harder” factors Technical Economic/Financial/ Market and “Softer” factors Institutional/ Regulatory Social/Cultural Drivers. Rather than barriers to CE, Gusmerotti *et al.*, (2019, p. 315) aim to explain “how CE principles are inspiring traditional and new business models and what the potential drivers are for the adoption of CE practices.”

Gusmerotti *et al.*, (2019) argue most firms (65.6%) still adopt a linear approach or just focus on providing information to end-users to maximize their satisfaction during the use phase, just 8% of firms seem to have approached CE holistically, by integrating CE principles in all business functions.

Gusmerotti *et al.*, (2019, p. 324) concede that “circularity should pervade the whole business and, therefore, encompass all business functions: from raw material purchasing to product design, operational activities, and market communication.”

This second SLR concludes there is significant research on the challenges and barriers to SMEs (Small to medium Enterprises) adopting a CE model, (Rizos *et al.*, 2016; de Jesus and Mendonça, 2018; Rizos *et al.*, 2015; Hemel Van and Cramer, 2002; Ormazabal *et al.*, 2018; Prendeville, O’Connor and Palmer, 2011). However, there are just two articles discussing SME readiness for adopting a CE. Lopes de Sousa Jabbour, (2018) discusses options for assisting managers in conducting a circular economy trial. Singh, Chakraborty, and Roy, (2018) developed the theory of planned behaviour to examine two additional factors, environmental commitment, and green economic incentives. They hypothesised that attitude, social pressure, and perceived behavioural control positively influence circular economy readiness based on previous work using the same concept and the willingness to act for waste management, recycling, and pollution prevention. This model considers the attitudes and beliefs of SME owners, Directors, Managers, and supervisors. However, Gusmerotti *et al.*, (2019) concede that “circularity should pervade the whole business and, therefore, encompass all business functions: from raw material purchasing to product design, operational activities and market communication.” From this research conducted, there is no comprehensive model of readiness for SMEs adopting a CE. This readiness model has therefore been identified as a gap in the knowledge, which this research develops a readiness model from the literature in other contexts.

2.7 Circular economy readiness in SMEs (Gap in the knowledge).

Lopes de Sousa Jabbour, (2018) presents two methods of circular economy implementation, adopting circular activity to optimise materials usage and developing new business models. As well as closing, slowing, and narrowing loops, they quote the resolve framework developed by the Ellen MacArthur Foundation. They assert that organisations should assess two aspects, willingness to adapt current business models or to adopt new ones. However, they accept the demand of a certain level of organisational change i.e., mindset, skills, corporate relationships, product design, or technologies. Arguably, this demand for organisational change dictates the readiness of an SME to engage in the circular activity. Lopes de Sousa Jabbour, (2018) proposes a level of analysis to assist managers in moving their organisations towards a CE approach, namely, the market environment, likely organisational changes, and tools and frameworks for assisting to start the journey. In terms of organisational changes, they favour technology interventions such as digital and virtual technologies, such as cyber-physical systems, the internet of things, cloud manufacturing and additive manufacturing. Lopes de Sousa Jabbour, (2018, p. 06) argues "Organisations need to reshape technical and managerial decision-making so that the journey towards the CE becomes inevitable." What an organisation measures and how it frames success is an important aspect of organisational change. The favoured strategy of technological interventions requires investment, knowledge, know-how, enthusiasm, and above all, human judgment, and financial justification, which re-introduces the barriers to a CE as outlined in this research.

Lopes de Sousa Jabbour, (2018) discusses options for assisting managers in conducting a CE trial. Better management of relationships between organisations, suppliers, and customers is paramount in the endeavour to develop circular practices, by sharing information and engagement across the supply chain. Whilst this paper generates some insights into factors for consideration in terms of SME readiness for the CE, it does not discuss in any detail the needs of the organisation from a human perspective. Further research around leadership, relationships, behaviour, competence, beliefs, processes, and knowledge in all functions of the organisation is absent from this study. It states there must be better relationships, but how do these

relationships need to change and develop to enhance circular behaviour? Finally, Lopes de Sousa Jabbour, (2018, p.7) concedes that “awareness of the market environment and likely organisational changes are the two levels of analysis which can help organisations understand how to enhance their readiness for the circular economy.” Furthermore, conducting a baseline assessment and understanding the market environment can underpin organisational preparation (Lopes de Sousa Jabbour, 2018). Whilst this paper offers some areas to consider for readiness, it does not offer any contribution to how an organisation may change its collective mindset, skills, and relationships. For example, it encourages the use of industry 4.0 digital technologies but does not state how an SME might make that transition.

Singh, Chakraborty, and Roy, (2018) make the connection between barriers to the CE such as ineffective enforcement of relevant regulations, institutional support, lack of economic incentives, poor technical skills, and low environmental awareness affecting the circular economy readiness in small firms. They assert that there are plentiful studies indicating both internal and external factors are responsible for a firm’s CE behaviour. Their paper uses the theory of planned behaviour to examine internal and external barriers. They relate the three areas of Ajzens’s theory of attitude, social pressure, and perceived behavioural control to environmental commitment and green economic incentives. Singh, Chakraborty, and Roy, (2018) developed the theory of planned behaviour to examine two additional factors, environmental commitment, and green economic incentives. They hypothesised that attitude, social pressure, and perceived behavioural control positively influence circular economy readiness based on previous work using the same concept and the willingness to act for waste management, recycling, and pollution prevention. Whilst this paper considers human factors, it does not address other factors associated with the broader concept of readiness, such as skills, relationships, product design, and additional barriers to circular economy as identified in this systematic literature review.

Conversely, Lopes de Sousa Jabbour, (2018) discusses three aspects of analysis for assisting managers in starting a journey towards a circular economy, such as the market environment, likely organisational changes, and tools, and frameworks. They continue to assert that the need to reshape technical and managerial decision-making is necessary to make the organisations’ transition to a CE inevitable. Whilst these are

extremely valuable contributions, they do not deliver a model of readiness that covers mindset, skill set, relationships, etc.

So to summarise, Singh, Chakraborty, and Roy, (2018) consider the intention of the manager/owner in terms of readiness and Lopes de Sousa Jabbour, (2018) considers more macro factors in terms of the environment, organisation, and tools. These papers are an important contribution to CE readiness but are limited to gauging awareness and intention on the first hand and higher order actions associated with understanding the environment, organisational change, and tools and frameworks on the second paper. They do not get into the details of what a competent circular workforce would look like! As Gusmerotti *et al.*, (2019, p. 323) stated, "The new challenge of the circular economy can also be addressed only by integrating its principles in all business functions: from logistics to procurement, from operations to marketing." In the same way that TQM must infiltrate the entire workforce, the same style of model is required for the CE. The gap in the research knowledge in terms of SME readiness is that there is no model for readiness to overcome all barriers to the implementation of circular practice.

The definition of CE for this thesis is one developed by Kirchherr, et al, (2017, p. 229) who analysed 114 circular economy definitions and now define it as "an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), Meso level (eco-industrial parks), and macro level (city, region, nation, and beyond), to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity, and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers."

The definition of readiness for the extent of this thesis means an organisation that is both willing and able to adopt the circular practice. This includes the intentions and attitudes of individuals but also ability, knowledge, know-how, and motivation, as well as a culture of continuous development. There is currently no readiness model that a manufacturing SME can use to identify their level of readiness to implement a CE. Based on the barriers and definition of CE, a readiness model must incorporate all

areas of the business and therefore all employees within the business. This body of work will create a conceptual model for identifying readiness in manufacturing SMEs for adopting and implementing a CE. It must address all barriers as determined from the literature and all functions of an SME. Therefore, the lack of a readiness model for manufacturing SMEs to make a transition to CE has been identified as a gap in the knowledge.

2.8 Conclusion

To conclude, this chapter starts by linking the concept of CE as an umbrella term for realising sustainability. The literature review (LR) around sustainability and CE compares other terminology to better understand similar concepts and other aspects associated with CE. It explores knowledge of CE through definitions and applications, but also reviews how CE is operationalised through novel business models and frameworks for a better understanding of its implementation. The first SLR provided some understanding of what CE meant for SMEs and what had been researched so far. Finally, there is an overview of the second (SLR) that identifies the relationship between the barriers and challenges for SMEs to make a transition to CE readiness. It also identifies a gap in the knowledge, that there is no measurement tool for SMEs to gauge their level of readiness to implement CE.

Chapter 3 Organisational Change Readiness

3.1 Introduction

While Sustainability has been at the forefront of academic discussion for decades and acted out in a linear economy of take-make-dispose and using reduce, reuse, recycle, it continues to fall short of meeting the sustainability challenges of the world (Jawahir and Bradley, 2016). Geissdoerfer *et al.*, (2017) found that CE is viewed as a condition for sustainability, a beneficial relation. Furthermore, CE should be perceived as a roadmap to achieve sustainability (Baratsas, et al, 2022). The CE has emerged as a fundamental tool in the transition to a more sustainable economic paradigm. It highlights what is to be rejected, the linear 'take-make-dispose' economy (de Jesus and Mendonça, 2018a). The linear economy model has dominated the industrial landscape for the past 150 years, based on products that are manufactured from raw materials, sold, and wasted after use (Ellen MacArthur, 2015; Govindan and Hasanagic, 2018; Jawahir and Bradley, 2016). However, according to de Jesus and Mendonça, (2018) CE and its methodologies are poorly understood. Therefore, making this transition "is not" business as usual. Making a transition from a linear economy to a circular will require individuals, organisations, and policymakers to think, behave, act, and engage differently. It is such micro-behaviours that will be considered as part of the solution for closing the gap. The author believes that this is the starting point for readiness to act and engage in different things in different ways. The gap in the knowledge was identified as there are no models of readiness for change for manufacturing SMEs adopting CE. This concept of readiness is borne out of such ideas for change and therefore explores the literature surrounding change readiness.

Whilst this thesis focuses on CE, it also naturally integrates, through the knowledge gap, the concept of change readiness and therefore requires an understanding of change readiness theory which originates in the theory of organisational change. To achieve this outcome, an additional literature review (LR) was conducted. This (LR) includes a brief overview of change methods and resistance to, and readiness for

change as they are two extremes of the same continuum. Change is viewed from the perspective of the individual as it is the individual that resists or becomes primed and ready for change. Finally, readiness for change models are explored and discussed as this relates directly to the notion of readiness for CE which is essentially a core part of the thesis. It interrogates the literature in terms of readiness for change models to distinguish and qualify pertinent factors for the development of the research in designing and building a readiness for change model. This chapter will attempt to answer the research questions postulated below.

Research Questions

- What drives the micro-behaviours necessary for overcoming barriers to CE transition?
- What change readiness theory applies to a transition to CE?
- To what extent do an individual's position in the organisation and their mindset influence CE readiness?

3.2 Organisational change

Organisations are increasingly having to adapt to changes in technology, new challenges, and emerging trends in how employees as well as stakeholders, supply chain (and customers) communicate and wish to do business (Shah, et al, 2017). According to Elving, (2005) many organisational change efforts fail, and more than half of change initiatives fail according to (Cartwright and Schoenberg, 2006; Vakola, 2013). Many books and journals and key respected authors on organisational change insist that up to 70% of all change initiatives fail (Balogun, J. and Hailey, V. H. 2004; Gondo, et al, 2013; Gigliotti *et al.*, 2019). This kind of statistics has incited researchers to investigate the causes underlying change failure (McKay, et al, 2013). However, Hughes and Hughes, (2017) argue there is no empirical evidence to support these claims. It can be said that change has uncertainty and multi-levels of success depending on the perspective and expectations of the individual reflecting on the outcomes. Moreover, it is abundantly clear that a company's ultimate success relies on the ability of organisations to successfully manage and implement change

programmes (Gigliotti et al., 2019). Of course, there is no one correct way to manage change as the success of any approach is largely context-dependent. What could work in one context, may not work in another (Michel, A., et al, 2013). Most change initiatives fail because many managers are not flexible in their approach to change (Kotter, J. P. and Schlesinger, L. A. 1979).

Harris, et al., (2002) state that implementing organisational change is an imperative task, but not fully understood by organisational leaders. They suggest that the negative responses to change are caused by a lack of a clear and consistent message from leaders. Alas, (2007) emphasises management learning through a change experience, that they intend not to underestimate the human side and the emotional side of change. Further, they deduced that communication must involve listening and two-sided conversations and discussions. This is supported by Galagan, (2010) who states that persuasive communication, and direct communication, e.g. speeches and memos are important messages from change agents. Alas, (2007) asserts that the true participation of employees was imperative rather than asking for opinions and forgetting about them. Moreover, a critical factor according to Galagan, (2010) is active participation; vicarious learning and participation in decision-making. Of course, this is not the entire picture as the personal traits of the manager or change agent are also paramount. The effectiveness of these approaches to change depends upon the expertise, trustworthiness, credibility, and sincerity of the change agent. Conversely, the lack of such attributes will have an unfavourable outcome regarding change (Armenakis, et al, 1993). The capability and social competence of a change manager or leader certainly have an impact on the change outcome. According to Grant, (2010), leaders and individual managers can move away from a command and control mentality by developing coaching skills that help foster a more positive humanistic and motivating communication style, thus resulting in positive change relationships. Additionally, coaching can be associated with developing employees' positive attitudes, performance, commitment and job satisfaction (Grant, 2010). Research suggests that commitment to change is the glue that brings people and change goals together, helping them understand the purpose of change and, as a consequence, increasing employee's efforts to change their work behaviours (Neves, 2009). The conviction that leaders within the organisation are confident they can manage a

changing organisation is a vital basis for growing employees' confidence and subsequent contribution toward a successful change program (Susanto, 2008).

In today's ever-changing world, organisational leaders must be attentive to the context in which their organisations are positioned, being particularly observant of changes in the general and task environments (Armenakis and Harris, 2009). Significant organisational change necessitates huge commitment in energy, time and resources, but Oakland's personal experience has demonstrated many change programmes fail to meet expectations (Oakland J. S. and Tanner S. J., 2007). Therefore, sustainable organisational change is a critical factor for the success and survival of any organisation. For sustainable change, the focus of the change is moving towards the motivation, ethics, values, identity and culture of that organisation (Michel, et al, 2013). It is motivation, ethics, values, identity, culture and more or the evaluation of these aspects towards an organisational change to CE that will be at the core of the research. These factors along with beliefs, norms and emotions are what drive the micro-behaviours that will either support or resist a change towards CE. Sustainability of change is when new ways of working become habitual because the thinking and attitudes behind them are fundamentally altered and the systems supporting them are transformed (Buchanan *et al*, 2005).

3.2.1 Sustainable change

Buchanan *et al.*, (2005) suggests it is imperative to have a sustainable strategic approach to change quoting evidence of change gains being eroded and lost over time. A key reason for "slipping back" can be that it is difficult for organisations to motivate their employees to support and work toward successfully implementing change (Neves, 2009). So, the successful implementation of change involves methods of engaging, motivating, and appealing to individual employees of that organisation. However, Individuals are complex in terms of change, adapting to or resisting change. Such complexities include the individual history, personality, organisational history, change consequences and the nature of the change all contribute to this complexity. According to Michel, et al, (2013) the size of the change is not necessarily relevant as small changes can be just as difficult as larger changes.

However, reducing ambiguity and uncertainty and increasing fairness positively impact employee engagement during change (Caldwell, 2013).

Galagan, (2010) makes explicit the correlation between change readiness and successful change management and emphasises the importance of continuous change readiness. They suggest a conscious approach to change management acknowledging continuous change readiness as a critical success factor. Graetz and Smith, (2010) concur suggesting most change initiatives are limited because they treat change as a single event that must be stabilised and controlled. They argue such perspectives fail to appreciate that change is a natural phenomenon; intimately entwined with continuity, and therefore must have a continuous approach. Resistance to change is considered the opposite of readiness for change and therefore requires exploration to understand what constitutes resistance and why it is potentially correlated with change failure.

3.3 Resistance to change

Change efforts often run into some aspect of employee resistance. Whilst experienced managers may be all too aware of this fact, surprisingly few take time before an organisational change to assess systematically who might resist the change initiative and for what reasons (Kotter, J. P. and Schlesinger, L. A.1979). According to McKay, et al, (2013) employee resistance has been identified as a significant contributor to organisational change failure. This employee resistance may be the result of management and leadership's failure to acknowledge or value employee input, change-related attitudes, participation and involvement in change planning, implementation and sustainability (McKay, et al, 2013; Armenakis, et al, 1993). This resistance can be manifested in many ways in which individuals and groups can respond to change. Therefore, correct assessments require careful thought. Coch L. and French, (1948) assert it is possible for management to modify greatly or to remove completely group resistance to changes using group meetings in which management effectively communicates the need for change and group participation in planning the change situation. Despite much literature on resistance to change, Piderit S.K., (2000) insists there is a failure to take the good intentions of the resistor seriously.

Researchers have largely perceived resistance to change as a restraining force for maintaining the status quo and practitioners also perceive resistance as a negative view. It could be argued the way researchers and practitioners view resistance is the issue and would be far better to perceive this resistance as reactive. There are many reasons for the motivation of resistance (Piderit S.K., 2000).

It can be argued that planned change is intended to make any organisation more effective or more competitive, yet resistance from members is expected. The fact that change often causes increased pressure, stress and uncertainty for individuals is the driving force for a negative response (Abdel-Ghany, 2014; Armenakis and Bedeian, 1999). Therefore, it is imperative that the perception of the employees about the change is managed and that they hold positive views (Abdel-Ghany, 2014; Armenakis and Bedeian, 1999; Jones, et al, 2005).

Moutousi and May, (2018) insist crucially, that members' and employees' support and engagement in the change process is a critical element for successful change in organisations. Oreg, (2003) agrees, however, that when organisations initiate a change, individuals and groups often resist that change as they disagree on some level. Elving, (2005) argues that when employees are ready to accept the change, a state of readiness, or at least resistance is reduced, the change effort will be more effective. However, Abdel-Ghany, (2014) states that employees rarely resist change without first considering the potentially negative consequences for themselves. What does this change mean for me is a question that is asked by individuals of change. The four most common reasons people resist change are a "desire not to lose something of value, a misunderstanding of the change and its implications, a belief that the change does not make sense for the organisation, and a low tolerance for change" (Kotter J. P. and Schlesinger L. A., 1979, p3). Successful organisational adaptation is increasingly reliant on generating employee support and enthusiasm for proposed changes, rather than merely overcoming resistance (Piderit S.K., 2000).

Elving, (2005) continues to state that when the resistance is low, the change effort will be higher. Arguably, this would apply to a greater state of organisational readiness. Resistance and readiness are linked at either end of a continuum. It could be argued that being resistant to change or ready for change are opposites. In other words, an

individual could be hugely resistant to a change or primed and motivated to accept change, or somewhere along the continuum (Seggewiss *et al.*, 2019; Armenakis, et al, 1993). Of course, attitudes toward change are temporary and may vary over time, across different stages of change implementation (McKay, et al, 2013). Not only are attitudes and responses to change temporary during the change process, but, Piderit S.K., (2000) asserts responses to a change initiative that are neither consistently negative nor positive, are potentially the most prevalent type of initial response.

If the change agents; involve, listen to, and allow participation in the change effort from the potential resisters, they can often reduce resistance (Kotter J. P. and Schlesinger L. A., 1979). However, "only recently have studies begun to explore concepts that are related to resistance to change from an individual difference perspective" (Oreg, 2003, p680).

Shah, et al, (2017) highlight how change is managed within organisations as a key factor influencing the level of employee engagement, who may develop positive or negative attitudes, beliefs and intentions towards the change agents as change is implemented. The individual employee contributes to every SME in terms of performance and response to change. This individual perception is paramount to successful change initiatives. Therefore, it is imperative to understand how individuals choose to change and what factors influence such change both positively and negatively.

3.4 Individual change

Many modern organisations value the employee who is both willing and able to champion change or even respond positively to change. However, organisations that attempt to drive such changes are often thwarted by individuals within the organisation who resist the changes (Oreg, 2003). It is critical to assess an individual's readiness perception before any change attempt, as it is these people within the context of this change that will either support or resist that change. It is only the people who are the real source of change (Abdel-Ghany, 2014; Susanto, 2008).

“In any organisational transformation, change recipients make sense of what they hear, see, and experience. Change recipients formulate pre-cursors (e.g., cognitions, emotions, and intentions), which become part of their decision processes that result in resistance or supportive behaviours” (Armenakis *et al.*, 2007, p 482). Support for an employee during times of change and more importantly, the degree to which the employee perceives their organisation to value their contribution, is a significant factor in employee well-being (Gigliotti *et al.*, 2019). However, Individual members of an organisation can simultaneously perceive both positive and negative attitudes towards change, within and between cognitive, emotional, and behavioural outlooks (Jansen, 2015). It is these attitudes that develop that apply to readiness theory. Gigliotti *et al.*, (2019) argue change recipients are vulnerable and that trust in the change agent or leader is paramount. Insomuch, that the recipient believes that this change is well intended and that the leaders have that employees’ interest at heart, correlates to that employees’ level of willingness. Often the reasons for individual resistance are based on perceived benefits to the organisation that are not necessarily compatible with the interests of the individuals being asked to make the change (Oreg, 2003).

According to Cunningham *et al.*, (2002) readiness for change commences with an individual's perception of the risks and benefits associated with that change. Cunningham *et al.*, (2002) discuss individual change and the movement through different stages being governed by a decisional balance between the anticipated risks and potential benefits of change. In their study, Cunningham *et al.*, (2002) promote active involvement in organisational change, reducing barriers to participation. They also refer to higher emotional exhaustion for workers in more demanding jobs as being a factor. “Although the type of change and the process of change are both important building blocks in any model for dealing with change, there is also a third crucial factor – a readiness to change in the organisation. The readiness factors act like a bridge between identifying what needs to happen and the activity of implementing the change” (Alas, 2007, p257). Alas, (2007) explores what theories are suitable for change in turbulent environments from those developed in more stable environments. The four main features of their model are connected types of research: process research, content research, contextual research, and readiness research expressed in their triangular model for organisational change.

However, Armenakis, et al, (1993) assert that readiness is distinguishable from resistance in terms of the leaders' approach. They argue that framing an approach towards readiness seems more congruent than an approach where one might monitor the workplace for signs of individual resistance. However, how readiness is defined is key to understanding any approach towards readiness. Therefore, it is vital to understand how readiness is defined, explore readiness for change literature and be explicit as to how readiness is defined in this thesis.

3.5 Definitions of change readiness

Armenakis, et al, (1993, pp 681 - 682) define readiness for change (RFC) as "the cognitive precursor to the behaviour of either resistance to, or support for, a change". "Both readiness to change and work engagement are important aspects of a successful organisation" (Matthysen and Harris, 2018, P 2). Armenakis, et al, (1993) state that readiness is a cognitive pre-cursor to resist or support a change effort and that the term readiness has often been explained in conjunction with reducing resistance. "In this sense, the concept of readiness for change consists of both resistance to change and support for change as a continuum with on one end resistance to change and on the other end readiness for change" (Elving, 2005 P 131). Extensive research conducted by Haffar *et al.*, (2017) states several definitions for employee readiness for change (ERFC) that include terms such as individual attitudes, beliefs about the organisation, and individual acceptance and participation. By contrast; Bouckenooghe, et al., (2009) state that readiness to change constitutes an emotional dimension, a cognitive dimension and an intentional dimension of change. According to Holt D. T. and Vardaman, (2013, P 9) "Readiness is defined as the degree to which those involved are individually and collectively primed, motivated and technically capable of executing the change." Armenakis, et al, (1993) argue at the core of a readiness model is changing the cognitions of a set of employees. However, they continue to qualify that readiness for organisational change is not only about individual cognitions but also a social phenomenon, which includes influence on the readiness of others or social norms. This notion of a social phenomenon is also evident in Ajzen's theory of planned behaviour, where behavioural intention includes an individual's beliefs about the normative expectations

of others and the level of motivation generated to comply with these expectations or normative beliefs (Ajzen, 2002). Bouckenooghe, et al, (2009) multifaceted view of readiness for change as a triadic attitude is better at capturing the complexity of the phenomenon. When there are high and significant levels of organisational change readiness, employees are more engaged in the change effort and prepared to expend more effort and persistence in the effect of change (Abdel-Ghany, 2014).

There is a body of work suggesting creating readiness for change involves the influence of the target audience in terms of beliefs, attitudes, intentions and ultimately behaviour. Readiness for change involves changing individual cognitions across the organisation. Furthermore, it involves a social phenomenon, meaning it includes the cognition of others, a culture, of how individuals influence each other. It also includes the efficacy of the change recipients, which is influenced by their thought patterns, actions, and emotional arousal. This thesis is intended to combine readiness models from other realms of change and adapt to the needs of a transition to a CE based on current perceived barriers. Therefore, readiness refers to all of these attributes such as cognition, emotion, attitude, intention, beliefs, values, and thinking styles of individuals and how they influence each other in the context of an organisation making a transition to CE.

3.5.1 Readiness for change

For more than 30 years, interest in change readiness has been rising among researchers and practitioners of organisational change (Caldwell, 2013). While change may often be instigated by external events, internal processes within the organisation will shape a successful response. A key challenge for these organisations; is to motivate their members to support and work toward the successful implementation of change. Whilst most change is often a result of external forces and pressures, internal change has to deal with these pressures to shape the organisation's response (Neves, 2009).

According to Holt & Vardaman, (2013) the transtheoretical model proposes that change occurs in five cognitive stages, namely, pre-contemplation, contemplation,

preparation, action and maintenance. Readiness for change compares to the preparation stage, in which individuals hold positive perspectives toward a change and signify an inclination to act in the immediate future. "When readiness for change exists, the organization is primed to embrace change and resistance is reduced" (Bouckenooghe, et al, 2009). Many commentators consider readiness for change a significant factor for successful change (Haffar, et al, 2013; Harris S. G. and Armenakis A.A., 2002; Elving, 2005).

According to Abdel-Ghany, (2014) agents of change can identify gaps that may exist between their expectations about the change outcome and those of other organisational members by assessing individual readiness for change. If significant gaps are perceived and no action is taken to close those gaps, resistance is likely and successful change compromised. Holt *et al.*, (2007) maintain the direction of change which the leaders desire must align with the beliefs and cognitions of the organisational employees they wish to follow and that any conflict must be addressed. The question remains, how do get "buy-in" or a commitment from individuals within the organisation? "Factors such as creating a vision and a sense of urgency, empowering broad-based action, communicating the change vision, and mobilising energy and commitment are all perceived as essential to change readiness" (Galagan, 2010, p4). Employee intentions to engage in change-related behaviours based on benefits, duty and cost-based perceptions are represented by a commitment to change (Bakari, et al, 2017). Commitment is considered a significant pillar in John Oakland's model of change readiness. Bakari, et al (2017) assert that authentic leadership fosters behaviours of compliance, cooperation, and championing by creating readiness for change through enhancing employee commitment to change. Moutousi and May, (2018) contend ethical leadership, can support the successful implementation of organizational change and unethical leadership may trigger resistance. According to Susanto, (2008) researchers' perception toward change readiness efforts includes a vision for change, mutual trust and respect, change initiatives, management support, acceptance, and how the organisation manage the change process.

McKay, et al, (2013) conclude that communications alone do not reduce resistance to change, moreover, if communication is to be effective it must convey the aims and outcomes and appropriateness of the change in a timely fashion. Furthermore, this

timely and positive communication may impact the take-up of employee participation. Through active, ongoing communication and meaningful involvement in the change process employees make connections between their work and see how the change may benefit them, which in turn increases their valence and the momentum for change (Susanto, 2008).

Affective commitment emerged as a significant predictor of resistance to change. Armenakis, et al, (1993) argue at the core of a readiness model is changing the cognitions of a set of employees. The way to change individual cognitions has many facets. To capture the key contributing factors surrounding individual readiness for change is a principal factor.

Literature on organisational change dates back many years and has covered a variety of subjects, including; influencing factors, motivation, strategic approaches, strategies models, and concepts. Armenakis and Bedeian, (1999) review organisational change published between 1990 and 1998. They divided this work into four main themes, content issues, contextual issues, process issues and criterion issues. Content issues review factors that comprise both successful and unsuccessful change efforts. Contextual issues focus on the forces operating in the external and internal environment of an organisation. Process issues deal exclusively with the implementation of change and subsequent actions as well as employee responses to these approaches. Lastly, Criterion issues assess the outcomes of organisational change such as behavioural criteria.

Content change: According to Holt *et al.*, (2007) content refers to the type of change or initiative that is being introduced. Characteristically this is focused on administrative, procedural, technological, or structural characteristics of the organization.

Process change: One dimension of the change process can be the extent to which employee participation is permitted (Holt *et al.*, 2007). However, Susanto, (2008) insists that individual change readiness is influenced by employees' perception of previous change efforts. These past experiences influence the perception process in interpreting information that passes through individual cognitive processes.

Context change: Context comprises the conditions and environment and arguably the culture within which employees function. For example, a learning organisation is one in which employees are more likely to embrace continuous change (Holt *et al.*, 2007).

Criterion issues: Individual attributes of employees are an influential factor in change readiness due to the differences between individuals. Some employees are more inclined to be receptive to organisational changes than others (Holt *et al.*, 2007). For example, affective commitment is when an employee identifies closely with the company they work for. These kinds of people would be often considered company workers and are likely to sign up for additional training or responsibility. Individuals' demonstrating an affective commitment to the organisation elicits positive perceptions of change and is directly related to lower intent to resist the change (McKay, et al, 2013). Moreover, there is consensus amongst researchers that an individual's change perception of a change is key to readiness and indeed organisational readiness (Abdel-Ghany, 2014). According to Susanto, (2008) perception influences employees' attitudes and behaviour intention in facing the impending change. Information related to change will be associated with the individual's past experiences by giving attributes toward the initiated change. Individuals have preconceived ideas about the extent their organisation is ready for change, which links to the notion of collective readiness.

Armenakis, et al, (1993) draw upon factors such as individual cognitive change, collective behaviour, social information processing and mass communication for creating organisational readiness. In terms of the message, they discuss this notion of discrepancy and appropriateness. That is, the discrepancy is the need for change, from the present state to the future state and that the change is necessary, also supported by earlier models by (John P. Kotter and Leonard A. Schlesinger, 1979; J.S. Oakland and S.J., 2007). The appropriateness is that employees agree that the approach being conveyed is indeed the correct approach. They also discuss efficacy based on work by Bandura (1982), which is referred to as the confidence that employees must hold in their capability to make the transition to the future state. Bandura, (1982) suggests from several different perspectives and a variety of names from the field of psychology comes the basic phenomenon of personal (self) efficacy, which is to produce and regulate events in one's own life. Self-efficacy is not simply a matter of knowing what to do, rather, it involves a generative capability in which

components of cognitive, social, and behavioural skills execute this capability. Armenakis, et al, (1993) argue that efficacy has been consistently found to affect thought patterns, action, and emotional arousal. Bandura, (1982) perceived self-efficacy accounts for such diverse phenomena as coping, level of physiological stress reactions, self-regulation, resignation and despondency to failure experiences, achievement strivings, growth of intrinsic interest, and career pursuits all of which are associated with some form of change.

Armenakis, et al, (1993) also discuss the dynamics of social information processing deemed to be the organisations' collective readiness which is in turn impacted by the individuals that comprise this organisation. These aspects of social information processing are further supported by the Theory of planned behaviour and the theory of reasoned action, in terms of social norms (Ajzen, 1991). The notion of an individual's intention to perform a given behaviour is at the core of this theory. It is based on individual Intentions, which are assumed to capture the motivational factors that influence behaviour. They argue, that the stronger the intention to engage in a behaviour, the more likely should be its performance. This intention is underpinned by three factors: attitudes, subjective norms, and perceived behavioural control. Essentially, the attitude pertains to whether an individual has a favourable or unfavourable evaluation of the behaviour in question. Social norms are interpreted as the degree of perceived social pressure to conduct a behaviour. Finally, there is perceived behavioural control which is the perceived ease or difficulty of performing a behaviour based on personal capability. These aspects concur with that of Armenakis, insomuch:

Perceived Behavioural Control	=	Self-Efficacy
Attitude	=	Discrepancy and Appropriateness
Social Norms	=	Social information processing

Table 3. 1 Comparison of work by (Ajzen, 1991) and (Armenakis, et al, 1993), source author.

Neves, (2009) draws upon work by (Armenakis et al., 1999) in terms of the five components: (a) discrepancy; (b) principal support; (c) self-efficacy; (d) appropriateness; and (e) personal valence, progressed out of Lewin's (1947) ground-breaking work and Bandura's (1986) social learning theory. Neves, (2009) asserts personal valence emphasises the positive and negative outcomes, including benefits

and fairness of change, arguing it can be operationalised through employee's affective commitment to change.

Daniel T. Holt and Vardaman, (2013, p10) propose a conceptual framework to guide scholars and practitioners in considering three main areas of organisational change readiness. "These include: (1) psychological factors (i.e. characteristics of those being asked to change), (2) structural factors (i.e. circumstances under which the change is occurring), and (3) the level of analysis (i.e. individual and organizational)". Holt D. T. and Vardaman, (2013) reason that the individual difference factors of readiness may be manifested through specific attitudes and beliefs regarding the need for, appropriateness of, management support for and value of the change, both individually and collectively.

Holt D. T. and Vardaman, (2013) include in their research and conceptual model self-efficacy, appropriateness and discrepancy as individual factors that echo the extent to which individuals hold core beliefs associated with the change, awareness that a problem needs to be tackled and agree with the changes that individuals and the organisation must make. They also include structural factors that reflect the circumstances under which change is occurring and the extent to which these circumstances enhance or inhibit the implementation of a change, i.e., the context and process aspects of change. However, although this concept of readiness for change comprises five different components, the relevance and weight of each factor may depend on the type of change organisations face (Neves, 2009). This is pertinent to applying any model of change readiness to SMEs adopting circular economy practices.

Rafferty and Minbashian, (2019) focus on change recipients' change attitudes and their change readiness. They argue researchers have failed to consider positive emotions about change as a precursor of change readiness. Further, they assert positive emotion is a key source of variation in change readiness. Using the works of (Holt *et al.*, 2007; Armenakis and Bedeian, 1999) discrepancy is redefined as a "belief that change is based on legitimate reasons and is needed to address a deficiency in the current state relative to a desired future state" (Rafferty and Minbashian, 2019 p1625).

Holt *et al.*, (2007, P235) reviewed 32 instruments that measure readiness quantitatively, and concluded that the "readiness for change was defined as a comprehensive attitude that is influenced simultaneously by the content (i.e., what is being changed), the process (i.e., how the change is being implemented), the context (i.e., circumstances under which the change is occurring), and the individuals (i.e., characteristics of those being asked to change) involved." Rafferty and Minbashian, (2019) remain consistent with previous definitions for appropriateness, self-efficacy, and principal support based on work from (Armenakis et al., 1999; Armenakis and Harris, 2002; Armenakis et al., 2007), where they agree that "appropriateness is defined as an "individual's belief that a change is an appropriate response to organisational issues. Change self-efficacy refers to an individual's perceived capability to implement a change initiative and has been consistently defined as an individual's confidence that s/he can implement a change. Finally, Rafferty and Minbashian, (2019 p1626) redefine principal support "as an individual's belief that support is provided by formal organisational leaders such as senior leaders and immediate supervisors as well as one's peers and personal valence, as the belief that change is perceived to be personally advantageous for an individual". However, in addition to these aforementioned aspects of individual change readiness, Rafferty and Minbashian, (2019 p1627) contend that "joy and interest represent core aspects of employees' positive emotional responses to organisational change and focus on the broad factor assessing employees' positive emotional responses to change, which encompasses the joy and interest emotion families".

Galagan, (2010) argue that change management should focus on performance rather than conformance and the concept of continuous change readiness. Further, they argue change management should focus on facilitating continuous change readiness rather than implementing and managing specific change efforts. Additionally, Daniel T. Holt and Vardaman, (2013) claim their concept should be expanded to reflect complex interactions and simultaneous organisational changes that go beyond a single static change. There is a wide and complex array of literature, models, and concepts around readiness for change. Holt *et al.*, (2007) propose a quantitative measure of readiness at the individual level. They argue that quantitative methods offer unique advantages to managers, consultants, and researchers and can be

distributed widely in relatively short periods, making an efficient means to garner change-related information.

There is no readiness for change models that pertain to CE. Therefore, to develop a new model of readiness, it seems appropriate to review readiness for change models from other subject areas. Below, change readiness models are reviewed for their content and applicability to being developed into a suitable model of readiness for CE.

3.5.2 Readiness for Change Models

There are numerous readiness-for-change models/frameworks in diverse fields such as Lean, Innovation, Six Sigma and TQM to name a few. These two terms, “models and Frameworks” for readiness will be used interchangeably for this thesis. These models are reviewed as to their suitability and adaptability for building a comprehensive readiness for change model for SMEs adopting a circular economy.

The theory of planned behaviour was developed by Ajzen, (1991), attempts to measure the intention of an individual to perform a particular behaviour. It uses three factors to help determine an individual’s intention, to act. These three factors in this theory are attitude, subjective norm, and perceived behavioural control. According to (Ajzen, 1991) the perceived behavioural control is most compatible with Bandura’s work on self-efficacy. They argue that this theory can be used directly to predict behavioural achievement.

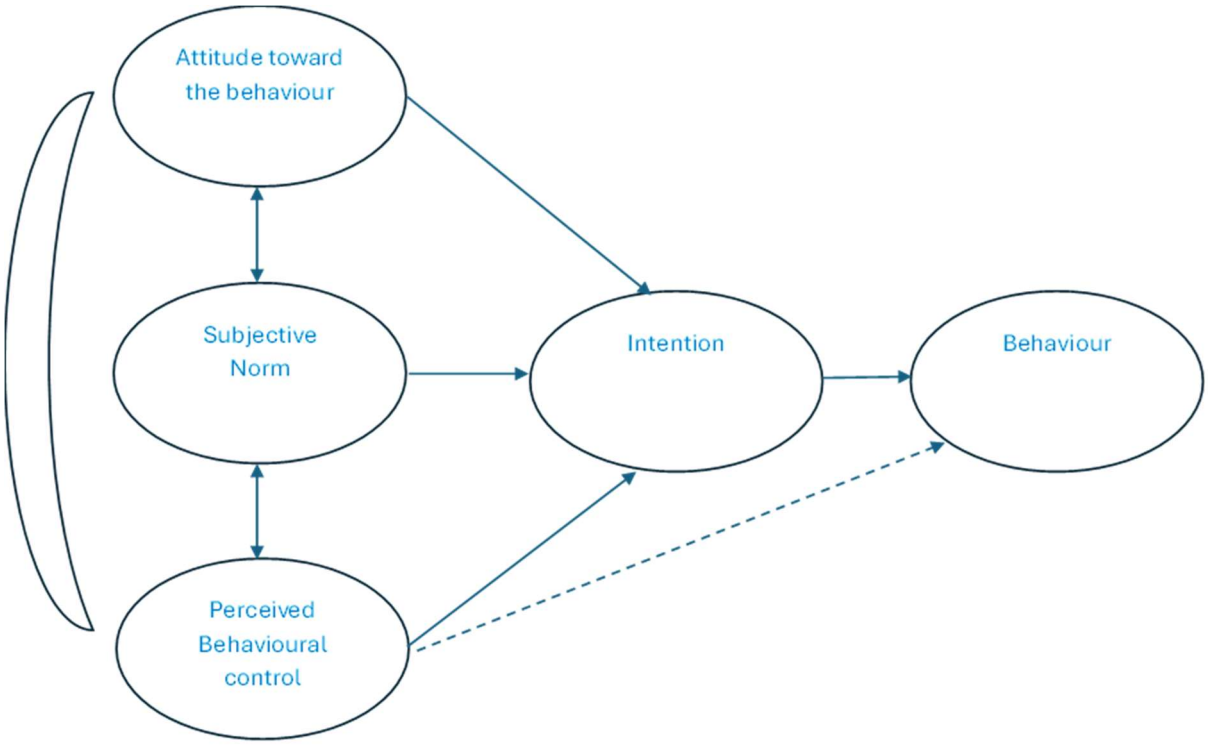


Figure 3. 1 shows the theory of planned behaviour, adopted from Source (Ajzen, 1991).

The theory of planned behaviour is depicted in a structural diagram for illustration and is an extension of the theory of reasoned action. Changes to the original model were made necessary due to limitations in dealing with behaviours over which people have partial volitional control (Ajzen, 1991).

A central factor in the theory of planned behaviour is the individual's intention to perform a given behaviour. Intentions are indications of how much effort an individual is prepared to exert to perform a given behaviour. Ajzen, (1991, p182) argues, that the stronger the intention the more likely an individual will engage with the behaviour, but only if this behaviour is under volitional control, i.e., "if the person can decide at will to perform or not perform the behaviour."

Bouckenooghe, et al, (2009, p562) argue that the practical soundness of a change model needs to include the climate or context of the change, readiness for the change and process variables. They call their model The 10 Dimensions of the Battery. This includes seven key points "(a) quality of change communication, (b) participation, (c) attitude of top management toward organizational change, (d) support by supervisors, (e) trust in leadership, (f) cohesion, and (g) politicking."

Bouckenooghe, et al, (2009) insist that readiness for change comprises emotional, cognitive, and intentional readiness for change and is, therefore, a multifaceted attitude toward change. They constructed a new instrument that measures the circumstances under which change embarks (context), the way a specific change is implemented (process), without specifying what the change is about (content) and the level of readiness at the individual level. However, they concede that further validation is required due to operational issues, despite some positive aspects.

Armenakis *et al.*, (2007) identified five important beliefs that influence the success of organizational change initiatives, namely, discrepancy, appropriateness, efficacy, principal support, and valence. Collectively, the beliefs provide a valuable framework for assessing the change process. They labelled their framework organizational change recipients' beliefs (OCRB) and developed a questionnaire that can be used to gauge the progress of organizational change efforts. They argue their assessment tool can be administered at any stage of the change process, serving as (a) a barometer of the degree of buy-in among change recipients, (b) an assessment of specific beliefs that can adversely impact the success of an organisational change, and (c) a basis for planning interventions to enhance buy-in among recipients. Discrepancy is the difference between current and desired performance and helps to promote the need for change. If change recipients believe there is no need for change, they are likely to resist or at least, not be proactive. Recipients of change must recognise this need for change.

Appropriateness of the proposed change must be seen (believed) by the recipients, that the proposed change addresses the cause(s) of the discrepancy. Efficacy is the extent to which an individual recipient of organisational change perceives their capability to implement the change initiative. In other words, individuals will undertake and perform those tasks that they judge themselves to be capable of. Thus, employees must believe they can execute the new behaviours required by the change initiative.

Principal support describes the support from change agents, the CEO, leaders, and management of the company. Do some (or all) of these principals genuinely support the change? Are their actions congruent with their words, are they "walking the talk?"!

Valence relates to motivation and refers to attractiveness (from the change recipient's perspective). Are there perceived personal rewards or benefits realised from adopting the new behaviours? What are the perceived benefits of contributing to the change initiative? (Armenakis *et al.*, 2007).

Whilst there is substantial literature examining the influence of organisational culture (OC) on total quality management (TQM) implementation, Haffar, et al, (2013) argue the relationship between an organisation's culture and subsequent impact on TQM implementation has not been sufficiently addressed. They propose a conceptual framework to examine the mediating role of individual readiness for change (IRFC) as one possible mechanism through which an organisation's culture results in having an impact on TQM implementation.

Haffar, M et al, (2013) utilised three reliable and valid instruments, one of which was the instrument developed by Holt et al., (2007) to measure the level of readiness for change. Their instrument consists of 24 items designed to assess the extent to which organisational members feel positive about (in this case), TQM as a new change initiative.

Their analysis and findings concluded that individual readiness for change (IRFC) has a direct influence on the level of implementation of TQM, by verifying the significance and positive influence of IRFC on the implementation of TQM and the importance of preparing organisational members to be ready psychologically to achieve change implementation success (Haffar, et al, 2013).

Next, Holt *et al.*, (2007) continue the work of Armenakis and Bedeian, (1999) suggesting that existing instruments appear to measure readiness from one of several viewpoints, such as change process, change content, change context, and individual attributes.

1. Process refers to the steps followed during implementation, of which an example could be the extent to which employee participation is permitted.

2. Content refers to the initiative that is being introduced and is typically directed toward administrative, procedural, technological, or structural aspects of the organization.
3. Context consists of the conditions and environment within which employees function, such as a learning organisation is one in which employees are likely to embrace continuous change.
4. Individual attributes of employees as some are naturally more tolerant to change than others therefore some employees are more inclined to favour organisational changes than others.

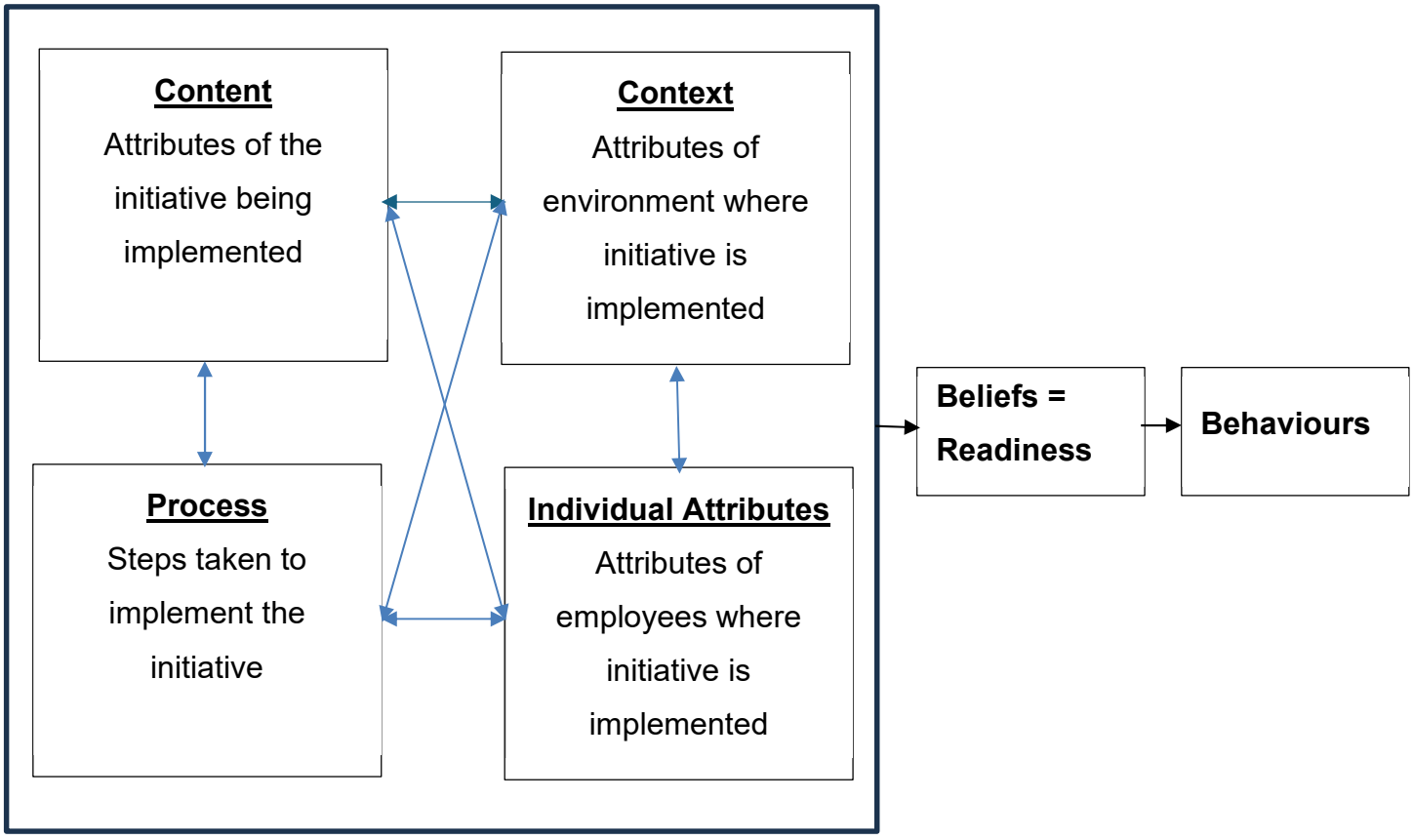


Figure 3. 2 shows Content, Process, Context, and Individual Attributes, source Holt et al (2007 p 235)

Holt *et al.*, (2007 p235) therefore define readiness for change as a "comprehensive attitude that is influenced simultaneously by the content (i.e., what is being changed), the process (i.e., how the change is being implemented), the context (i.e., circumstances under which the change is occurring), and the individuals (i.e., characteristics of those being asked to change)" Whilst they acknowledge this model

is not tested, they argue it provides a conceptual framework to direct scholars in the development of a new readiness model, suggesting that a generic set of beliefs form readiness and provide the basis for resistance or readiness behaviours.

Rafferty and Minbashian, (2019) propose a theoretical model based on the five change beliefs from Armenakis *et al.*, (2007) of Discrepancy, Appropriateness, Efficacy, Principal support and Valence, but additionally include positive emotions about change and identify three change-supportive behaviours of compliance, cooperation and championing. Based on their research, Rafferty and Minbashian, (2019, p1625) redefine discrepancy "as a belief that change is based on legitimate reasons and is needed to address a deficiency in the current state relative to a desired future state." Whilst they leave the other belief definitions largely the same, they argued that the affective component of change readiness should be assessed by discrete emotion items that capture an individual's positive emotions concerning a specific change event, such as pleasure about change, or response to change, including happiness, excitement, enjoyment, delight, curiosity, enthusiasm, and pride. Rafferty and Minbashian, (2019) insist that when an individual is involved with change and experiences positive emotions, it results in employees seeking to gather knowledge of and engage with change, which will translate into change-supportive behaviours.

Bakari, et al (2017) suggest authentic leadership is a pre-cursor for change readiness, with a commitment that will lead to behavioural support for change. From a positive psychology perspective, authentic leadership means being consistent in one's beliefs, and actions as well as being accountable for them. To be authentic, one must be congruent!

The above framework links together several models such as the theory of planned behaviour from (Ajzen, 1991) and aspects of the beliefs scale (Armenakis *et al.*, 2007) whilst using the same behaviours or outcomes as (Rafferty and Minbashian, 2019) and referring to (Lewin, 1947) and was used to support the study (Bakari, et al, 2017).

Bakari, et al, (2017) suggest from their research that authentic leadership leads to employees' positive belief about the appropriateness of change, which is a key belief according to (Armenakis *et al.*, 2007). Additionally, the positive impact of team

leaders' authentic leadership led to employee beliefs of management support for team innovativeness and individual creativity, which positively influences change self-efficacy, leading to an increased likelihood of successful implementation of planned change.

Rudolph *et al.*, (2021) provide a critique of theories, definitions, measures, and practical studies of respect in leadership. They maintain that respect must be understood as a process that evolves and cultivates between leaders and their followers, including respectful intentions affecting behaviours and subsequent perceptions of being treated respectfully. According to Epure and Tonis B. M, (2017) leaders have a vision and travel with their minds into the future not caught in the present. Leaders build trust and confidence and take advantage of the good communication, collaboration, and innovativeness of members of their teams. Veli Korkmaz *et al.*, (2022) research on inclusive leadership suggests fostering employees' uniqueness, including supporting employees as individuals, being attentive to their feelings, and expressing high emotional intelligence. Furthermore, promoting diversity, by valuing employee's unique characteristics, empowering employees to act and serving employee's learning and development needs. Finally, it is the responsibility of the leader to communicate the change thus preparing in readiness for the change, the management, and staff. Communication is pivotal to the effective implementation of organisational change and readiness for change (Elving, 2005; Jones, et al, 2005). Poorly managed change communication results in rumours and resistance to change, overstating the negative factors of the change (Elving, 2005).

When considering the appropriate change readiness model for SMEs adopting a circular economy, the context of this type of change is key. Other applications of readiness to change models vary depending on such circumstances. For instance, when reviewing approaches to improving healthcare delivery, Weiner, (2009) focused on the organisational level of analysis as this entails collective behaviour change in the form of systems redesign and simultaneous changes in staffing, workflow, decision-making, communication, and reward systems. Conversely, Rusly, et al, (2012) depict the conceptual model developed here to analyse the effects of change readiness on knowledge management processes and effectiveness. This model proposes multidimensional analysis, encompassing individual psychological

dimensions and conditions of the structural dimension. Concurrently, the model also suggests a multilevel analysis of the change readiness construct at individual and organisational levels in the context of Knowledge Management implementation. Chen, (2016) uses an extended theory of planned behaviour (TPB) model to explain people's intentions to engage in energy savings and carbon reduction behaviours that can help mitigate climate change.

Considering organisational readiness for change for an SME to engage and become ready to adopt CE activities relies on both individual and collective beliefs and attitudes. However, Vakola, (2013) raises concern that the literature does not differentiate between individual and organisational readiness to change. Moreover, they argue this creates confusion for both research and practice as there is a lack of definitional and conceptual clarity. Weiner, (2009) discusses organisational valence and emphasises shared resolve. He argues that the implementation of multifaceted organisational change involves collective action by many people and therefore collective commitment, belief in each other and trust. Each team member contributes something to the change effort and problems arise when some team members lack these vital attributes. Organisational readiness to change is shaped as team members collectively acquire, store, manipulate and exchange information about each other's attitudes toward change (Vakola M, 2013). For example, team members will informally discuss the proposed change and decide whether they believe the change is needed, important, beneficial, or worthwhile (Weiner 2009). It is clear that individuals and change are influenced by what is considered social norms, i.e., they are likely to conform to change or resistance based on the view of others.

This readiness also relies on structural factors such as knowledge, know-how, facilitation, relationships with upstream and downstream actors and most importantly, leadership. The decision to invest time, money, and effort into doing things differently and making a moral choice rests firstly with the leader of the SME. For this reason, their perspective toward CE is fundamental to success. Secondly, the leaders of the organisational functions will also play a key role. For example, if the head of procurement is not individually primed and motivated to systematically challenge current practices in favour of ethical and environmental procurement practices, then this function is unlikely to excel in this domain.

Rafferty and Minbashian, (2019, p1642) concluded that “positive emotion about change was relatively more important for predicting change readiness than any single one of the five change cognitions”. The leaders’ role therefore would require that individuals possess a high level of emotional intelligence, specifically empathy to ensure at the beginning and throughout the change process that positive emotion throughout the workforce is sought.

Holt D. T. and Vardaman, (2013) decree that due to the complexity of individual differences occurring at both the individual and organisational levels, success is reliant on the collective contribution of many interdependent individuals. When interdependence is high, collective capabilities may be a much stronger indicator of readiness for change than individuals’ confidence in their capabilities. Holt D. T. and Vardaman, (2013, P13) qualify this difference in that “individuals reveal what they feel the group can do together, rather than what each individual feels he or she is capable of doing”. This aspect is crucial to an SME’s adoption of a CE as this kind of change may have supply chain and system-wide aspects. The model represented below is the starting point from which to develop a new conceptual model. Other components or inputs into the blended approach come from the literature outlined in Chapter 4.

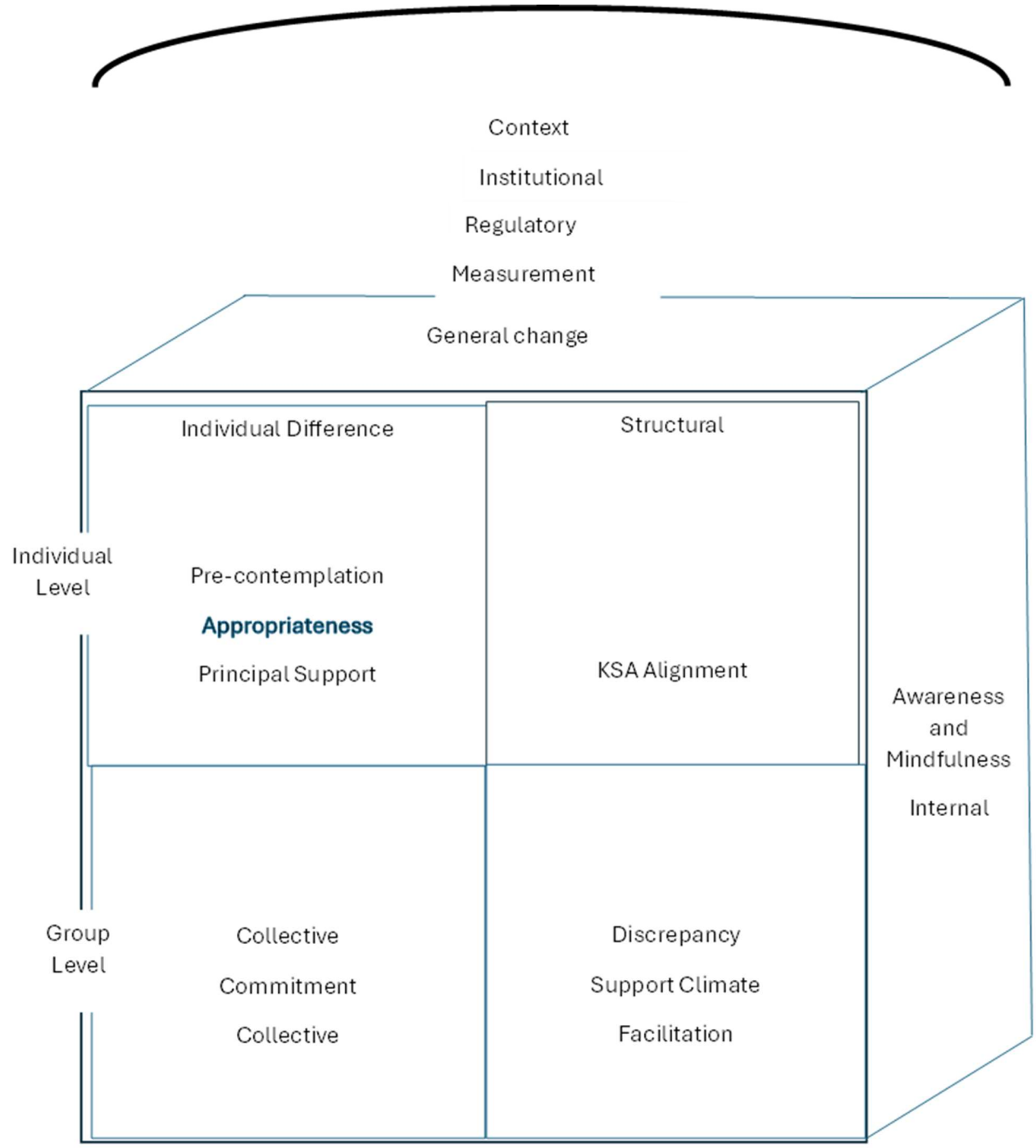


Figure 3. 3 An expanded conceptualization of change readiness adopted from (Holt and Vardaman, 2013).

3.6 Conclusion

The contextual studies include insights into the impact of internal/external factors (e.g., organisational age, size, and inertia/momentum) on an organization's effectiveness

and how it might respond to environmental (internal/external) changes (Armenakis and Bedeian, 1999). The context in this readiness for change model/diagnostic is certainly a factor for this thesis. It is specifically targeting SMEs and their readiness for adopting circular practice for a CE. Whilst this context must be unique in terms of an SME's position and strategy there will also be an element of similarity for a transition to CE. Teams operate at all levels of an organisation whether it is a leadership team, or a team developed by the manager to implement and sustain change. In terms of SMEs' adapting CE practices, working in teams across many organisations will certainly be a factor.

Expanded conceptualisation of change readiness by Daniel T. Holt and Vardaman, (2013) captures individual and structural aspects of change readiness and argues it is necessary to measure at the individual level and also the organisational level. They add further dimensions of mindfulness and general change. Critically, they assert that with this expanded model, researchers will need to adapt and refine the methods of measurement. As researchers, they recognise the nature of their model as a starting point for others to build and reconstruct to expand their understanding of readiness to account for the multifaceted and multilevel nature of an organisation's readiness for change. It is on the further development of such a model that this thesis will adopt a change readiness model for SMEs adopting CE, outlined in Chapter 4.

The gaps in knowledge are severalfold. Firstly, as previously stated there are no readiness models for SMEs adopting CE. Whilst academics link the barriers to CE to resistance to change and therefore readiness for change, there are no models that relate these together. Barriers to CE have been discussed in academic circles but have not been examined in terms of attitudes, beliefs and behaviours necessary to overcome them. Furthermore, individual attitudes towards other groups, teams or departments within an organisation and the sense of commitment and belief from others have not been addressed in this context. As mentioned earlier, academic statements suggest all areas of an SME and all employees should be considered when transitioning to a CE, but this has not been addressed in any model or framework. Additionally, there is no mention of obtaining expressed views of different groups within an SME in terms of readiness to compare and contrast attitudes and beliefs to the general change and specific barriers. This lack of perspectives of the leader,

senior management and employees from different areas does not allow comparison to measure multiple levels of readiness. There are no criteria for offering feedback to users of any model/framework. Moreover, there is no targeted and specific feedback based on readiness measurement for stimulating conversation, providing insights or musing organisational strategy for change interventions during a transition to CE.

Chapter 4 A conceptual model for SME's change readiness for adopting circular economy.

4.1 introduction

For more than 30 years environmental authorities have been enforcing regulations that faced strong resistance to compliance by organisations (Corral, 2003). Sustainability, and CE as a strategic part of any business should be addressed through transformative management but are often characterised by high complexity and resistance to simple solutions (Lahtinen and Yrjölä, 2019). Mishra et al., (2022) argue the concerns for the adoption of the CE become worryingly high in small and medium enterprises (SMEs) due to resource constraints in terms of finance, human resources, and infrastructure. The move from a linear economy to a CE is crucial to reducing pressure on the environment and requires a paradigm shift in the way that human activity is interconnected with nature (Neves & Marques, 2022; Grafström & Aasma, 2021; Ellen MacArthur Foundation, 2013). Gusmerotti et al., (2019, p318) hypothesised that "organisations that are driven by economic benefits are more likely to adopt CE practices." However, on exploration of the CE paradigm and implementation in some traditional manufacturing sectors Gusmerotti *et al.*, (2019) reveal that the internalisation of CE principles is still at an early stage since only around 30% of the surveyed companies had begun to change their business routines to become more circular.

According to Muranko *et al.*, (2018) behaviour has not been identified and defined in the CE domain. To distinguish specific behaviours that support the development of a CE, they propose to define Pro-Circular Behaviour (P-CB) as an action which is developed by prioritising resource efficiency. Tonglet et al., (2004) suggest that pro-recycling attitudes are the key to recycling behaviour and that these attitudes are firstly, by having the appropriate opportunities, facilities, and knowledge to recycle, and secondly by not being deterred by the issues of physical recycling, such as time, space, and inconvenience. Similarly, CE implementation requires strong awareness, salient beliefs, and organisational culture to foster individual attitudes towards the

adoption of positive behaviour and that positive owner/manager's attitude towards the natural environment has a profound effect on a firm's green commitment and leads to the adoption and implementation of sustainable practice (Singh, Chakraborty and Roy, 2017). As sustainability requires new forms of organisational arrangements such as CE, the 'human side' of this complex process should be understood better. The capacity of human resources to facilitate sustainable change initiatives goes beyond the boundaries of the organisation (Chiappetta Jabbour *et al.*, 2019). It is this organisational readiness for change that was an identified gap in the knowledge through a systematic literature review of readiness for change models for SMEs to adopt CE. This systematic literature review identified just two models that were related to organisational readiness but were appraised for their merits in Chapter 2. In Chapter 3 organisational change and readiness for change models in other areas such as Lean, Six Sigma and TQM were investigated. The results from the findings in chapters 2 on CE and 3 organisational changes are blended here into the construction of the conceptual model.

4.2 Current state

As previously stated, from the literature review on CE readiness, there were only two papers about change readiness, and both were limited. Examining these two papers is the starting point, (the current state) of the literature. The theory of planned behaviour has been used by Singh et al., (2017) who developed an extended theory to study and explore small firms' readiness towards a CE. Additionally, Lopes de Sousa Jabbour, (2018) presents two methods of CE implementation, adopting circular activity to optimise materials usage and developing new business models.

As well as closing, slowing, and narrowing loops, Lopes de Sousa Jabbour, (2018) quotes the resolve framework developed by (Ellen MacArthur, 2015). They assert that organisations should assess two aspects, the willingness to adapt their current business model or to adopt new ones. However, they accept the demand of a certain level of organisational change i.e., mindset, skills, corporate relationships, product design or technologies. Arguably, this demand for organisational change dictates the

readiness of an SME to engage in circular activity. Lopes de Sousa Jabbour, (2018) proposes a level of analysis to assist managers in moving their organisations towards a CE approach, namely, the market environment, likely organisational changes and tools or frameworks for assisting the journey. They continue to suggest support schemes and fiscal frameworks as a solution to the market environment. In terms of organisational changes, they favour technology interventions such as Digital and virtual technologies, such as cyber-physical systems, the internet of things, cloud manufacturing and additive manufacturing. Lopes de Sousa Jabbour, (2018, p6) argues, “Organisations need to reshape technical and managerial decision-making so that the journey towards the circular economy becomes inevitable.”

Lopes de Sousa Jabbour, (2018) discusses options for assisting managers in conducting a CE trial, including better management of relationships between organisations, suppliers, and customers to develop circular practices, by sharing information and engagement across the supply chain. Whilst this paper generates some insights into factors for consideration in terms of SME readiness for the CE, it does not discuss in any detail the needs of the organisation from a human perspective. It states there must be better relationships, but how do these relationships need to change and develop to enhance circular behaviour? They do state that the development of shared values between consumers and other organisations is key to any strategy supporting circular practice. The point here is, how do you change their values? Whilst this paper offers some areas to consider for readiness, it does not offer any contribution to how an organisation may change its collective mindset, skills, and relationships. For example, it encourages the use of industry 4.0 digital technologies but does not state how an SME might make that transition.

Singh, et al, (2018) make the connection of barriers to CE such as ineffective enforcement of relevant regulations, institutional support, lack of economic incentives, poor technical skills and low environmental awareness affecting CE readiness in small firms. They assert that there are plentiful studies indicating both internal and external factors are responsible for a firm’s CE behaviour. Singh, et al, (2018) developed Ajzen, (1991), a theory of planned behaviour, theory of attitude, social pressure, and perceived behavioural control to examine the two additional factors, environmental

commitment, and green economic incentives and examine internal and external barriers.

Singh, et al, (2018) hypothesised that attitude, social pressure, and perceived behavioural control positively influence CE readiness based on previous work using the same concept and the willingness to act for waste management, recycling, and pollution prevention. Whilst this paper considers human factors, it does not address other factors associated with the broader concept of readiness, such as skills, relationships, product design and additional barriers to circular economy as identified in this systematic literature review.

Singh, et al, (2018) conclude that there is a positive impact on CE readiness from their extended TPB model, which includes attitude, social pressure, environmental commitment green economic incentives. Their questionnaire was sent to 570 enterprises with 248 valid responses. The respondents to the survey broke down as, 47 owners, 29 Directors, 93 Managers and 79 senior-level employees and supervisors. Whilst they used a Likert scale to measure the responses to questions and assert that each respondent was introduced to the concept of CE, this will only indicate attitude and belief towards CE behaviour. Whilst this is a crucial indicator for showing the owner/manager's attitude and subsequent impact on CE readiness, it does not highlight the skills required, corporate relationships, and company culture and leadership ability.

So, to summarise, Singh, et al, (2018) consider the intention of the manager/owner in terms of readiness and Lopes de Sousa Jabbour, (2018) considers more macro factors in terms of the environment, organisation, and tools. These papers are an important contribution to CE readiness but are limited to gauging awareness and intention on the first hand and higher-order actions associated with understanding the environment, organisational change and tools and frameworks. They do not get into the details of what a competent circular workforce would look like! As (Gusmerotti *et al.*, 2019, p323) state "the new challenge of the CE can also be addressed only by integrating its principles in all business functions: from logistics to procurement, from operations to marketing." In the same way that TQM must infiltrate the entire workforce, the same model is required for CE.

4.3 Conceptual Model Development Process

The conceptual model can be viewed in Figure 5.1 and is designed to measure the readiness of a manufacturing SME for CE. This conceptual model was developed using several design dimensions. These design dimensions were partly adapted from Eccles, (2006) who proposes theory analysis which helps to guide the choice of theory from a confusing range of theories from which to choose. The first dimension considered the original development of the theory and the credibility of those who developed it. Consideration was also given to any evidence to support or refute the development of the theory (Eccles, 2006). This conceptual model was adapted from Holt & Vardaman, (2013) those who earlier carried out a comprehensive review of 32 instruments that measure readiness quantitatively. Their conclusion declared that there was considerable opportunity for improvement due to the instrument's lack of evidence of validity and reliability (Holt *et al.*, 2007).

The second dimension entailed guiding the process of translating research into practice, using the author's experience, knowledge, and prior research to contextualise the development of the conceptual model (Nilsen, 2015). For example Buchanan et al., (2005) state that a model should explain a range of outcomes, which may be expressed in terms of the presence or absence of the factors identified. In this model, there are 23 readiness factors, identified as to their degree of readiness.

The final design dimension was to determine the usefulness of the theory and how practical and helpful the theory is in providing a sense of understanding and applicability to address the specific challenge of change readiness (Eccles, 2006). Appelbaum et al., (2012) suggest practitioners are more likely to look into theory from a practical perspective when appraising Kotter's eight-step model which is intuitive and relatively easy to accept.

To complement the design dimensions outlined above, this process of conceptual model development also follows a blended theory by Fauconnier and Turner, (2008)

who suggest there are three steps for the development of the blend, which are composition, completion, and elaboration.

The first step is composition which is developing inputs into a conceptual model. Different parts may be brought into the “Blend” either as a separate entity or as a fused element. The second step is completion, where the author or researcher forms a variety of related conceptual structures and knowledge without being aware of it consciously. In this way, the composed structure is completed from a combination of inputs and other structures (Fauconnier and Turner, 2008). The final step is elaboration, which develops the blend using creative intellectual simulation according to principles and logic in the blend. A dynamic elaboration process can employ new principles and logic during the elaboration and can be run indefinitely. Through the process of Blended theory, composition, completion, and elaboration an emergent structure in the blend is created. Once the blend is recognised, one can function cognitively within that space, which enables the manipulation of inputs as an integrated unit and the relationships of the inputs and connection to the blend become known.

This conceptual model starts with inputs from research and well-established theories of individual and collective attributes such as Self-Efficacy and Personal Valance as well as structural and contextual factors. Through the completion stage, it recognises other inputs such as individual barriers to CE, (the context), positions of individuals in an organisation (the process), the strategic plan and specific vision for organisational change, (the content). Other inputs include a readiness factor and new insights for intervention formulation. In the elaboration stage, an emergent structure recognises the complex and myriads of relationships between inputs in the blend. 5.1

To develop a readiness model for an SME to measure their circularity readiness, one must consider the nature and context of the change to adopt CE as well as change readiness theory. Both the nature and context of SMEs’ adopting CE and readiness for change models were explored in chapters 2 and 3, respectively. These four main themes of content, process, context and Criterion relate directly to the foundation of the Readiness Model. 5.2

When researching the willingness of enterprises to embark on cleaner production Zhang et al., (2013) outlined both internal and external barriers to adopting such behaviour. Rizos *et al.*, (2016, p11) outline several barriers for SMEs in adopting circular practice, such as "Lack of support supply and demand network, Lack of capital, Lack of government support, Administrative burden, Lack of technical know-how, Lack of information and Company environmental culture." The context for adopting CE identifies barriers for SMEs to make the transition. In terms of readiness to change models, context is a key ingredient according to (Armenakis et al., 1993; Harris, 2002; Holt et al., 2007).

Consequently, barriers expressed in the literature have been collected and analysed for meaning and context and have been categorised for use in the conceptual model regarding the context for change readiness. The categorisation process is explored below.

4.4 Readiness Context

Whilst these CE Barriers below were all identified in the literature, some were combined as they were of similar context or deemed to be expressing the same barrier differently. The words and phrases that were used were identified and categorised to form specific barriers to be used for the conceptual model of readiness to form the context within the model. According to (Rizos *et al.*, 2016) "Research on SMEs has shown that they are becoming increasingly aware of the benefits of improving resource efficiency even though, they do not often link them well to the concept of a CE." This SLR indicates there is significant research into the challenges, barriers, and enablers for SMEs to adopt circular practices/activities (Rizos *et al.*, 2016; de Jesus and Mendonça, 2018; Rizos *et al.*, 2015; Van Hemel and Cramer, 2002; Ormazabal *et al.*, 2018; Prendeville et al., 2011). Table 5.1 below outlines some of the evaluations from the phrases, with the blue cells forming the main category and the white cells forming a subcategory. A further table 5.2 shows the entire summary of the categories. Beyond this, each category is discussed in terms of contribution from the literature and how this has shaped the researcher's thinking and subsequent selection of barriers to acting as the context for the conceptual model.

Barriers	References
Lack of support supply and demand network	(Rizos *et al.*, 2016); (Ormazabal *et al.*, 2018) (Geng and Doberstein, 2008)(Ormazabal *et al.*, 2016)
Lack of support from public institutions, lack of commitment	(Ormazabal *et al.*, 2018), (Singh, Chakraborty and Roy, 2018),
Economic and market limitations	(de Jesus & Mendonça, 2018)
Lack of capital / financial support	(Rizos *et al.*, 2016); (Ormazabal *et al.*, 2018) (de Jesus & Mendonça, 2018), (Singh, Chakraborty and Roy, 2018)
Lack of government support	(Rizos *et al.*, 2016); (Ormazabal *et al.*, 2018)
Misaligned incentives	(de Jesus & Mendonça, 2018)
Inconsistent legislation	(Singh, Chakraborty and Roy, 2018)
Administrative burden	(Rizos *et al.*, 2016); (Ormazabal *et al.*, 2018)
Significant transaction costs	(de Jesus & Mendonça, 2018)
Lack of technical know-how / technical resource	(Rizos *et al.*, 2016); (Ormazabal *et al.*, 2018)
Lack of technical support	(de Jesus & Mendonça, 2018)
Lag between design and diffusion	(de Jesus & Mendonça, 2018)
Poor technical skills	(Singh, Chakraborty and Roy, 2018)
Lack of information/information management systems	(Rizos *et al.*, 2016); (Geng and Doberstein, 2008) (de Jesus & Mendonça, 2018)
Company environmental culture	(Rizos *et al.*, 2016); (Ormazabal *et al.*, 2018)
Internal conflict	(Van Hemel & Cramer, 2002)
Lack of customer/consumer interest in the environment	(Ormazabal *et al.*, 2018)

The rigidity of consumer behaviour and business routine	(de Jesus & Mendonça, 2018) (Van Hemel and Cramer, 2002)
Lack of qualified personnel in environmental management	(Ormazabal *et al.*, 2018)
Lack of leadership commitment	(Ormazabal et al., 2018)(Rizos *et al.*, 2016)(Geng and Doberstein, 2008)(Ormazabal *et al.*, 2016)
Lack of environmental awareness	(Singh, Chakraborty and Roy, 2018)

Table 4. 1 shows links between subcategories and main categories.

Barrier's definition	References
Lack of support supply and demand network/constraints to adopting new circular business models.	(Rizos et al., 2016; Ormazaba et al 2018; Geng & Doberstein, 2008).
Lack of capital / financial support Government support / economic and financial drivers, support from public institutions, misaligned incentives.	(Rizos et al., 2016; Ormazabal *et al.*, 2018; de Jesus & Mendonça, 2018; Singh et al., 2018)
Administrative burden	(Rizos et al., 2016; Ormazabal *et al.*, 2018)
Lack of technical know-how / technical resource / Lag between design and diffusion or lead time to market.	(Rizos et al., 2016; Ormazabal *et al.*, 2018; de Jesus & Mendonça, 2018; Singh et al., 2018)
Lack of information/information management systems	(Rizos et al., 2016; Ormazabal *et al.*, 2018; de Jesus & Mendonça, 2018)
Company environmental culture / internal conflict	(Rizos et al., 2016; Ormazabal *et al.*, 2018; Van Hemel & Cramer, 2002; Singh et al., 2018)
Lack of customer/consumer interest in the environment / Rigidity of consumer behaviour and business routine	(Ormazabal *et al.*, 2018) (de Jesus & Mendonça, 2018; Van Hemel & Cramer, 2002)

Lack of qualified personnel in environmental management.	(Ormazabal et al., 2018)
Lack of leadership commitment.	(Ormazabal et al., 2018; Ormazabal et al., 2016; Geng & Doberstein, 2008; Rizos et al., 2016)
Lack of environmental awareness, training, and support	(Singh et al., 2018; de Jesus & Mendonça, 2018)

Table 4. 2 shows barriers to SMEs adopting CE and the definition

4.4.1 Lack of support in the supply and demand network

Lack of support supply and demand network/constraints to adopting new circular business models. Rizos et al., (2016) suggested 54% of sampled SMEs mention this as their main barrier in the transition towards a circular economy. In terms of suppliers, many believe there to be an absence of “green” suppliers for specific inputs that the SME needs in the production process of a product or a service and that supply chains are insufficiently developed. de Jesus & Mendonça, (2018) agree stating that the practical implementation of CE is often limited by economic and market limitations. Geng & Doberstein, (2008) categorise barriers may be into three groups: 1) policy; 2) technology and 3) public participation when researching the development of CE in China. They argue a need for better management of natural resources, and to protect the environment; all of which require the full support of all stakeholders, who they define as industrial managers, government officials, staff of research institutions, community, and financial organisations. Ormazabal et al., (2016) also cite the lack of customer interest in the environment as a barrier that concurs with lack of support in the supply and demand network. Govindan and Hasanagic, (2018) identified 39 barriers, some relating to the external and internal environment. Other barriers were also related to Consumers, government, society, and the combination of the organisation and suppliers. They were then classified into eight clusters as follows: Governmental issues, Economic issues, Technological issues, Knowledge and skill issues, Management issues, Circular economy framework issues, Culture and social issues and Market issues. All of these categories are potentially relatable in terms of

this barrier as individuals perceive many obstacles when confronted with a paradigm shift in their everyday practices. The resulting argument according to Rizos *et al.*, (2016) is that SMEs, must provide accurate figures and additional evidence relating to circular goods and services, and convince potential customers that the CE approach is the right one. Additionally, there is a need to persuade customers that circular products and services are of a similar or better quality than traditional goods and services. Neves and Marques, (2022) suggest that education is a driver of this circularisation, increasing the propensity to recycle, being more aware of environmental issues and, more likely to adopt environmentally-friendly behaviour. Augmenting CE initiatives with its upstream and downstream supply chains Khan, et al,. (2022) construe that relationships must be maintained. They also cite the importance of the top management team support and change management, which will act as a key influencer and gain employees' intrinsic motivation. In essence, this barrier relates to the way the supply chain both upstream and downstream is perceived by individuals of an SME and their relationships. It is first about their beliefs, attitudes, and subsequent behaviour towards adopting CE practices or not. This particular barrier and subsequent behaviours required to overcome such a barrier will first require a level of awareness, understanding and commitment from individuals to enable them to be primed and ready to embrace the change. It is this level of readiness that is required to break down these types of barriers for the adoption of CE practices. This barrier essentially relates individual beliefs, resistance to change to employees, senior management and leadership to potentially overcoming such a barrier to promote CE. It is most likely that marginal gains will develop in the supply and demand network as attitudes change.

4.4.2 Lack of capital and financial support.

This is defined as the lack of capital to invest or financial support from government or other funding bodies, lack of economic and financial drivers, support from public institutions and misaligned incentives. According to Rizos et al., (2016) finance and up-front green investments emerged in the literature as a significant barrier. The lack of economic incentives from the Government Ormazabal et al.,(2016) and lack of finance (Singh, Chakraborty and Roy, 2018).

4.4.3 Administrative Burden.

Administrative burden refers to any additional green business practices that stem from environmental legislation, which de Jesus & Mendonça, (2018) described as significant transaction costs. SMEs often rely on external consultants to meet their admin obligations, which in turn involves extra cost, which might be significant for SMEs, seen as unaffordable financial and significant time resources because they lack the specific knowledge and capacity to comply with the requirements. This administrative barrier is typically complex systems and long procedures that organisations face to gain certification and meet standards and legal responsibilities (Rizos *et al.*, 2016).

4.4.4 Lack of technical know-how / technical resource / Lag between design and diffusion or lead time to market.

The lack of technical know-how or internal technical skills is an obstacle that prevents SMEs from taking advantage of green economy opportunities. Many SMEs do not have the technical capacity to identify, assess and implement more advanced technical options and tend to prioritise familiar or rely on the opinions and recommendations of external actors (Rizos *et al.*, 2015). In addition, de Jesus and Mendonça, (2018) suggest that inappropriate technology and the lag between design and diffusion are barriers to CE, such that the rise of new technology may be perceived as a trigger for change, arguing that technical capacities are now essential in the transition to a CE. These technical barriers are not only the existence of appropriate technology but also technology gaps between processes and product development, and the lag between invention and production. Poor technical support and the lack of technical resources within the company are perceived as a barrier to CE (Ormazabal et al., 2016; Singh et al., 2018; de Jesus and Mendonça, 2018).

4.4.5 Lack of Information/Information Management Systems

The lack of SME information and knowledge about the benefits of CE is a barrier to the implementation of CE practices, with many SMEs considering resource efficiency practices to be a cost and neglecting the potential financial gains (Rizos *et al.*, 2015). Additionally, de Jesus & Mendonça, (2018) insist more information is required regarding the mass implementation of the CE, to understand the interactions and relations, as well as trade-offs and disparities, between technological and socio-institutional systems. Accordingly, Geng & Doberstein, (2008) suggest an information system assuming a systems approach is essential if decision-makers are to develop more environmentally and financially favourable ways to plan and manage their resources. However, from a survey of 300 companies that expressed an interest in sustainability, most of the participants had either never heard of the term 'CE' or did not understand its meaning. Interestingly, when participants were given a clear definition of CE, the majority responded that they were making efforts to recycle and repair (Rizos *et al.*, 2015).

4.4.6 Organisation Environmental Culture

SME culture refers to barriers borne out of the leaders' and employees' attitudes habits and philosophies. It is often also the owner, who is the leader of the company and has significant power for strategic decisions. Therefore, the SME Leaders' attitude towards CE will influence whether they are willing to adopt CE practices (Rizos et al., 2016). The lack of commitment on the part of the organisations' leaders is cited by Ormazabal et al., (2018) about company culture. An attitude that determines no clear environmental benefit, not perceived as their responsibility and no alternative solution is available cited by Van Hemel & Cramer, (2002) around the implementation of eco-design. Additionally, poor information sharing, lack of political willpower, weak inter-agency coordination, and low commitment Singh et al., (2018) are all contributing factors that indirectly shape the organisational culture. Furthermore, Rizos et al., (2016) assert that strong risk aversion in management and leaders as well as resistance to change in the workforce will hinder the transition to CE practices and

keep business models locked in their conventional configuration. He suggests that the mindset and commitment of the staff are imperative to ease the transition.

4.4.7 Lack of Customer/consumer interest

The lack of customer interest in the environment according to Ormazabal et al., (2016) acts as a barrier to implementing CE at the meso level, where other actors must work together, which means industrial symbiosis. Consumer habits and organisations' routines change slowly because of insufficient awareness and information regarding the CE concept de Jesus & Mendonça, (2018) leading to inactivity in selecting possible choices available, resulting in a barrier. (Van Hemel and Cramer, 2002) assert their barrier 'not yet required by customers' seems to have an influence which leads to the presumption that SMEs perceive environmental customer demands as a more important driver. de Jesus & Mendonça, (2018) reveal the rigidity of consumer behaviour and business routines is a barrier to CE implementation.

4.4.8 Lack of qualified personnel in environmental management

Whilst Ormazabal et al., (2018) consider the lack of qualified professionals in environmental management a barrier to the implementation of CE in their research, the companies surveyed did not think that the lack of qualified people is a problem for CE implementation. Earlier, Ormazabal et al., (2016) suggest 64.7% of the companies surveyed had no environmental management for the company, and did not consider the lack of specialism in environmental fields as a barrier. Interestingly, Singh et al., (2018) cite poor technical skills and low environmental awareness as a barrier to CE readiness in SMEs. However, having a person in charge of the environmental management of a company could have a direct impact on the awareness of coaching people and the actions necessary to mitigate environmental damage (Ormazabal *et al.*, 2016). Finally, the technological expertise of organisations strongly impacts their overall environmental commitment and consequently willingness to innovate (Singh, Chakraborty and Roy, 2018).

4.4.9 Lack of leadership commitment

Some SME managers may have a positive attitude towards CE, while others may not, leading to a divergence of perspectives towards CE which contributes to the number of reasons for barriers (Rizos *et al.*, 2015). Whilst Ormazabal et al., (2016) found contradictory answers because 64.7% of respondents rated the level of commitment of top management highly on a 7-point Likert scale, but merely 35% of them stated clear environmental objectives were part of their company's strategic plan. Leaders/managers, usually trained in production/output activities, lack an appreciation of the benefits of a CE (Geng and Doberstein, 2008). However, the research carried out by Ormazabal et al., (2018) suggests the companies surveyed did not believe the lack of leaders' commitment is problematic for CE implementation. Finally, Singh et al., (2018) states the leader's attitude impacts CE readiness, with their attitude as a dominant factor that fashions technological innovation. Without strong leadership, the transition to CE will not happen or even start to happen.

4.4.10 Lack of environmental awareness, training, and support

Another key barrier is perceived to be a lack of technical support and training (de Jesus & Mendonça, 2018). Their study by Singh et al., (2018) suggests awareness should be created about the potential harm due to industrial waste and its damaging environmental and public health impact. Larger firms must take the initiative and school their supply chains about sustainable waste management and CE practice. However, the promotion of consumer awareness and the benefits associated with CE are left wanting (de Jesus & Mendonça, 2018).

4.5 Barriers as they relate to change readiness.

Barriers to the implementation of CE can be formed on three levels, micro, meso and macro according to Grafström & Aasma, (2021) who suggest these types of barriers are interrelated. Mishra et al., (2022) researched barriers to CE and captured various top-level barriers, such as knowledge & skills, technological, cultural, financial,

strategic, market, and government & regulatory barriers, but interestingly relate these barriers to resistance to change. One social (and cultural) barrier to CE adoption is resistant company culture, playing out on three levels: resistance from managers, low engagement due to CE initiatives in isolation from main operations and top management having different incentives to a CE direction creating resistance to change (Grafström and Aasma, 2021). Readiness for change is essentially the cognitive pre-cursor to either resist or support a change effort (Armenakis, Harris and Mossholder, 1993). "In the absence of a clear engagement of management to overcome barriers related to human resources and know-how, resistance to change in SMEs could occur with less positive consequences in terms of attitude towards CE and the ability to perform the necessary innovations that the implementation of this concept requires" (Ghenţa & Matei, 2018, p306). Whilst Piderit S.K., (2000) argues not all resistance is bad and often formed with good intentions, it is ultimately the approach by leaders to facilitate readiness for change through good communication and the ability to overcome barriers to change. Mishra, Singh and Govindan, (2022) identify a positive relationship in their research between barriers to adopting a CE and resistance to change and argue that barriers to adopting a CE play an essential role in resistance to change. Grafström and Aasma, (2021) state that future research should identify how theoretical knowledge can be circulated to practitioners to break down barriers. Therefore, readiness for change is inextricably linked to the barriers to a circular economy for SMEs.

The CE is fundamental in the transition to a more sustainable economic paradigm (de Jesus & Mendonça, 2018). However, whilst CE seems a rather straightforward concept, it can be confusing, due to the vagueness of the definition, its extensive and universal nature and the lack of clarity around the implementation (Baratsas, Pistikopoulos and Avraamidou, 2022). So, the way CE is conceived in the mind of leaders and business owners of SMEs is crucial to making the transition, at both the micro and meso levels.

For example, Agudo et al., (2022) discuss in their model the exchange of resources such as water, energy and waste but discuss an organisation's capacity to do so, which they relate to trust, information, access conditions and infrastructure. Trust is established by norms, values, goals, and governance, however, extended return on

investment, incomplete and complex contracts unpredictable risks, and poor on-time delivery performance of the supplier foster a lack of trust (Agudo *et al.*, 2022).

Pro-circular behaviour is the kind of behaviour that is fashioned by what an organisation measures and subsequent organisational action taken, but it is the leader of an SME that decides on what to measure within their organisation. Within the context of CE, entrepreneurial behaviour is increasingly being recognised as a significant conduit for bringing about a transformation (Hall, Daneke and Lenox, 2010).

The barriers above pertain to the contextual part of the conceptual model. The readiness model is further developed by combining parts and elements from previous readiness models (explored in chapter 3), that have addressed readiness in a different context. The aim is to produce an overarching comprehensive conceptual model of readiness for SMEs to implement CE. These barriers were identified in the SLR as major roadblocks for SMEs and the implementation of CE. They have also been related in the literature to resistance to change. As stated earlier, resistance to change is at one end of the continuum and readiness for change is at the other. Therefore, the inclusion of these barriers in the model and their relationship to readiness is justified. It is not the barriers themselves that the model is endeavouring to measure, but the perception of employee readiness from an SME. This model directly relates the attitudes and beliefs of employees to the barriers in an attempt to judge their individual and collective readiness to overcome such barriers. It is only when this appropriate level of readiness is achieved that the most applicable behaviour will follow. This is the justification for addressing the perceived barriers.

4.6 Readiness elements of the model

The definition of readiness for the extent of this thesis means an organisation that is both willing and able to adopt circular practice. This includes the intentions and attitudes of individuals but also ability, knowledge, know-how, and motivation, as well as a culture of continuous development. Based on the barriers and definition of CE, a readiness model must incorporate all areas of the business and therefore all employees within the business. It is also important to build a readiness (diagnostic)

that is relatively easy and simple to apply where the benefits can outweigh the time and effort in using the diagnostic / model as outlined in chapter 3.

These readiness models, concepts and frameworks from the literature review were analysed for their suitability and contribution to use as a readiness conceptual model for CE. Whilst there were a few models and frameworks, it was clear that there was no comprehensive model or framework that would be entirely suitable. As a foundation for the new conceptual model, the model that was deemed to include the greatest number of significant factors of readiness elements was chosen to build upon rather than starting with nothing. Then, from a variety of models and frameworks, other attributes and elements could be combined using blended theory to develop a new contextualised and comprehensive model. A list of models and frameworks that were considered and formed a significant part of the literature review for change readiness can be seen in Table 5.3 with a brief overview of the application. As previously stated, the most comprehensive model that would form the basis of this new conceptual model was that of Holt and Vardaman (2013) and was chosen as a basis to be further developed. These factors were incorporated into the model which covered both individual readiness, and collective readiness as well as structural factors, all of which were deemed relevant. This model would be modified and developed using elements from other models and frameworks from the literature.

Model	Author	Application
Theory of Planned Behaviour	(Tonglet, Phillips and Read, 2004)	What influences the behavioural choices of an individual to recycle?
Extended Theory of Planned Behaviour	(Singh, Chakraborty and Roy, 2017)	Used to explore a small firm's readiness toward a circular economy.
Interventions to promote mindfulness	(Gondo, Patterson and Palacios, 2013)	For changing an individual's beliefs about change
Ten Organisational Dimensions	(Douglas, 2017)	Used to measure the climate of readiness for

		lean, next phase (a case study).
Extended theory of Organisational culture	(Haffar, Al-Karaghouli and Ghoneim, 2013)	Used for explaining the relationship among OC types, IRFC and TQM implementation
The survey questionnaire was validated by the literature	(Shokri and Waring, 2016)	Used for data collection to analyse the behavioural-related critical success factors of Lean Six Sigma readiness.
Conceptual model of communication during organisational change	(Elving, 2005)	This aims at communication not only to inform but also to create a community.
The survey questionnaire was adapted from previous work using a small pilot study to remove irrelevant questions and ambiguity.	(Jose Arturo Garza-Reyes, Emre Mehmet Ates, 2014)	Used for data collection to ascertain if a company is indeed ready for Lean implementation and sustaining.
Theoretical model for change readiness for supportive behaviours of compliance, cooperation, and Championing.	Rafferty & Minbashian (2019) theoretical model	This model uses Discrepancy Appropriateness Valence, self-efficacy Principal Supports and adds positive emotion as a key contributor.
Theory of a Change Readiness Scale instrument	(Holt *et al.*, 2007)	Concluded 5 factors were dominant: discrepancy, efficacy, organisational valence, management

		support and personal valence
Expanded conceptualization of change readiness	(Holt & Vardaman (2013)	Includes individual factors, organisational factors, and structural factors.

Table 4. 3 shows a summary of existing change readiness models.

The various models, frameworks and theories were reviewed and evaluated to ascertain which parts would serve the best to act as a conceptual model for change readiness for manufacturing SMEs to adopt CE. The following criteria in Table 5.4 were originally chosen to be part of the conceptual model based on the author's perspective of what would work and what makes sense in the environment for which it is to be used. It is also supported by a variety of sources of research over several years and is justified below. These form the inputs that are to be blended into this conceptual model. All of these change readiness criteria inputs are based on very well-established research and theoretical concepts that have been developed over many years.

Change Readiness Criterion	Associated Authors
Discrepancy	(Rafferty & Minbashian, 2019; Holt et al., 2007; Armenakis & Harris, 2009; Oakland, J. S. and Tanner S.J., 2007; Kotter J. P. and Schlesinger, L. A. 1979)
Appropriateness	(Armenakis & Harris, 2009; Holt & Vardaman, 2013). Kotter J. P. and Schlesinger, L. A., (1979)
Personal Valence	(Armenakis & Harris, 2009; Holt & Vardaman, 2013; Armenakis et al., 1993; Kotter J. P. and Schlesinger, L. A. 1979; Susanto, 2008)
Positive emotions about change	(Rafferty & Minbashian, 2019;).

Change self-efficacy	(Holt & Vardaman, 2013; Armenakis & Harris, 2009; Holt et al., 2007; Bandura, 1982).
Principal Support	(Holt & Vardaman, 2013; Vakola, 2013).
Awareness and Mindfulness	(Gondo et al., 2013; Charoensukmongkol, 2017)
Collective commitment	(Holt & Vardaman, 2013; Weiner, 2009).
Collective Efficacy	(Holt & Vardaman, 2013; Vakola, 2013)
Collective Trust	(Holt & Vardaman, 2013; Weiner, 2009)
Knowledge and Skills Alignment	(Daniel T. Holt and Vardaman, 2013).
Support climate	(Daniel T. Holt and Vardaman, 2013).
Facilitation	(Daniel T. Holt and Vardaman, 2013).

Table 4. 4 shows the readiness criterion for the conceptual model

The full description and justification for inclusion in the readiness criteria can be seen below.

Discrepancy - a belief that there is need for a change. That there is a difference between the current and future state. This notion is supported by the literature notably by Armenakis & Harris, (2009) who state this is one of five main beliefs that contribute to a change effort. Kotter J. P. and Schlesinger, L. A. (1979) support this with the first step of their 8-step model, which is to create a sense of urgency, to develop and promote the change as a necessity. In other words, convince employees and management that there is a need for change. Lastly, Oakland, J. S. and Tanner S.J., (2007) identify a need for change in their figure of 8 model where this forms part of their readiness criteria along with planning and leadership.

Appropriateness - a change is an appropriate response to organisational issues.

This is the belief held by employees and management that a specific change is correct for the situation that is being addressed (Armenakis & Harris, 2009; Holt & Vardaman, 2013). Kotter J. P. and Schlesinger, L. A., (1979) suggest it creates a form of resistance if it is considered the wrong or inappropriate approach and therefore agreement is conducive to readiness.

Personal Valence - an individual's belief that change has intrinsic and extrinsic benefits including the perceived benefits of a change for an individual, has personal benefits (Armenakis, Harris and Mossholder, 1993). Personal "valence reflects the belief that the change is beneficial to the change recipient; there is something of benefit in it for them" (Armenakis & Harris, 2009, p129). If a person perceives the change will hurt them, they are likely to resist or certainly not champion the change. What is in it for me is a question people ask first when confronted with change. Their belief around this has a huge impact on their cognition to support or resist change (Kotter J. P. and Schlesinger, L. A. 1979). Personal valence can help develop momentum for change when employees see how the change will benefit them personally, they will seek out methods to assist in the change transition (Susanto, 2008).

Positive emotions about change - According to Rafferty & Minbashian, (2019) positive emotions about a change are critical to an individual's change attitude. Their research suggests that change readiness is indeed a cognitive and emotional construct, which requires that researchers consider both backgrounds and experiences when defining and assessing change readiness.

Change self-efficacy - Confidence in your ability to affect change (Daniel T. Holt and Vardaman, 2013). Efficacy refers to the belief of the change recipient that they can successfully implement a change (Armenakis and Harris, 2009), a belief that change could be implemented (Holt *et al.*, 2007). Self-efficacy is a fundamentally significant feature because efficacy is related to the amount of effort and persistence individuals are willing to exert towards the goals (Holt & Vardaman, 2013; Bandura, 1982).

Principal Support – This is the perceived provisional support from a range of leaders, formal, informal and opinion leaders, direct line management and one's peers, (Holt and Vardaman, 2013). The idea of principal support is conducive to readiness when

the change recipient perceives his/her group or social environment as supportive of such change initiatives (Vakola, 2013).

Awareness and mindfulness – According to Gondo et al., (2013) awareness and mindfulness are being attentive to, aware of and mindful of how a change is unfolding in the present, awareness of their routine behaviours and how they need to change. It allows change recipients to identify and challenge their help assumptions, alter routine behaviours, and contribute to the change effort. Fundamentally, mindfulness is 'being attentive to and aware of what is taking place in the present. Additionally, Charoensukmongkol, (2017) asserts that mindfulness can facilitate employees in lowering change resistance, which will encourage readiness, through the role of optimism and general self-efficacy associated with mindfulness. Fundamentally, mindfulness is being attentive to and aware of what is taking place.

Collective commitment – shared belief and resolve to pursue courses of action that will lead to successful change implementation. Commitment based on "want to" motives reflects the highest level of commitment to implement organisational change. It is these I want to motives, that the instrument questions are based (Holt and Vardaman, 2013; Weiner, 2009).

Collective efficacy – is a belief in their shared conjoint capabilities to organize and execute the courses of action required to implement change successfully (Holt and Vardaman, 2013). Additionally, Vakola, (2013) asserts collective efficacy is when the change recipients perceive his/her organisation as ready and capable of implementing the change. Organisation success is reliant on the collective and coordinated actions of many interdependent individuals who each contribute to the change effort. In cases like CE transition, when reliance on each other is high, a shared sense of confidence in collective resolve may be a much stronger indicator of readiness for change than individuals' confidence. (Daniel T. Holt and Vardaman, 2013).

Collective trust – a shared belief that leaders will act in the best interest of the organisation's stakeholders (Holt and Vardaman, 2013). According to Weiner, (2009) organisational readiness is a shared psychological state in which members feel committed to implementing an organizational change and confident in their collective

abilities to do so. Considering organisational readiness in this way works best where collective, coordinated behaviours are necessary to effectively implement the change. A transition to CE requires collective, coordinated change.

Skills and knowledge alignment – the degree to which the employees' knowledge, skills and abilities align with the change (Holt and Vardaman, 2013). A change to CE requires a paradigm shift in thinking, behaviour, and action, thus requiring new knowledge and skills. Asking questions of the entire workforce, to what extent their knowledge, skills, and abilities match their new roles is fundamental to the change effort.

Support climate – sufficient tangible (e.g., funding, reward, and incentive systems) and an encouraging intangible environment (i.e., culture and climate) to support implementation (Holt and Vardaman, 2013).

Facilitation – a set of clearly articulated goals and objectives that are supported by a detailed implementation plan defining roles and systems to measure progress (Holt and Vardaman, 2013).

These inputs have been blended into the model and relate specifically to the literature surrounding change readiness. Of course, each SME will have a different journey to circularity depending on the nature of their business, process, products and their position in the supply chain. Therefore, their vision and strategy will be different, moreover, their leadership and approach to the CE transition will be different. It is these factors that relate to individual and collective readiness as well as the structural factors. Once a vision has been communicated and a strategy has been declared, it is then that the challenges of resistance may occur and measuring levels of readiness will enable further understanding of the organisation's mindset towards the change.

4.7 The Conceptual model and summary

In summary of this chapter and the development of the conceptual model, in Table 5.2, there is a list of perceived barriers preventing SMEs from adopting CE which were

identified in previous research (Thorley, et al, 2019). This is followed by a more detailed explanation of each barrier from the literature. These barriers were used in contextualising this readiness conceptual model.

This conceptual model relates individual and collective differences directly to the strategy that an SME has developed. It assumes that an SME is making plans and has communicated its strategic vision for transition to CE to the organisation. It is at this point that the individual and collective differences/beliefs are measured as well as the structural factors. At the same time, the model anticipates the barriers and uses the instrument to identify leaders, senior management and staff's perception of the barriers and what they believe in this particular context/strategy.

In Table 4.4 above, there is a list of change criteria that contribute to the conceptual model followed by a more detailed description of each term. The literature suggested any model or framework must be contextualised to the specific change requirement. Therefore, based on reasoning and analysis, Table 4.5, below shows how the barriers from Table 4.2 were mapped and potentially connected to the readiness criteria in Table 4.4 which provides further context for the conceptual model. These are tenuous connections as it is hugely dependent on the strategy and approach the SME is developing. This decision was made based on the reasoning that an organisation would need to be prepared and ready to overcome such barriers if it were to become successful in this transition to CE. The barriers and change criteria are the focus for the development of an instrument (questionnaire) to be created to produce a diagnostic for measurement of an organisation’s readiness for adopting CE. Whilst the barriers and readiness criteria can be linked in this way, it is more for illustrative purposes, in that a relationship exists and could be argued in different combinations. For example, the barrier Lack of support in the supply and demand network could present a myriad of scenarios within a strategy and therefore the appropriateness of the approach could be a contentious point for some participants. For the purpose of the questionnaire, all items are independently questioned on the beliefs about such barriers. It is the individual interpretation of such a barrier that may be perceived differently. The barriers are not measured directly at the organisational level, but the vision and strategy are through organisational valence. However, groups of individual

responses to the barrier questions will identify organisational perceptions towards individual barriers.

Barriers Definition	Readiness criterion
Lack of support supply and demand network/constraints to adopting new circular business models.	Appropriateness, Awareness and mindfulness, collective efficacy.
Lack of capital / financial support Government support / economic and financial drivers, support from public institutions, misaligned incentives.	Collective efficacy, support climate.
Administrative burden	Collective commitment
Lack of technical know-how / technical resource / Lag between design and diffusion or lead time to market.	Change self-efficacy, collective efficacy, Knowledge, and skills alignment.
Lack of information/information management systems	Support climate, Facilitation, and collective efficacy.
Company environmental culture / internal conflict	Support climate, principal support, and collective efficacy.
Lack of customer/consumer interest in the environment / Rigidity of consumer behaviour and business routine	Appropriateness, Awareness, and mindfulness,
Lack of qualified personnel in environmental management	Facilitation, principal support.
Lack of leadership commitment	Collective trust, collective efficacy, Principal support.

Lack of environmental awareness, training, and support	Knowledge and skills alignment, collective trust.

Table 4. 5 below shows the connection of CE barriers to the readiness model context.

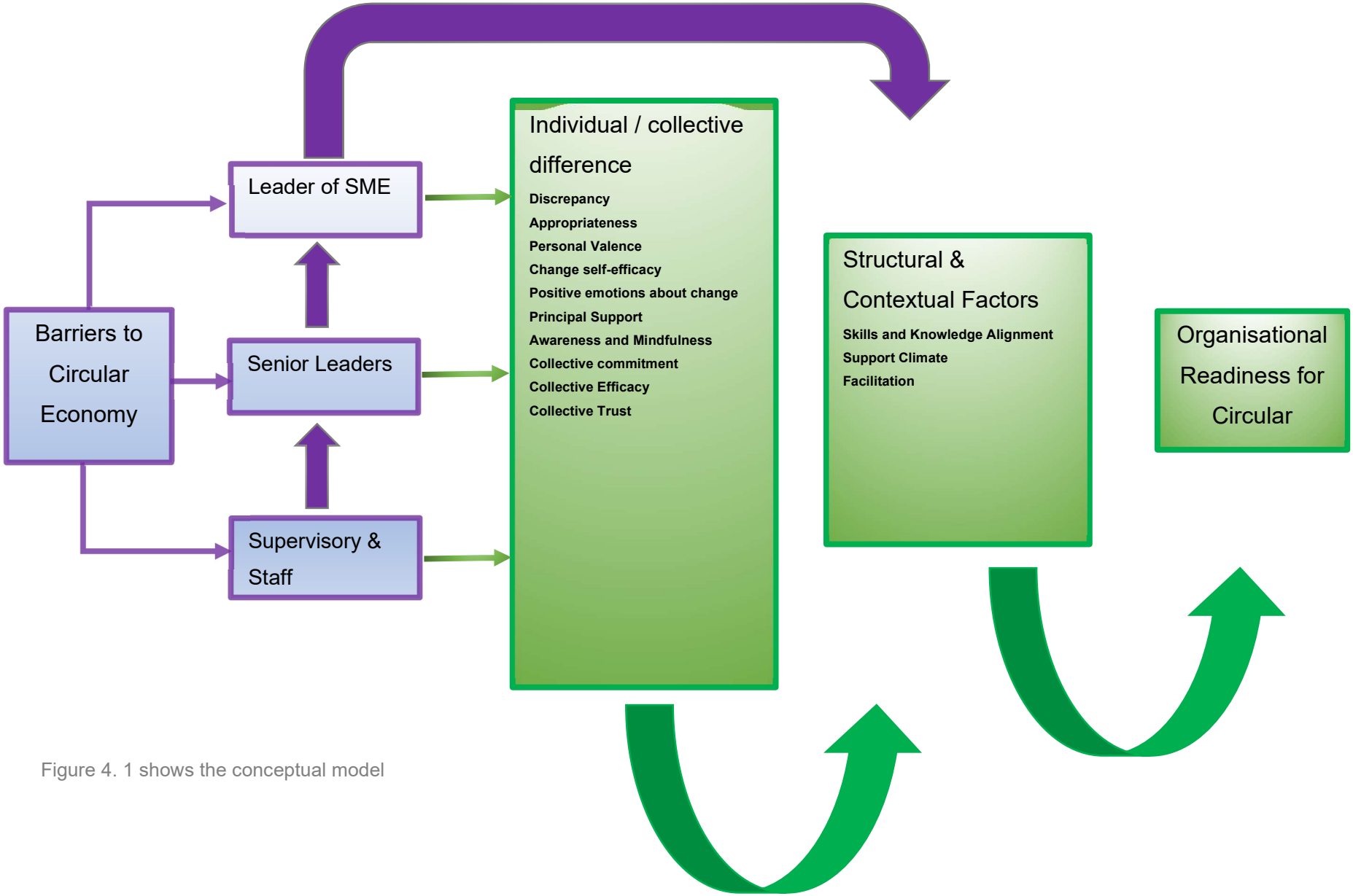


Figure 4. 1 shows the conceptual model

The model itself is depicted in that the barriers form part of the challenge, essentially, the context at the front of the model. These barriers form part of the instrument that leads to the three groups, leader, management and staff, all of whom participate using the instrument in a slightly different form. Also in the instrument, are the individual /collective differences that form part of the criteria for readiness. Then there are the structural factors that contribute to the instrument and organisational change. The combined readiness factors and CE barriers form 23 readiness factors that are essentially the measurement of readiness. The change in colour from purple to green on the arrows simply represents this change transition in favour of CE.

4.8 The instrument

To operationalise the conceptual model shown above, an instrument (questionnaire), was developed that would form the basis for a diagnostic (measurement) of the perception of the organisation's leader, management, and staff. There were three questionnaires developed that were similar but with slightly different wording to reflect the recipient perspective, i.e., the leader, senior management, and staff. The justification for having 3 questionnaires is that the same situation can be perceived differently from different viewpoints. For successful change, it is imperative to consider individuals from all parts of the business, to understand where differences occur which will enable a more informed strategy for developing intervention ideas and tactics to encourage a smooth transition.

According to Michel, et al, (2013) the discussion on approaches to change is moving attention to motivation, ethics, values, identity and culture and is more about individual and group mindset than change strategy in isolation. Determining the readiness for change of employees before organisational changes are implemented, enables leaders to identify gaps that may exist between all members of the organisation compared to their expectations about the change initiative (Holt *et al.*, 2007). Providing opportunities for participation in a change has also been commended as a means to reduce negative attitudes and resistance toward transformations (McKay, et al, 2013). This readiness instrument provides an opportunity to raise awareness and

educate employees about the purposes and value of the change. This social information processing through participation shapes the collective readiness which is constantly influenced by the individuals that comprise the organisation (Armenakis, et al, 1993). Such consultation and developmental interventions empower employees and build confidence through the development of knowledge, skills and abilities needed to cope with the requirements (McKay, et al, 2013). Therefore, this shared social reality must be controlled as it will prescribe what is normal and acceptable to individuals in that organisation. If managed well, it will reinforce cultural patterns of shared assumptions, leading to individual or group readiness rather than resistance (Clausen and Kragh, 2019).

Galagan, (2010) recognises the need for continuous change readiness as a vital part of conscious change management and asserts this conscious approach is supported by a continuous, proactive and awareness-driven culture to promote choice and decision-making. Clausen and Kragh, (2019) suggest the need to broaden the way preparation, planning and evaluation of change are considered and continuous change readiness and Gigliotti *et al.*, (2019) supports building trust towards management.

Conscious change management should be at the heart of the organisation's culture rather than merely concern one individual manager's approach to change management. Whilst leadership is imperative to successful change, this instrument considers the readiness of the entire organisation to be fundamental to preparing individuals to be primed, ready and motivated to engage fully and champion the change. As Gusmerotti *et al.*, (2019) state, for CE implementation, all functions of the business must be involved and therefore all individuals of the organisation must be involved.

How the diagnostic is used, and the follow-up interventions are key to a successful outcome. A copy of these questionnaires can be seen in the appendices, Appendix 5.1, the leader questionnaire, Appendix 5.2 the senior management questionnaire and Appendix 5.3, the staff questionnaire. Some of the questions relate to more than one aspect, i.e., they may relate to one of the barriers but also to the change criteria. For example, questions relating to the barrier "lack of qualified personnel in environmental

management" may also relate to facilitation and principal support. This is depicted in the number at the end of the question. That number is related directly to the number in the analysis table at the end of the questionnaire. There are 23 clusters in total, (10 barriers and 13 change criteria). Each question is rated from 1 to 5, with 5 being the highest level of agreement and 1 being the least agreement. The scores are then totalled up for all participants in each of the three questionnaires and divided by "n" the number of participants to obtain the average score. The leader is much simpler, as it is expected to be just one. Comparisons of the leader, senior management and staff data can be made to evaluate the different perceptions. This aspect should enable a greater understanding of how the change is perceived by the organisation.

The questions that are used in the questionnaire have been developed in different ways. For most of the individual factors, Discrepancy, Appropriateness, Personal Valance, Self-Efficacy and Principal Support, questions were developed by Armenakis (2007) Organisational Change Recipients' Belief Scale (OCRBS). These questions were the same in sentiment but have been adapted slightly for the context of this study. To ensure that the other questions were necessary, relevant and aligned to the research the following approaches were used to justify the questions. They will all be checked for content, cognitive and practical validation. Firstly, the content of the questions must be valid. According to Jose Nicolas Cardona Mora M. et al., (2017) content validity is a method to evaluate how much the items or questions in the questionnaire measure the construct being evaluated. In this case, the construct is the readiness of individuals for CE. The barriers that form 8 factors in the Readiness Model have been related to the readiness in the literature. Structural factors of skills alignment and facilitation and Organisational Valence have been related to Readiness Models previously (Holt and Vardaman 2013; Weiner 2009). In terms of Cognitive validity, Faddar et al., (2017) suggest that questions should be checked whether participants comprehend and understand the item and interpret it as intended. This study utilises the Delphi Pilot and then the Delphi Survey to test the terminology for the questions in the instrument and their suitability for both content and cognitive attributes. They will then be tested again in the validation stage of the research. Finally, for practical considerations, a Likert scale is used to gain responses to the questionnaire. Likert scale is commonly used and understood by the broader population and enables a variety of responses that make it suitable for a Readiness

Model. The questions that are aimed specifically at the barriers are designed from relevance to the context of the Readiness Model / Diagnostic and also for their simplicity in assessing the readiness towards each construct.

4.9 Conclusion

To conclude, the need for change readiness has been discussed and justified for manufacturing SMEs making a transition to CE. The parts of the conceptual model and instrument have been evaluated for inclusion to provide context, content and process aspects of the developed conceptual model. This chapter has explained how the conceptual model of readiness for manufacturing SMEs' adopting CE was derived, which is adopted from conceptual models of readiness and research (Holt, Armenakis, Feild, & Harris, 2007; Holt & Vardaman, 2013; Rafferty & Minbashian, 2019; Weiner 2009; Gondo et al, 2013). Within the conceptual model above it was important to define each point in each of the sections as well as an overall method by which the model will be applied. This approach demonstrates the author's thinking, analysis and decisions on how to develop the model which has also considered the personal bias of the author, discussed in Chapter 4. This model captures the fundamental parts such as the operationalisation, and a companywide perspective, i.e., the leader, the management, and the staff. It also includes the barriers for manufacturing SMEs adopting CE (context) and the change criteria (attitudes and beliefs) about the planned change, content and the perceived approach or process.

Chapter 5 Research Methodology and Methods.

5.1 Introduction

Whilst this chapter refers to research methodology, it also covers the research methods. Research methodology and research methods are not the same Adams, John, et al (2014) assert that research method is about how research is conducted and implemented. At the same time, research methodology is the science and philosophy behind the research.

This chapter aims to present the research methodology for the thesis including the purpose of the research, the philosophy, and the development of theory. It also intends to present the research methods, including the approach taken for the study and the strategic choices taken at each stage of the research. Based on a plethora of researchers, and a myriad of terminology this researcher will choose to follow the work by Saunders to understand research philosophy and methods. According to Saunders, Mark N. K., et al. (2019) this onion serves as a route map for describing the research process. The outer two layers of the onion contain thinking about research philosophies and the development of theory. The next three steps aid consideration of research methods, research strategies and the time horizon. At the centre is data collection and analysis.

According to Saunders, Mark N. K., et al. (2019) the term research philosophy refers to a system of beliefs and assumptions about the development and nature of knowledge. These assumptions fall into three main categories, which are called ontological assumptions, epistemological assumptions, and axiological assumptions. The research onion is applied to this study and depicted in Figure 4.2.

5.2 Research Philosophy

According to Saunders M. K., et al (2019) research philosophy falls under three main umbrellas. Firstly, ontology refers to the nature of reality and how the researcher might see the world. Questions relating to the nature of reality and our ways of being in the world are questions of ontology (Zikmund, William G. 2015). Epistemology is concerned with knowledge, and what might be acceptable, valid, and legitimate knowledge. According to Chia, R. (2002) in epistemological inquiries one endeavours to reflect on the approaches and techniques through which reliable and verifiable knowledge is constructed. This might include numeric data, textual and visual data, and facts versus opinion. Lastly, axiology refers to the role of values and ethics. The philosophy adopted by this researcher will be presented by addressing the three key philosophies stated above.

The author's philosophical stance is such that the natural world is benign and that it can be understood using scientific methods to uncover single truths. However, when investigating human endeavours within the world, it is not so. This is different in that the world is constructed through human interaction, especially in business. These interactions are tempered by human perception, driven by values, beliefs, emotions, self-interest, personal attitude to societal influences, social norms, external factors, law, money, risk, and business conduct. Human perception varies from person to person, from culture to culture and also in different situations and scenarios. There are an infinite number of variables that could contribute to the beliefs, emotions, values and attitudes of an individual. Therefore, knowledge is gained by measuring an individual's perception of a future event. The author's philosophical stance considers the five major philosophies below and concludes with a pragmatist approach.

In terms of this research study, as it is associated with organisational change, it will consider five major philosophies for business management research as suggested by (Saunders M. K., et al 2019). The five major philosophies are as the research onion suggests: positivism, critical realism, Interpretivism, Postmodernism and pragmatism.

Positivism

Positivism relates to the position of a natural scientist and endeavours to create observable generalisations. This philosophy promises accurate data and facts from a scientific empiricist approach free from interpretation or bias (Saunders M. K., et al 2019). Positivism has but one objective reality and it is singular and separate from consciousness (Zikmund, William G. 2015).

Critical Realism

Critical realism focuses on the explanation of what we see, experience, and observe. Critical realists see reality as sensations, manifestations, or representations of reality rather than actual things. Part of this two-step process is the second stage where mental processing takes place to understand and reflect on the causes of such representations (Saunders M. K., et al 2019).

Interpretivism

According to Saunders M. K., et al (2019) interpretivism essentially takes the view that humans can create meaning and therefore observe differently from physical incidents. Interpretivism rejects the notion of a single objective measurable reality but rather insists there are subjective multiple constructed realities (Mason, P, 2022). Interpretivism argues that social science cannot be observed in the same way as natural science because there may be multiple social realities formed from differing backgrounds, cultures, circumstances, and experiences of the people being studied (Saunders M. K., et al, 2019).

Post-Modernism

Post-modernism tends to emphasise the role of language and seeks to challenge accepted ways of thinking. This philosophy deems order can only be sought through language categorisation and classifications and favours chaos, flux, movement, and fluidity. They also recognise language as being partial and inadequate resulting in

decisions about what is right and truthful about the world being taken by power relations that dominate a particular context (Saunders M. K., et al 2019).

Pragmatism

Pragmatism considers concepts, ideas, theories hypotheses and research findings in terms of the role they play in forming instruments that impact thought actions and behaviour in a specific scenario and context. For a pragmatist, research will begin with a problem for which they seek to ascertain a solution to transform the practical reality in each context (Saunders M. K., et al 2019).

In terms of ontology, it asks the question, what is real? Mason, P, (2022) postulates there are two possible responses based on different paradigms. One is, that there is a single objective truth, or knowable reality determined by a set of laws, which is a positivist approach. Alternatively, those who don't subscribe to this notion and believe there are many truths, and they are subjective, created by people in their heads, are known as interpretivists or (constructivists). The researcher in this study adopts a lifelong belief that SMEs have little time and resources for such topics as change management and readiness for change. This assumption is made based on working within and providing training to SMEs for many years, experiencing how they operate daily and at times of adversity. Further, the author believes there are many solutions to the challenges faced by organisations' transition to CE, therefore mindful of many subjective realities. In terms of epistemology and knowledge being legitimate, the belief here is that reality sits in the industrial setting in each organisation and that whilst academic research is helpful, there is a gap that exists between research and reality "in the field". The researcher therefore adopts the belief that to have an impact, the researcher must bridge this gap between academia and industry. This leads to the aspiration to design an instrument that is value-adding, meaningful simple and easy to use. Finally, concerning axiology, the author's values and ethics will also be key to the nature of this research because the author's values have been shaped through years of working with organisational change as a recipient of change and a driver of change. Therefore, there is an assumption that has been developed through personal values and ethics of how organisational change should be delivered what aspects of human behaviour hamper the change process and additionally, what characteristics

of the change agent could also impact the level of change success, both positively and negatively. Furthermore, the researcher adopts a social constructivism or interpretivism viewpoint as a set of assumptions in that there is a belief that social reality is made from perceptions and consequent actions of people. Moreover, the belief is that reality is constructed intersubjectively in which social actors create partially shared meaning and reality (Saunders M. K., et al 2019). Philosophical attitudes (often inherited from our cultural background), shape our strategies for knowledge creation and action. Such attitudes shape our means of thought and our methods of sense-making. They guide our focus of attention, what we consider to be important or trivial, and ultimately our methods of conceptualization (Chia, R. 2002). Therefore, as a researcher, it is imperative to be mindful of personal bias and preferences when carrying out research. However, it is quite clear that the researcher in this case will adopt a pragmatist approach to research. Pragmatism is defined by Saunders M. K., et al (2019 p111) "as a philosophy which argues that the most important determinant of the research design adopted is the research question(s) and objectives, the aim often being to contribute practical solutions." Having impact within the research is of paramount value and importance and therefore dictates the approach. Furthermore, the researcher concurs with the notion presented by Saunders M. K., et al (2019), which suggests the pragmatist's perspective that it is perfectly reasonable to work with diverse kinds of knowledge and methods. For the reasons mentioned above the justification for a pragmatist approach has been chosen.

5.3 Research Purpose

Research essentially is about the production of new knowledge (O'Gorman, K. D., and MacIntosh, R. 2015). Research purpose can be one of 4 types according to Saunders M. K., et al (2019), exploratory, explanatory, descriptive or evaluative. He argues it can also be a combination of the four types. The purpose of this research is to understand what prevents an SME from adopting CE, thus making it exploratory but at the same time validating a tool /model that means it is also evaluative, a combination. This kind of research aligns with what O'Gorman, K. D., and MacIntosh, R. (2015) label mode 2 research where the emphasis is on real-world problem-solving. It also focuses on an industry looking to achieve a specific outcome and a dominant

factor is that the research delivers a practical solution rather than a curious theory. The purpose of this research is to propose a method to better understand how an SME can prepare their employees and management through planning the strategy for the journey to circularity. It therefore creates a tool for measuring the readiness of an SME for adopting CE. Based on the researcher's philosophy, it endeavours to focus on impact, thus closing the perceived gap between academia and reality for an SME. The tool is designed to present feedback to the leadership team about their individual and collective attitudes and beliefs toward adopting CE and allows them to make judgements about change interventions and changes to strategy to ensure maximum readiness.

5.4 Approach to the Development of Theory.

According to Adams, John, et al (2014) there are two styles of reasoning, either inductivism or deductivism, also known as induction and deduction, respectively. However, Saunders M. K., et al (2019) state there are indeed three approaches to theory development to add a third of abduction to the already two identified as induction and deduction. Inductivism or induction is a bottom-up approach and relies on broader generalisations and theories (Saunders M. K., et al 2019). With this kind of reasoning, hypotheses are formed based on the observation and measurement of ongoing occurrences of phenomena that can then be investigated. According to Mason P, (2022) it is unlikely to use a hypothesis, but more likely to work from the unknown, collecting data. Deductivism or Deduction involves the testing of a theoretical proposition by designing a research strategy to perform the test (Saunders M. K., et al 2019). Deduction research often involves the application of previous theories. Deduction is where a researcher proposes a hypothesis and endeavours to prove or disprove this hypothesis Mason P, (2022). The third approach is abduction which combines both induction and deduction. This essentially involves the collection of data to explore a phenomenon and then generate a new or modified theory that is to be tested (Saunders M. K., et al 2019). Induction is to draw general conclusions from a finite number of predictions and relies on empirical verification. Conversely, deduction is where hypotheses are tested against the observations. Interestingly, they

are not opposite perspectives but are complimentary with researchers often swapping between the two (Adams, John, et al 2014).

In summary, induction is moving from data to theory. Deduction is moving from theory to data and an abductive approach moves back and forth, combining both approaches. Abduction starts with an occurrence and works out a plausible theory and Saunders M. K., et al (2019), suggest that the perceived choice between inductivism and deductivism is not at all rigid and they can be combined in the same piece of research and may indeed be advantageous to do so. However, this thesis takes an inductive approach by first making specific observations and developing general conclusions. It starts with a research question which guides the collection of empirical data. It is an exploratory process by nature, open-ended and aims to build theory from research and existing theory. It involves collecting data through Delphi with a group of experts, to understand their perspectives and develop a new theory. This empirical data then drives the researcher to generate ideas to explain the concept of readiness for CE and develop a theory to explain the concept. To conclude, this research will adopt an inductive approach.

5.5 Research Design

The next stage of the research onion is the methods to use for design. When choosing a method, there is generally a choice of three Saunders M. K., et al (2019) qualitative methods, quantitative methods, and mixed methods. Quantitative methods generally use numeric data or analysis using graphs or statistics, whereas qualitative methods use non-numeric data collection techniques and analysis through word cloud or categorising data that uses words or audio recordings to generate non-numeric data (Saunders M. K., et al 2019). Additionally, Wallwey and Kajfez, (2023) state quantitative research is specifically useful in examining the existence and strength of relationships among variables. By contrast, Wallwey and Kajfez, (2023) insist qualitative research is best when designing and conducting new research, developing new theories, and revising previous theories better to explain humans' experiences, thoughts, and behaviours,

Whilst this has been recognised as problematic having to choose one or the other, a popular choice is to have a mixed method, where both quantitative and qualitative techniques are applied at the data collection and analytical stage of the same project (Saunders M. K., et al 2019). It is argued, that researchers can improve research performance by using mixed, with both methodological strategies (Wallwey and Kajfez, 2023).

A mixed method approach aligns perfectly with a pragmatist philosophy due to enabling the collection of credible, reliable, and relevant data. Moreover, it is a pluralist view in that it is a legitimate approach to use both quantitative and qualitative methods and that approaches to research should be flexible, respecting the approaches of other researchers.

This research utilises a mixed method simple rather than complex, in that it uses a single linear phase of data collection and analysis rather than multiple phases of data collection and analysis. The table below demonstrates the tools and techniques that have been applied to the research and the particular method to which they belong.

Tools and Techniques	Method
Systematic Literature Review	Qualitative
Delphi Survey	Quantitative and Qualitative
Readiness Indicator (instrument)	Quantitative and Qualitative

Table 5. 1 shows the tools and techniques utilised in the research. Source – Author

This research study commences with a combination of two Systematic Literature Reviews, the latter of which is essentially a qualitative process of exploring the literature and identifying the research gap. Both of these two SLRs follow the steps and techniques outlined by (Mulrow, 1994; Tranfield, et al, 2003) and stated by (Xavier, et al, 2017).

Then, a third comprehensive literature review to further interrogate the literature to build a conceptual model. The approach to developing a conceptual model follows two theories, firstly, design dimensions as partly adapted from Eccles, (2006) who proposes theory analysis and secondly Blended theory as stated by Fauconnier and

Turner, (2008) who suggest Blended theory incorporates three steps for the development of the blend, which are composition, completion, and elaboration.

Evaluation and analysis, using the blending theory of existing inputs and models of change readiness and research enabled the building of a new emergent conceptual model.

The next phase of this research was to verify this conceptual model which employs a Delphi research survey which is both qualitative and quantitative. Finally, the Readiness Model and (instrument) are validated in the industry by applying the tool to a real-world problem. Feedback from this experience of applying the instrument will also be both qualitative and quantitative methods, using questionnaires. A more detailed view of the research methodology can be found in Figure 5.1 below.

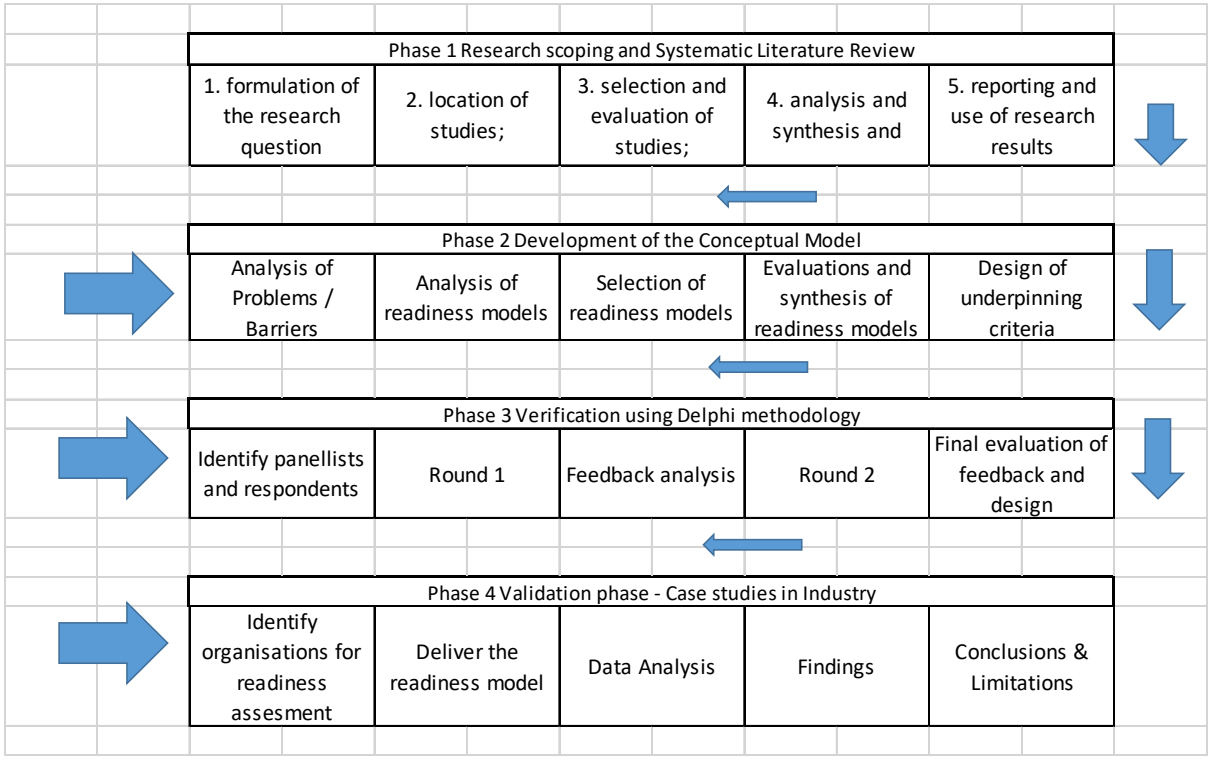


Figure 5. 1 Showing a flow chart depicting the key objectives and research methodology

The benefits of using a mixed methods design according to Saunders M. K., et al (2019) are initially used for defining the research questions, providing contextual background, and better understanding the research problem. It also allows flexibility from learning from new insights part way through the research and further analysis of meaning and findings helping to clarify, enhance and confirm understanding.

5.6 Strategic choice

Once the literature reviews were carried out, the gap in the knowledge identified and a conceptual model produced, the research strategy for its subsequent verification and validation would be sought. The research strategy is a defined plan of how the researcher intends to answer the questions postulated in the thesis. Saunders M. K., et al (2019) recognise that there are often open boundaries between research philosophies, research design and strategy and discuss several strategies from the research onion outlined below.

The experiment has its roots in natural science research and is seen as the gold standard against which the rigour of other strategies is assessed.

Survey strategy is popular with business and management studies for the collection of standardised data from many participants. It is deemed easy to explain and understand.

Archival and documentary research is associated with the digitisation of data and creation of archives which has accelerated the use of this strategy as it is possible to access online sources from around the world.

A case study is the investigation into a topic in a real-life setting and can refer to a person, group of people, an industry, an organisation a change process or any other number of types of case subjects.

Ethnography refers to the study of a group, such as a culture or community with social ties. One approach to ethnography is for the researcher to live amongst those they study and talk to them and create cultural accounts of their shared beliefs, language, rituals, and events that shaped their lives.

Action Research is an emergent and iterative process of applying new knowledge to organisational problems through a collaborative and participative approach to finding

a solution in real time. They apply the action for practical purposes for resolving issues.

Grounded Theory refers to the data collection techniques and analytical procedures that it employs. It specifically refers to a theory that is grounded in or developed inductively from a set of data.

Narrative inquiry is a personal story or account which interprets an event or series of events. It is best applied where the researcher believes the experience of participants can best be accessed by collecting and analysing these complete stories.

(Saunders M. K., et al 2019).

On the evaluation of the strategies that are open for consideration, it was deemed that the survey and case study/action research offered practical and achievable methods as well as scientifically acceptable strategies for verification. However, due to the position held by the researcher, not being employed in an organisation where a case study could be deployed, this was no longer a practical option. The most practical method to use was a survey and the most favourable survey strategy, in this instance uses the Delphi method or technique as a way of eliciting and refining group judgments (Dalkey, 1969). The Delphi is a group facilitation technique that seeks to obtain consensus on the opinions of experts through a series of structured questionnaires (commonly referred to as rounds). These `experts' (commonly referred to as the panellists, participants, or respondents) complete the questionnaires anonymously (Hasson, et al, 2000). According to Okoli and Pawlowski, (2004) using a Delphi survey research tool increases the rigour and confidence with which researchers can use the results in subsequent studies and which managers can use the verified tool in application. The Delphi model has been criticised for the lack of methodological rigour and there are no universal guidelines (Hasson, et al, 2000). However, according to Gracht, Von Der (2012) the term (Delphi study) has become even more popular in recent years and argues that this methodology is widely accepted as a research technique and that its value has been scientifically and practically proven.

The ideal method for validation would be a case study with action research. Whilst a case study strategy can engender new insights, and rich empirical descriptions in a real-life context, leading to new theories and applications Saunders M. K., et al (2019) also propose that action research can promote organisational learning to produce practical outcomes, identify barriers through the planning, taking and evaluation of an action. Also, as highlighted by Moody, (2005) the case study is a passive research method and action research, which is an active variant of the case study, is well suited to the validation of a framework or model. Therefore, this research method of case study with action research would be the perfect strategy to adopt. However, this approach relies on a huge commitment from an SME willing to invest much time and resources for the action research case study approach. Therefore, for practical reasons and time constraints, the validation of the verified Readiness Model and (instrument), was a partial validation using a presentation, simulation and demonstration of the instrument with survey feedback, that was carried out with a manufacturing SME.

5.7 Time Horizon

According to Saunders M. K., et al (2019) one question researchers must face is whether they intend their research to be a snapshot of a given time or a series of snapshots, likened to a diary, covering a given period. The snapshot time horizon is therefore either labelled cross-sectional (a snapshot in time) or likened to a diary which is labelled longitudinal. Cross-sectional studies often use a survey strategy but also may include qualitative or mixed methods strategy (Saunders M. K., et al 2019). This research will lend itself to cross-sectional as it is intended to run just once and act as an indicator as to how ready for CE an organisation is and provide feedback to the company as to how to plan for interventions to increase the level of readiness. It could be argued that this tool can be used several times during the change process, but for the duration of this research will be used just once.

5.8 Data Collection and Analysis

Reliability and validity are core aspects associated with research quality. Reliability is about the level of consistency and whether the research could be replicated by another researcher and find the same results. Validity is more about the appropriateness of the measure, the accuracy of the analysis and whether the results can be generalised (Saunders M. K., et al 2019). In essence, Saunders M. K., et al (2019) assert three key questions to be considered are:

1. Are the measures in the research appropriate for their intended purpose?
2. Is the analysis of the results accurate?
3. What do the research findings represent and can they be generalised?

Research strategy, tools, and techniques	Systematic Literature Review	Delphi Survey	Readiness Model Validation.
Sampling Method	Keyword searches	Purposive sampling	Volunteer sampling
Data Collection technique	Categorisation of terms	Questionnaire	Questionnaire facilitated Presentation
Analysis method	Gaps in the research	Qualitative and quantitative	Qualitative and Quantitative

Table 5. 2 shows the validity of sampling data collection and analysis

There are several types of validity according to Saunders M. K., et al (2019) but the two main types to be discussed here are internal and external validity. Internal validity refers to consistency and suggests using more than one researcher to conduct interviews, analyse data and evaluate how much they agree with the data and its analysis. However, this would not be possible as it is an individual piece of work, but they also suggest summarising the coding of data, analysis, and interpretation, which is possible. External validity refers to whether the data collection process and analysis could be performed by different research and glean the same results. Threats to reliability include participant error, participant bias, researcher error and researcher bias. Whilst trying to eliminate every possible contributing factor in these areas, being

aware of them helps to reduce some aspects that become apparent. For instance, selecting participants for the Delphi survey needs to rule out unqualified people contributing to the survey. Furthermore, how they understand and respond to the questionnaire may incorporate participant bias. Of course, the more obvious challenges are researcher error and bias.

A systematic literature review adopts a keyword search to capture all published work between a given time amongst a defined number of search engines/databases.

According to Briner and Denyer, (2012) A systematic literature review involves five key steps:

(1) planning the review,
(2) locating studies,
(3) appraising contributions,
(4) analysing and synthesizing information, and
(5) reporting “best evidence.

Systematic reviews allow us to conclude, though, of course, with varying levels of certainty, consistency, and confidence about what is known and not known about the answer to the review question. This process was adopted to help identify the research question and gap in the research.

A Delphi survey technique was identified to verify the conceptual model. As part of the Delphi survey, panellists or participants would be required and purposive sampling was used to determine qualified participants. In terms of sampling techniques, Saunders M. K., et al (2019) suggest they fall into two main categories, probability, and non-probability. For the sake of this part of the study, purposive sampling also known as judgemental sampling was employed to ensure the choice of participant enable the researcher to best answer the research question and meet the objectives (Saunders M. K., et al 2019). Purposive sampling is best used when working with small samples and the data is not reliant on a statistical representation of the target population. The data collection technique was using a 2-iteration questionnaire, which was adjusted based on feedback. The analysis method was both quantitative in that it relied on gaining consensus but also qualitative in that there were specific comments

made that would be judged by the researcher in terms of relevance and appropriateness.

In terms of validating the Readiness Model (diagnostic) and instrument, volunteer sampling was adopted. Volunteer sampling falls into two types, either snowball sampling or self-selection sampling Saunders M. K., et al (2019). Snowball sampling is when participants volunteer to be part of the study, and that participant may introduce you to another participant, hence the snowball effect. However, the challenge is contacting the first willing participant. Alternatively, is the self-selection sampling which is where an individual or organisation express a desire to take part in the study. However, the challenge here is to publicise the study asking for participants to contribute and take part in the study (Saunders M. K., 2019). It is effectively the same challenge for both, which is to attract the first willing organisation. The latter technique of self-selection is adopted by advertising the opportunity to be part of the study. In essence, the validation of the Readiness model will be achieved following several steps highlighted below.

1. Identify an SME for participation in action research.
2. This SME identifies the context by which the Readiness model will operate.
3. Determine the specification by which acceptance of the Readiness model will be judged.
4. Define a method for measuring the level of acceptance or validity of the Readiness model.

5.9 Conclusion and Summary

In conclusion, it appears there are many methods and approaches to research depending on many varying factors such as the area of study the research question and even the researcher. Other practical and realistic aspects impact such as how many researchers, budget and access to information, knowledge, and people. For this study, the research overview was based on Saunders's research onion and adopted a pragmatist approach to research philosophy as indicated in Figure 5.2 below.

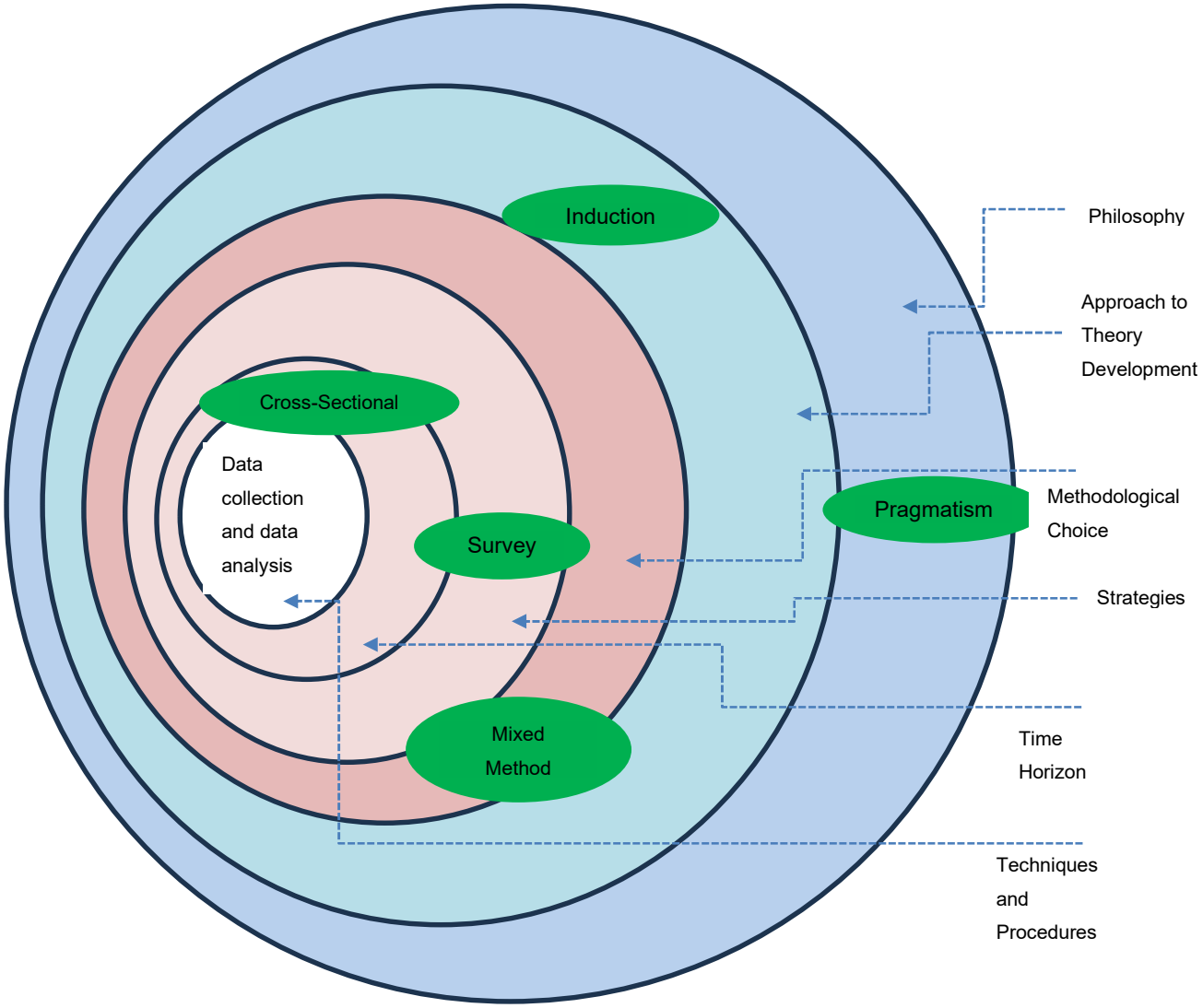


Figure 5. 2 outlines the choice of methodology adopted from Saunder's Research Onion (Saunders M. K. 2019)

This study developed an abductive approach as it combines both inductive and deductive methods throughout the research. The chosen research design is a mixed methods design incorporating both quantitative and qualitative approaches. The strategy highlighted is a Delphi survey through the verification stage and then action-centred research, with presentation and questionnaire through the partial validation of the Readiness Model and diagnostic instrument, with a cross-sectional time horizon. The research participants for the Delphi study used purposive sampling and the action-centred case study employed volunteer, self-selection sampling.

Chapter 6 Verification of the Readiness Conceptual Model.

6.1 Introduction

Now that the conceptual model has been fully developed, the next stage of the research was the verification process of the conceptual model. This verification process was carried out before the validation stage which will see this model applied in an industrial setting. To verify this conceptual model the Delphi technique was applied. The adoption of the Delphi method was used in the fields of management and marketing, medical science, and information systems in the early 1970s. Delphi was considered a legitimate research method in academia primarily where collecting the focused opinions of a large group of respondents was shown to have potential benefits (Lund, 2020).

The Delphi method according to Toma and Picioreanu, (2016 p48) is defined “as a structured communication technique that allows a group of individuals, acting as a whole, to deal with complex problems”. The Delphi Technique is commonly known as a consensus method, as it aims to generate a general agreement or convergence of opinion around a particular topic (McMillan, et al, 2016). According to (Freitas *et al.*, 2018; and von der Gracht, 2012) the Delphi enables gathering opinions and knowledge of a wide range of individuals with diverse backgrounds and located in various regions as well as ensuring anonymity. While Delphi is a popular choice for research verification, it comes with limitations like all research methods. Winkler and Moser, (2016) warn of the researchers’ cognitive biases taking effect at different stages, including feedback and revision loops.

According to Linstone, H.A., Turoff, (2002) several requirements may lead to the application of Delphi. In this particular study, these requirements are the need for individuals to contribute to the examination of a broad or complex problem. They also need to represent diverse backgrounds concerning experience or expertise. Time and cost make frequent group meetings infeasible, so a Delphi study administered online

will facilitate such by reducing time and cost. Finally, anonymity must be assured to reduce bias and avoidance of domination by quantity or by strength of personality.

This chapter aimed to employ the Delphi approach to verify the conceptual readiness model. Using this methodology requires a thorough understanding of its application, process, and design aspects. As can be noted in the flow chart below, the first task was to gain this understanding before designing the research to apply in this context. The objectives of this chapter were to:

1. Create a Delphi research design to verify the conceptual readiness model.
2. Identify and improve operational aspects of the conceptual model.
3. Ensure suitability of the conceptual model to deliver benefits on application.

6.2 Overview of the Delphi Method

Below is a flow chart depicting the steps taken to administer the Delphi research and application. This process was followed and is described within this Chapter along with a justification for the approach.

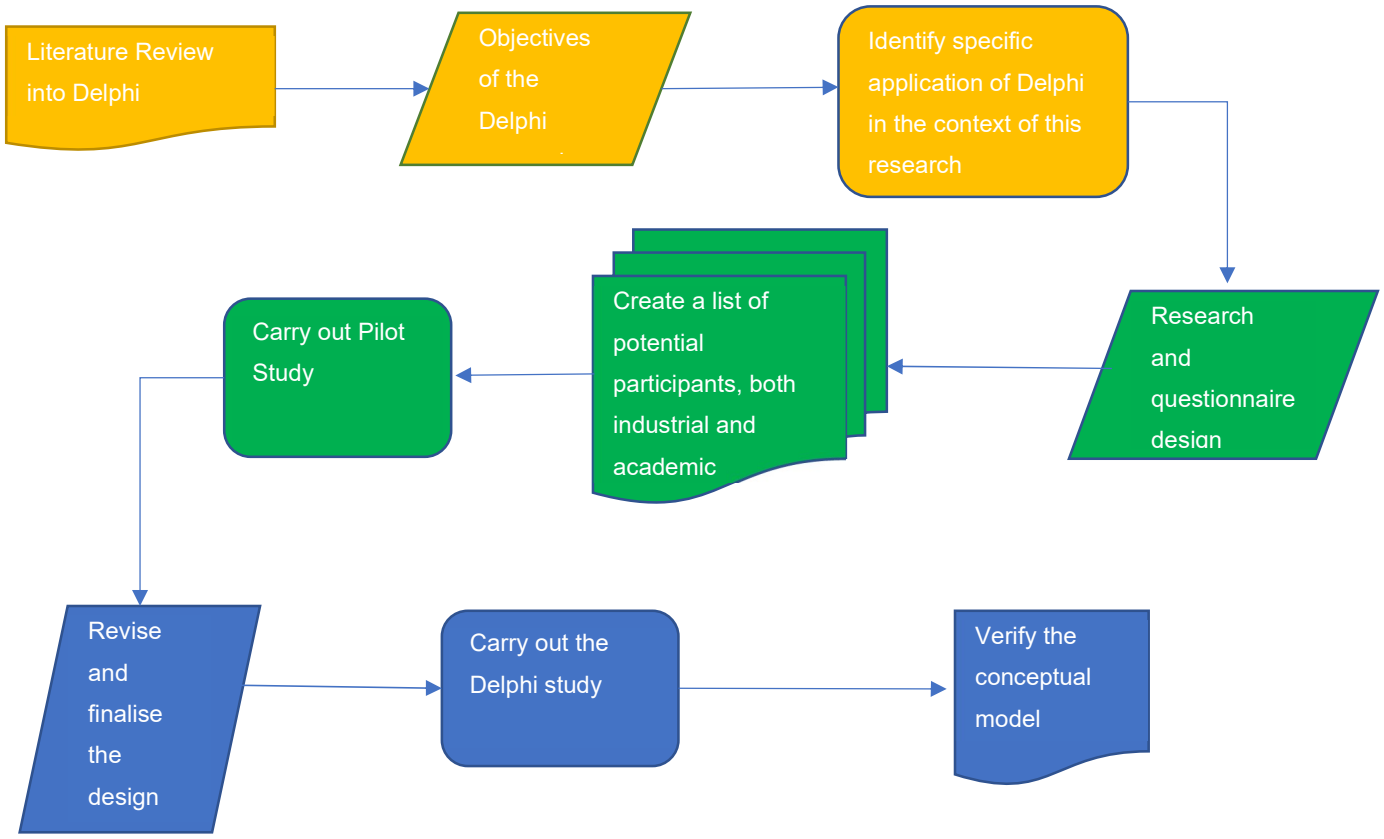


Figure 6. 1 Flow chart identifying the Delphi methodology for research design

Delphi Method takes its name from the ancient Greek city that housed the oracle, where Pythia, a priestess allegedly communicated directly with the gods (Avella, 2016). However, the Delphi survey technique, hereafter referred to as "Delphi" was originally developed by U.S. Rand Corporation for technology forecasting (Hasson, et al, 2000). Delphi is a method for identifying and refining group judgements (Dalkey, 1969). Since the 1950s the usage of Delphi has assumed several development stages, stagnating for a while in the 1980s and then made popular again in the 1990s (von der Gracht, 2012). Delphi has three key features anonymous response, iteration and controlled feedback and statistical group response, all designed to minimise the bias effect of dominating individuals and social pressure to conform to others' ideas (Dalkey, 1969). Okoli and Pawlowski, (2004) suggest Delphi is a method for dealing

with a complex problem using a structured group communication process that allows a group of individuals, to act as a whole, to seek consensus effectively.

Delphi is predominantly a forecasting procedure because of its noteworthy application in that area, but there are other areas where Delphi can be applied (Linstone, H.A., Turoff, 2002). The Delphi procedure has been applied repeatedly across many distinct fields, incorporating judgmental forecasting and policy-focused decision-making in various contexts (Belton *et al.*, 2019). However, concept/framework development signifies an additional type of application of the Delphi method. These types of study typically involve a two-step process beginning with the identification and elaboration of a concept, followed by classification and development Okoli and Pawlowski, (2004) and are becoming increasingly popular among student qualitative researchers pursuing their dissertations (Avella, 2016).

Whilst Delphi has proved popular over recent years, according to Hasson, et al, (2000) there are no universal guidelines to conduct Delphi. However, Belton *et al.*, (2019) set out a practical approach to both the design and delivery of a Delphi survey. Delphi is a research approach that includes several experts (participants) in the specific field of research (Okoli and Pawlowski, 2004). These participants may have practical experience (industrialists) or maybe academics. The researcher compiles a questionnaire around the topic of study and disseminates this to the group of participants.

As with all Delphi surveys, pilot testing with a small group of participants should precede implementation (Hasson, et al, 2000). McMillan, et al, (2016) state the first-round questionnaire will show a string of statements that the participant is invited to rate on a clearly defined Likert scale. The questionnaires are disseminated anonymously, in that each participant is not aware of other participants and their responses. By designing an anonymous environment and bypassing those weaknesses found in meetings and conferences, researchers have been able to accurately forecast (Avella, 2016). Delphi is primarily employed in cases where judgmental information is indispensable, and where controlled opinion feedback avoids confrontation of the participants or experts (Okoli and Pawlowski, 2004).

After dissemination, the feedback from the questionnaire is received by the researcher and responses are analysed and statistically summarised, which are then presented to the participants for further consideration (Rowe and Wright, 1999). This process of iteration continues for several rounds. The number of survey rounds is usually decided in advance and is dependent upon the level of disagreement expected. In most studies, two rounds are used (McMillan, et al, 2016). Most commonly, round one is structured to make the application of the procedure simpler for the researcher and participants. The number of rounds is variable, though seldom goes beyond one or two rounds or iterations (Rowe and Wright, 1999). More than two rounds increase participant attrition, so this is rarely done (McMillan, et al, 2016). However, the round process continues until the goal of “consensus” is achieved (Avella, 2016; Linstone, H.A., Turoff, 2002). If Delphi requires to reach a consensus amongst the participants, then McMillan, et al, (2016) the decision as to when consensus will have been attained must be decided at the beginning of the study.

Consensus is when the participants form an agreement over time through the rounds or iterations of the Delphi process. Consensus methods raise potential solutions to a question, which can then be prioritised or agreed upon (McMillan, et al, 2016). It is imperative that Delphi studies reach a group consensus and therefore it is essential for researchers to choose how they wish to define and manage that consensus design, given there is no standard method (Belton *et al.*, 2019). A balanced contribution from participants is a key strength of consensus methods (McMillan, et al, 2016).

6.2.1 Delphi features.

Delphi is a group facilitation technique that seeks the opinions of experts and creates a consensus through the use of structured questionnaires (Hasson et al, 2000). These questionnaires are dispersed individually avoiding confrontation with the experts (Okoli and Pawlowski, 2004). These `experts' (commonly referred to as the panellists, participants or respondents), referred to as participants from here, complete the questionnaires anonymously (Hasson, et al, 2000). Rowe and Wright, (1999) define a procedure for Delphi using four key features which are: iteration, controlled feedback, anonymity, and the statistical sum of group response.

Iteration and controlled feedback is a systematic exercise conducted in several iterations (Dalkey, 1969). Between each iteration or round, controlled feedback is provided through which the participants are informed of the opinions of their anonymous colleagues. Participants in a Delphi survey do not interact directly; rather, after the completion of each round of questionnaires, the collated group responses are fed back to participants (Keeley *et al.*, 2016). Using these rounds, individuals are given the chance to change their minds and judgments without fear of being judged as others in the group are anonymised (Rowe and Wright, 1999). Additionally, this idea of controlled feedback is imperative to the process. It facilitates a more independent thought on the part of the experts. Alternatively, confrontation, all too often induces the hasty formulation of preconceived ideas. Experts may be influenced by others with a more persuasive argument or tend to defend a position once taken (Okoli and Pawlowski, 2004). In particular, the structure of the technique is intended to allow access to the positive attributes and negate the negative attributes of interacting groups (Rowe and Wright, 1999). In terms of practical implications, Delphi allows input from a larger number of participants than could feasibly be included in any such meeting, but also from members who are geographically dispersed (Rowe and Wright, 1999). The statistical sum of responses is produced between each questionnaire iteration or round. Controlled anonymous feedback is often presented as a simple statistical summary of the group response, usually comprising a mean or median value, such as the average 'group' estimate. At the end of the polling of participants (i.e., after several rounds), the group perspective is taken as the statistical average (mean/median) of the participants' estimates on the final round. Participants are asked both to rate the item and to write free-text comments that, for example, explain their rating or express disagreement with the statement's relevance (McMillan, et al, 2016). This enables the final judgment to be of equal weight to all participants (Rowe and Wright, 1999).

6.2.2 Disadvantages and limitations of the Delphi.

Like all research approaches Delphi also has limitations. The Delphi is based upon the assumption that several people are less likely to arrive at a wrong decision than just one person deciding alone. Any assumptions are subsequently challenged by

anonymised reasoning and these decisions are then improved, helping to enhance validity (Hasson, et al, 2000). Delphi is not without fault, but according to Avella, (2016), those faults arise with the researcher and not the design. Faults can appear from the failings of the researcher or from participants. The researcher's bias may creep into the process, even unintentionally. How the question(s) are formulated and who is invited to participate can become tools for the researcher's bias to prevail (Linstone, H.A., Turoff, 2002; Avella, 2016).

Bias from the researcher is a major factor, even if it is unintentionally given their position in the process, influencing how the questions are formulated. They may preside over who is invited to participate and may steer, guide or direct responses (Avella, 2016). Other limitations according to Drumm, et al, (2021) might include poor questionnaire design whether the questions, responses and results are meaningful and whether the analysis and interpretation of findings are accurate. An additional limitation is poor attrition rates due to participants losing interest as Delphi use multiple rounds, meaning that the process can take longer to complete than other methods. A potential disadvantage lies in the way feedback is given between rounds or iterations, by poor summarising of panel contributions or incomplete presentation of the group response for the next round (Avella, 2016).

However, potential may exist for Delphi (conducted properly) to produce results far superior to those that have been demonstrated by research (Rowe and Wright, 1999). Therefore, "it would be in the best interest of a Delphi researcher to have an outside expert review the formulation of the question(s). That outside expert could be the dissertation committee chair or another faculty member familiar with the Delphi design" (Avella, 2016, p315).

6.3 The Delphi Process

According to Toma and Picioreanu, (2016) the process for Delphi starts with the preparation stage. It then proceeds with several rounds before reporting the findings of the research. Similarly, Winkler and Moser, (2016) start with the projection/question development. This is followed by expert selection, first estimates, feedback and revised estimates and then final analysis and decision making. According to Day and Bobeva, (2015 p106) “a generic Delphi model, comprising three stages: Exploration, Distillation and Utilisation.”

To implement a Delphi approach, according to Belton *et al.*, (2019) you must identify what is it that you want to gain expert opinion on. This choice influences the selection of expert participants. In terms of this thesis, it was imperative to get expert opinions on how SMEs become ready to make a transition to CE. The expert opinion must identify what skills competencies and behavioural changes are necessary. It must identify the underlying beliefs and attitudes of individuals and that of an SME collectively, that need to be acquired to be ready for transition to CE. The type of industrialist to be selected would be the ones in charge of a company or a senior person within a company that has already “partly or fully” made the transition to CE.

In terms of academics, the target group was individuals who have written papers around change readiness and specifically, the authors of the models where this conceptual model has been further developed. According to Belton *et al.*, (2019) the next step would be to pilot these issues to understand how they are viewed by the expert participants. As with all good surveys, running a pilot test with a small group of individuals would be the best first step (Hasson, et al, 2000). The first round often has open-ended questionnaires that are utilised initially to enable a substantial range of viewpoints to be evaluated (Belton *et al.*, 2019). For this research, it is intended to follow the Delphi process mapped out in the following way. This process has been developed as a result of adapting the Delphi approaches identified in the literature review.

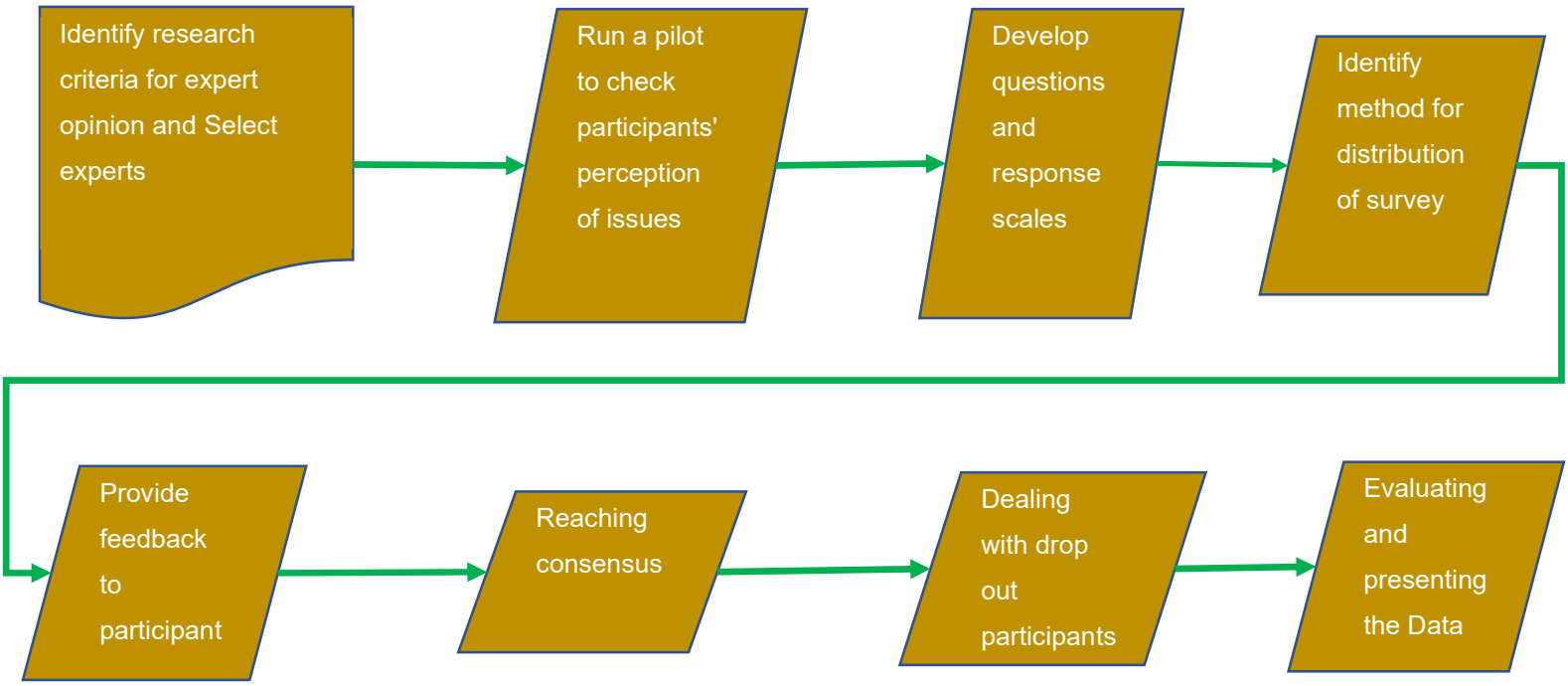


Figure 6. 2 above shows the Delphi Process

6.3.1 Selection of Expert Opinion and Participants

According to Belton *et al.*, (2019) the researcher must first ascertain what it is that you wish to gain expert opinion on. This criterion will influence the selection of expert participants and the design of the survey. However, a Delphi study does not depend on a statistical sample that attempts to be representative of any population. It is a group decision mechanism requiring qualified experts who have a deep understanding of the issues. Therefore, one of the most critical requirements is the selection of qualified experts (Okoli and Pawlowski, 2004; Avella, 2016). Defining those qualified experts should include measurable characteristics that each participant within the group would acknowledge as defining an expert (Avella, 2016). Furthermore, the larger the sample size, the greater the generation of data, which impacts the amount of data analysis, and potential issues of data handling if employing a qualitative first-round approach (Hasson, et al, 2000). As it is proposed to feedback to participants after each round, Belton *et al.*, (2019, p74) warn “This may be a limiting factor since

the volume of material for participants to review after each round can quickly become unmanageable."

"Participants in a Delphi study are traditionally selected based on some level of expertise relevant to the research questions of the study" (Lund, 2020 p930). One technique for the selection of experts is purposive sampling, where participants are not selected randomly, rather, they are selected for a purpose, to apply their knowledge and understanding to a certain problem (Hasson, et al, 2000). It is for this reason that purposive sampling was used, to enable individuals to speak knowledgeably from the position of the group to which they belong. However, researchers must ignore the appeal of becoming a judge of who participates, as this scenario may produce skewed outcomes (Avella, 2016). Purposive sampling is a nonprobability sampling technique where generating a random sample of a population is not of importance. It uses subjective methods to decide which elements are included in the sample (Ilker Etikan, Sulaiman Abubakar Musa, 2017). Using purposive sampling the expert participants were chosen by the researcher in terms of who is perceived to be best placed to contribute to the study. According to Ilker Etikan, and Sulaiman Abubakar Musa, (2017) the purposive sampling technique is the deliberate choice of a participant due to the knowledge and experience of the participant. Put simply, the researcher found people who were willing and capable of providing the information. There are many ways to profile the participants, by age, nationality, knowledge, expertise, qualifications, occupation or position (Day and Bobeva, 2015). For this study, the participants were differentiated by qualifications, research, position, and expertise. Specifically, industrialists by position and expertise, academics by qualifications and research. Therefore, the definition of an industrialist is someone with a senior position in an SME and at least three years of experience in sustainable endeavours and change. In terms of the academic, it is someone at the Doctoral level with research in the field of circular economy or organisational change or both. More on purposive sampling can be seen in Chapter 4.

Sampling method	Purposive Sampling
Sample Size	Ideally 20
Participant profile (academic)	Working at Doctorial or Professorial in a relevant field of organisational change or circular economy
Participant profile (industrialist)	A minimum of 2 years' experience in the fields of management of change and/or environmental issues
Invitation	By letter in an email
Dissemination	Link to MS Forms by email

Table 6. 1 shows the participant selection criteria

6.3.2 Consensus

In a normal application of the Delphi method, the result is a consensus of views amongst the participants. During the last round, only very precise and common feedback is collected, giving a clear, expert response to the research questions (Lund, 2020). However, according to von der Gracht, (2012) a consensus has not been uniformly defined and remains a contentious component of the Delphi method. The method of measuring consensus varies from study to study and could hold a variety of meanings. According to Jarir S. Dajani, et al (1979) in most Delphi studies, consensus is assumed to have been achieved when a pre-determined percentage of the responses fall within a prescribed range. Hasson, et al, (2000) draw upon a variety of studies that suggest the consensus percentage could be equated between 51% agreement amongst respondents, to as much as 80%.

Many Delphi studies have used all kinds of descriptive statistics to measure consensus, including measures of association as well as measures of central tendency and dispersion. (von der Gracht, 2012). According to Belton *et al.*, (2019) measuring both stability and consensus on a round-by-round basis and continuing until acceptable levels of both are achieved is best practice. Stability refers to the consistency of responses between successive rounds of a study. Depending on the parameters used in defining the stopping criterion, "consensus" may or may not

describe the real level of agreement reached by the participants (Jarir S. Dajani, 1979). Belton *et al.*, (2019) suggest researchers should ensure that the chosen approach provides a level of confidence in the outcome. Typically, the first question once the idea of a consensus has been defined is how many rounds it takes to reach consensus. The number of rounds depends on the amount of time available, the number of questions and the consideration of levels of sample fatigue (Hasson, et al, 2000). There is a fine balance between the number of rounds necessary to gain consensus and having too many rounds that create attrition rates. Therefore, based on the above literature, consensus was deemed to have been reached when 70% of participant responses agreed.

6.3.3 Dissemination and Anonymity

In its simplest form, a Delphi procedure comprises a group of individuals responding anonymously to a series of questions (Belton *et al.*, 2019b). Rowe and Wright, (1999) suggest anonymity is achieved through the use of questionnaires, which allows individuals to express their opinions and judgments privately, avoiding social pressures from dominant or dogmatic individuals, or from a majority. For this research, the questionnaire was disseminated by email using a link to MS Forms. This was done because it can easily and efficiently reach a wide audience.

6.3.4 Number of iterations

Sometimes, the number of iterations or rounds to achieve consensus may be greater than expected (Belton *et al.*, 2019b). Rowe and Wright (1999) assert the number of rounds is variable, though seldom goes beyond one or two iterations, during which time most change in participants. However, the Delphi 'researcher', has the autonomy to choose not to hold another round if disagreements remain after a few iterations (Belton *et al.*, 2019b; Rowe and Wright 1999). The plan was to have two iterations at the most to prevent a lengthy process and risk of attrition. This research consisted of a pilot followed by two iterations.

6.3.5 Stopping and Dropping Out

Once participants have been selected, those participants must be approached to engage them in the study. Some researchers target their sample `cold' without any prior notice, which may influence the response rate (Hasson, et al, 2000). Alternatively, one could attempt to build relationships to try and foster a better response rate, but this would be far more time-consuming. Once the participants are engaged with the study, the challenge going forward is to keep them engaged. The risk of asking participants to respond to a topic over several rounds should be carefully assessed, as this could undermine the process by causing drop-out or attrition among participants (Belton *et al.*, 2019). In this research, a mixture of each method was used to try and maximise a broad list of participants. Some potential participants were known to the researcher, and many were cold targets with no prior notice.

6.4 Delphi Research Questionnaire Design

Expert opinion and the selection of participants for this study used purposive sampling. It was designed to get twenty industrialists and twenty academics. To identify potential participants LinkedIn was used as well as various business groups and associates. Okoli and Pawlowski, (2004), insist the questionnaire should not take more than 30 minutes to complete. Further, Kluge, et al, (2020) state that any questionnaire should be tested by a couple of experts for plausibility, comprehensibility and consistency before going live with the study. This questionnaire took approximately 30 minutes to complete and used a pilot to check before going live with the study.

6.4.1 Pilot Testing

The next step was to pilot the Delphi to determine insights into how these issues were perceived by the participants. Day and Bobeva, (2015) recommend conducting a pilot study at the exploration stage and developing the design and content as per the feedback from the participants in the pilot. This idea of pilot testing is reinforced by Hasson, et al, (2000) who suggest the pilot be done with a small group of individuals

before implementation. Therefore, for this study, the pilot was carried out with three academics. The letter for the pilot can be seen in Appendix 6.1 and the participant responses from the pilot study in Appendix 6.2.

6.4.2 Developing the questions and response scales

The language used to formulate how the questions are articulated in a Delphi study, and the options available to participants to respond, are features which must be carefully thought through (Belton *et al.*, 2019). As part of the planning process according to Day and Bobeva, (2015) the researcher must transpose the framework into a set of questions, preparing questionnaires and supporting letters. The type of questionnaire in a Delphi study will depend on how broadly the issue has been contemplated in previous literature (Belton *et al.*, 2019). In this particular case, whilst some aspects have been discussed in previous literature, they have not been applied in this context. According to Belton *et al.*, (2019) in these types of cases, particularly where there has been relatively little research in the field, many more questions may be needed (e.g. 50–85 topics, 7 questions on each topic. Typically, a Delphi survey is designed using a set of questions that necessitate a numeric response, commonly used are a rank-ordered or Likert-type scale (Belton *et al.*, 2019b).

Belton *et al.*, (2019b), suggest, that researchers may also choose to allow participants to offer written reasoning in support of their responses as well as collect numerical responses. The initial questionnaire sent to the participants in a Delphi is normally either an open-ended questionnaire or a structured questionnaire (Toma and Picioreanu, 2016). In this study, this initial questionnaire was a structured questionnaire with some opportunity for open responses. According to Drumm et al (2021) published examples of Likert scales within Delphi have tended to use odd numbers of points which include a neutral point. The letter delivered to potential participants can be seen in Appendix 6.3 and the full questionnaire can be viewed in Appendix 6.4. For this research, the Likert scale was applied in the following way.

Strongly Agree = 5
Agree = 4
Neutral = 3
Disagree = 2
Strongly Disagree = 1

A Likert scale is often employed in a Delphi as a tool to measure attitudes, beliefs and opinions (Drumm et al, 2021). The structure of the Likert scale is a symmetrical scale, where the position of neutrality (don't know) lies exactly in between two extremes of strongly disagree (SD) to strongly agree (SA), which facilitates a participant to choose any response in a balanced and symmetric way in either direction (Joshi *et al.*, 2015).

The comments within the feedback may be treated by thematic analysis. In other words, if something is said often it will carry more weight than if it is said once. However, the main method for interpreting feedback will be the author's rational interpretation. Whilst there is recognition of internal bias, the author is responsible for the research and therefore made decisions that are deemed appropriate in light of feedback. Interpretation of the Likert style of questions was averaged out to get consensus from participants.

6.5 Executing the Delphi Study

As stated previously, it is standard practice for a Delphi to 'pilot' the questionnaire to gain an understanding of how it might be viewed by the potential participants (Belton *et al.*, 2019b). Avella, (2016) agrees that a pilot test may be advantageous where the researcher plans a self-designed survey instrument. Once the questionnaire was designed, a pilot was disseminated through an invitation on MS Forms as per Appendix 6.1. The summary of the feedback can be seen in Appendix 6.2.

Any researcher employing the Delphi technique must pay attention to the appropriateness of the data collection methods and any other possible methods considering the logistical implications (Hasson, et al, 2000). As previously mentioned, this study uses purposive sampling and is interested in the quality of participants.

Using a variety of contacts, a list was drawn up from experts in the field and also from academia. This initial list was constructed from acquaintances and professionals from research and industry. It was also compiled using LinkedIn and other groups on social media such as the Circular Economy Club. In total the list of invitations was 87 of which just 14 responded to the first iteration. This small number of responses was anticipated as when they are approached cold, there is less chance of a response as opposed to building relationships with people which is extremely time-consuming and problematic. The full list of participants for the first iteration can be seen below.

Participant ID	Organisation	Country	Role	Academic / industrialist
1	MDI Gurgaon,	India	Manager	Both
2	Richard Hagan	UK	Director	Both
3	University of Derby	UK	Professor	Academic
4	Eastern Med University	TRNC	Lecturer	Both
5	Ecoidea M Ltd	Scotland	Specialist	Both
6	SOENECS/University of Brighton	UK	Professor	Both
7	Freelance	UK	Doctoral	Both
8	University of Sindh, Jamshoro	Pakistan	Professor	Academic
9	University of Derby	UK	Lecturer	Academic
10	Czech Academy of Sciences	Czech Republic	Specialist	Academic
11	University of Derby	UK	Specialist	Both
12	Santa Clara University	USA	Lecturer	Academic
13	Qinesis	Italy	Specialist	Industrialist
14	Shane Walton Consulting	Italy	Director	Both

Table 6. 2 shows the background of the participants selected.

The first iteration was conducted over six weeks to allow time for participants to engage with the Delphi survey. An email was sent out to all of the contacts on the list with an overview email and a letter attached, which can be seen in Appendix 6.3. It also had a link to MS Forms to access the survey. After several weeks, a reminder

was sent out to try and garner more engagement. The responses to this first iteration can be seen below.

6.5.1 Responses and analysis from the first iteration.

The extract below is what the participants saw as part of the questionnaire, followed by the questionnaire and responses.

Circular Economy is a model of sustainability which has captured the attention of both academics and practitioners alike. Core activities associated with Circular Economy are built on the notion that no waste goes unrecovered and all materials can be reused, recycled, re-purposed etc. It aligns with the United Nations - Sustainable Development Goals, UN-SDGs in that it endeavours to promote renewable energy, helping to address the climate change crisis. The key aspect of this study is to understand how SMEs are able or not, to make the transition from a linear economy to a Circular Economy through circular thinking.

Readiness for change is when individuals of an organisation are collectively primed to embrace a change and are motivated to execute the change. The beliefs, emotions and attitudes of these individuals are key to assessing this level of readiness. Additional factors are the circumstances and context of the change and the level to which these circumstances and context support or hinder the implementation of change. Below is the conceptual model of change readiness for SMEs to adopt CE. This conceptual model is facilitated by a questionnaire (instrument), that is designed to assess the readiness of various members of an organisation. It is designed to establish individual readiness and collective readiness as well as categorise the readiness of the Leader, the senior management, and the staff. Defining readiness

Red = Not Ready,

Amber = Need some intervention

Green = Ready.

1. What is your Company/institution Name?

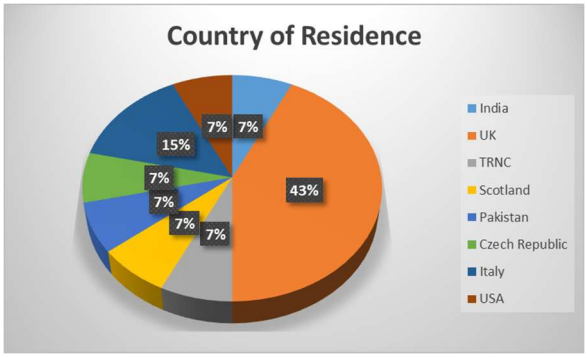
14 Responses

ID	Name	Responses
1	anonymous	MDI Gurgaon, India
2	anonymous	Richard Hagan
3	anonymous	University of Derby
4	anonymous	Eastern Mediterranean University
5	anonymous	EcoideaM Ltd
6	anonymous	SOENECS/University of Brighton
7	anonymous	Freelance
8	anonymous	University of Sindh, Jamshoro
9	anonymous	University of Derby
10	anonymous	Czech Academy of Sciences
11	anonymous	University of Derby
12	anonymous	Santa Clara University
13	anonymous	Qinesis
14	anonymous	Shane Walton Consulting

2. Country of residence

14 Responses

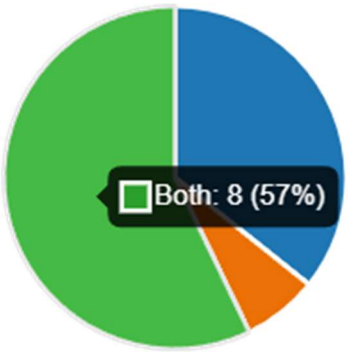
ID	Name	Responses
1	anonymous	India
2	anonymous	UK
3	anonymous	UK
4	anonymous	TRNC
5	anonymous	Scotland
6	anonymous	UK
7	anonymous	UK
8	anonymous	Pakistan
9	anonymous	United Kingdom
10	anonymous	Czech Republic
11	anonymous	UK
12	anonymous	USA
13	anonymous	Italy
14	anonymous	Italy



3. How would you describe yourself, academic, industrialist or both?

14 Responses

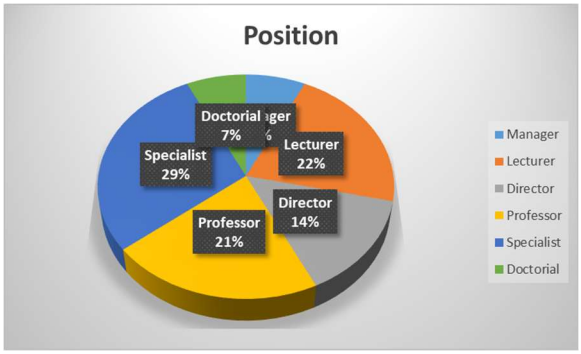
ID	Name	Responses
1	anonymous	Both
2	anonymous	Both
3	anonymous	Academic
4	anonymous	Both
5	anonymous	Both
6	anonymous	Both
7	anonymous	Both
8	anonymous	Academic
9	anonymous	Academic
10	anonymous	Academic
11	anonymous	Both
12	anonymous	Academic
13	anonymous	Industrialist
14	anonymous	Both



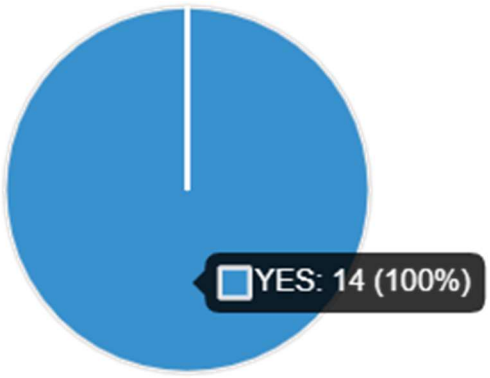
4. What is your position?

14 Responses

ID	Name	Responses
1	anonymous	Manager
2	anonymous	Director
3	anonymous	Professor
4	anonymous	Lecturer
5	anonymous	Specialist
6	anonymous	Professor
7	anonymous	Doctoral
8	anonymous	Professor
9	anonymous	Lecturer
10	anonymous	Specialist
11	anonymous	Specialist
12	anonymous	Lecturer
13	anonymous	Specialist
14	anonymous	Director



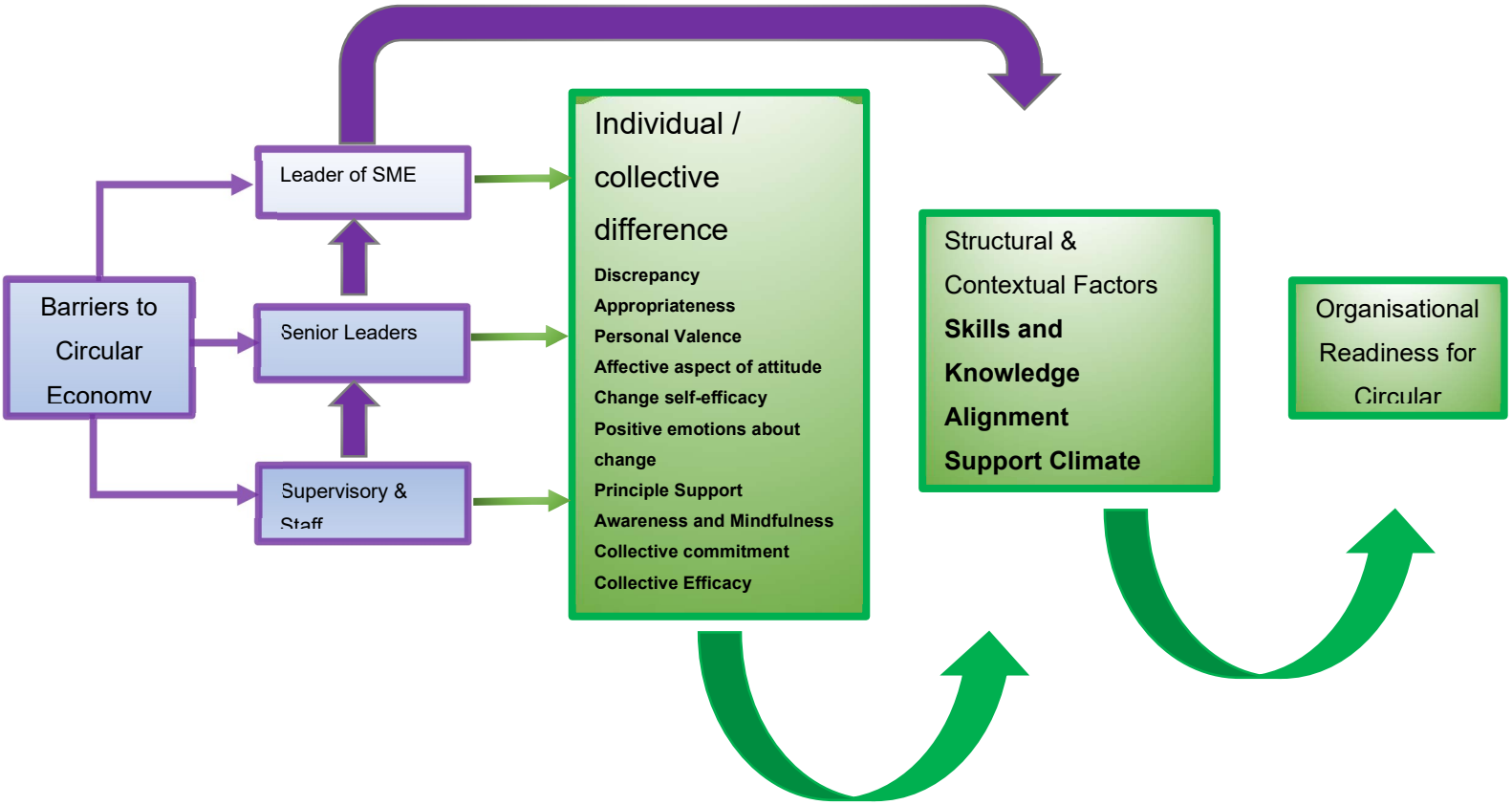
5. To proceed with the Delphi study, you must be considered an expert in the field of Circular Economy and/or change. Have you had managerial experience of 2 years or more or academic research of two years or more in Circular Economy or management of change?



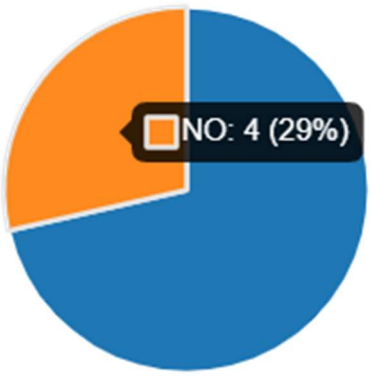
Conceptual model and explanation.

This conceptual model seeks to measure the level of readiness of individuals through understanding their beliefs about a variety of factors associated with the specific change. These individual/collective beliefs are based on the perceived barriers to SMEs adopting Circular Economy (CE). Different individuals are assessed, starting with the main leader, CEO, Chief exec or business owner to ascertain their particular views. The change readiness criteria are defined by several factors that are related to the barriers to SMEs adopting a Circular Economy. A questionnaire instrument has been developed to gauge their attitudes and beliefs towards these criteria. It is intended that the measurement will be using a traffic light system. The model works by using the change readiness criteria including the contextual factors and also linking into the barriers for developing questions to ask the SMEs' leader, senior

management, and staff. It seeks to understand their attitudes and beliefs about factors associated with a specific organisational change.



6. Does the conceptual model and explanation above make sense?



This has a consensus of 71%. However, adjusting the model should help with clarity.

7. If this does not make sense, please elaborate on what is not clear.

Responses	Analysis
1 anonymous This is making sense	Ok
2 anonymous What if barriers to CE relate to the readiness of suppliers or customers or the nature of the products/services?	They do. This is the perception of leaders' senior managers and staff as to what they think of whether customers and suppliers are supportive. This is captured in the barrier Supply network constraints. Consider explanation! Arguably, there is duplication between customer and consumer behaviour routines. This can be merged to prevent duplication.
3 anonymous The role of the wider strategic and policy environment in influencing the ability to make the transition to a circular economy. Whilst individuals and companies can each individually and collectively contribute to organisational readiness for change this needs the wider systemic enabling frameworks to be conducive to this change.	Agreed. However, this level of readiness is about the thoughts, attitudes, and beliefs of the organisation regardless of the status of the external policy. Effectively, the external environment is the same for organisations that engage in CE and those that do not.
4 anonymous The text does not reflect the diagram, for example, "Different individuals are assessed, starting with the main leader, CEO, Chief exec etc" The	The leader can be assessed first hence, being on top of the three. It leads to a level of perceived readiness. This needs to be made clearer using a traffic light system.

graphic shows all interviewees are interviewed at the same time. There is also a large leap from structural and contact factors to organisational readiness	The diagram will be revised in light of these comments.
5 anonymous three factors such as leader of SME, senior leaders and supervisory and staff do not make sense here. or at least it is not clear how these factors will be operationalized and measured	The arrows will indicate the direction of travel for the questionnaire's operation. The end traffic lights include what it is measuring, attitude, beliefs, and intentions will be made clearer as per this feedback.
6 anonymous What is the difference between the purple and green arrows? Are those different workflows?	The green arrow is the output whilst the purple arrows are the input. Some arrows will be changed colour to reflect this better.

8. From the list of barriers to SMEs adopting a circular economy expressed in the literature. Are there any further barriers missing?

6.5.2 Barriers definition sent in the Form

Lack of support supply and demand network/constraints to adopting new circular business models.

Lack of capital / financial support Government support / economic and financial drivers, support from public institutions, misaligned incentives.

Administrative burden

Lack of technical know-how / technical resource / Lag between design and diffusion or lead time to market.

Lack of information/information management systems

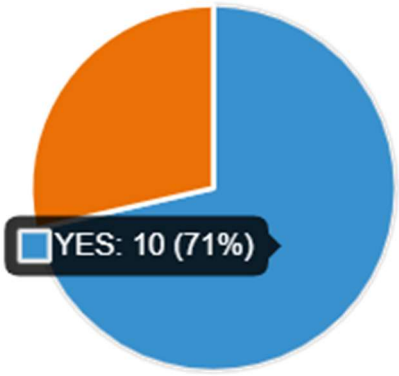
Company environmental culture / internal conflict

Lack of customer/consumer interest in the environment / Rigidity of consumer behaviour and business routine

Lack of qualified personnel in environmental management.

Lack of leadership commitment.

Lack of environmental awareness, training, and support



9. If yes, please enter your comments below.

Response	Analysis
1 anonymous the list appears comprehensive - covering all aspects	ok
2 anonymous Money is the usual, will do x when government grant or is profitable.	Agreed. However, it is the same for all SMEs. The opportunities for funding etc are the same!
3 anonymous Regulatory frameworks? Creative mindset?	This is at the core of the study. It is the beliefs, attitudes, and intentions of the leaders etc. The same regulatory framework exists for all, but it is the creative mindset that makes the difference.
4 Anonymous could include fiscal incentives as a modulator of consumer behaviour (consumer responsibility).	Agreed. Any incentives are the same for all SMEs and their consumers. However, consumer behaviours are included in a

Otherwise, it is a good and comprehensive list.	barrier number 1 supplier and network constraints and consumer behaviour.
5 anonymous you need to add in expertise in systems, planning, procurement and most importantly time	I think this will be evident in the outcome of the instrument. It is designed to recognise a shortfall in perceived expertise. The perception of planning is covered in the structural factors.
6 anonymous Lack of legislative measures & and targets, operational barriers such as time, logistics, space etc., lack of stakeholder collaboration, lack of available data to present financial benefits or lack of precedents, lack of consistency in defining elements of CE such as reuse, misleading information/data such as recycling figures tend to represent recovery figures too	The lack of legislative measures is an external factor and is not covered by this readiness model. Time, logistics and space are covered in the change criteria in terms of beliefs as is stakeholder collaboration through the barrier of lack of support in the supply and demand network. Lack of data and precedents is covered by awareness and mindfulness as is consistency of definition. However, some companies overcome these barriers.
7 anonymous Fear of change, uncertainty, leaders' commitment to the status quo	Again, this should be evident in the feedback from the instrument in terms of beliefs, attitudes, and intentions. This is exactly what the diagnostic is designed to measure. Not just the leader's perspective but also the employee's perception of leadership.
8 anonymous Lack and/or weak policies at industrial and governmental level.	These will be the same for all SMEs. They are of course very valid points!
9 anonymous Companies may lack of strategic vision about medium-long term benefits, being more focused on the attempt of immediate cost minimisation	Agreed. Some SMEs will lack long-term vision and leadership. This should become evident in the feedback or the fact they would not see the relevance of this kind of diagnostic or circular economy in general. Also covered awareness.
10 anonymous Lack of policies. But mainly internal and external factors	Yes, it is a deliberate plan to avoid policies as these cannot be influenced by the SMEs.

	It is focused on the perception of internal capabilities only.
11 anonymous Lack of suitable infrastructure to support SME, Talent pipeline, lack of awareness	Agreed. This should also be evident in the feedback. Lack of talent is covered by a lack of technical know-how and also a lack of qualified personnel. Lack of awareness is part of the criteria.

10 Having read the list of readiness criteria with the explanation, used in the conceptual model.
Do you believe there should be any other readiness criteria added to the model?

6.5.3 Change Criteria sent in the Form

Discrepancy - a belief that there is need for a change. That there is a difference between the current and future state (Rafferty & Minbashian, 2019; Holt et al., 2007).

Appropriateness - the change is an appropriate response to organisational or external issues (Holt & Vardaman, 2013).

Personal Valence - an individual's belief that change has intrinsic and extrinsic benefits including the perceived benefits of a change for an individual (Holt & Vardaman, 2013).

Positive emotions about change - the emotions that are present in response to change, such as joy, happiness, excitement, curiosity, enthusiasm, and pride (Rafferty &Minbashian,2019).

Change self-efficacy - Confidence in your ability to affect change (Holt & Vardaman,2013).

Principal Support - Provisional support from a range of leaders, moreover senior leadership, direct line management, formal, informal and one's peers (Holt & Vardaman,2013).

Awareness and Mindfulness - being attentive to, aware of, and mindful of how a change is unfolding in the present, awareness of their routine behaviours and how they need to change (Gondo et al., 2013).

Organisational Factors / Valence.

Collective commitment - shared belief and resolve to pursue courses of action that will lead to successful change implementation. Commitment based on 'want to' motives reflects the highest level of commitment to implement organizational change. It is these; I want to motives, that the instrument questions are based (Holt & Vardaman, 2013), (Weiner, 2009). A shared sense of confidence in collective capabilities.

Collective Efficacy - a shared belief in their conjoint capabilities to organize and execute the courses of action required to implement change successfully (Holt & Vardaman,2013).

Collective Trust - shared belief that leaders will act in the best interest of the organization's stakeholders (Holt & Vardaman, 2013).

Structural & Contextual Factors.

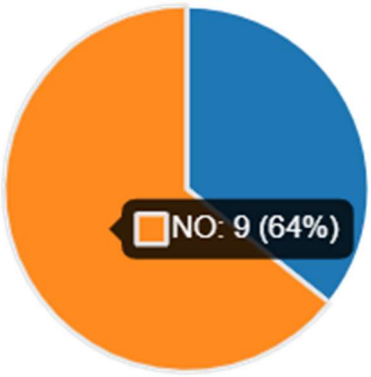
Knowledge and Skills alignment – the degree to which the employees' knowledge, skills and abilities align with the change (Holt & Vardaman, 2013).

Support climate - sufficient tangible (e.g. funding, reward, and incentive systems) and an encouraging intangible environment (i.e. culture and climate) to support implementation (Holt & Vardaman, 2013).

Facilitation - a set of clearly articulated goals and objectives that are supported by a detailed implementation plan defining roles and systems to measure progress (Holt & Vardaman, 2013).

Yes = 5

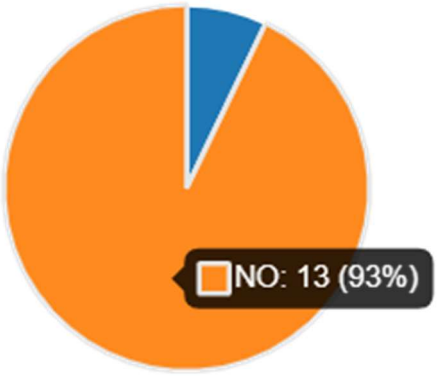
No = 9



11. Do you believe any readiness criteria should be removed?

Yes = 1

No = 13



12. If yes, to either question, please inform what and why

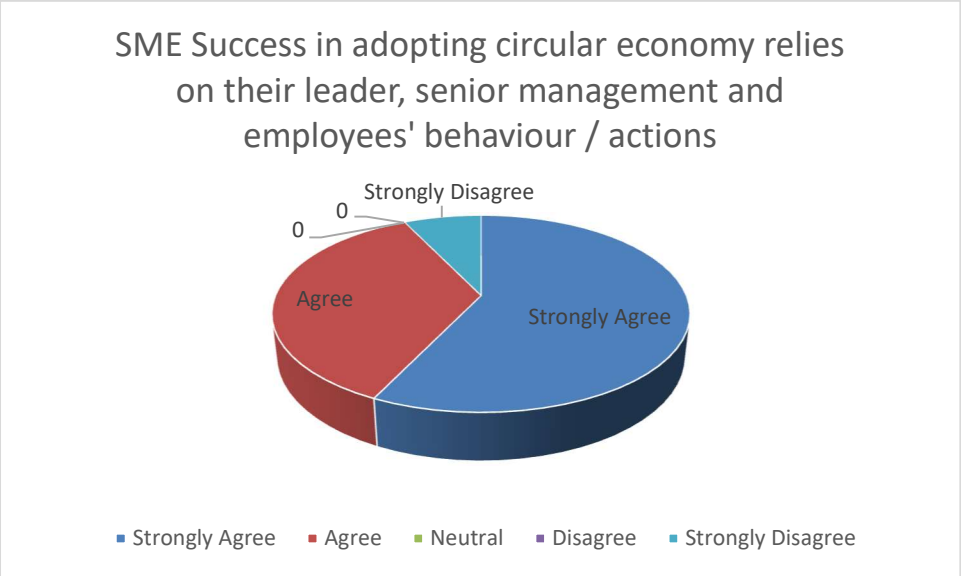
Anonymous Response	Analysis
looks good	Ok
The baseline assessment here is great, but how do evidence back to them? Hotspots, spider diagram. This is where the lever is to evidence the easy savings in costs today, or a small investment will return benefits beyond more sales, profits, brand value, lots and lots	This is an important aspect of change. Whilst not directly part of this model may need to form part of the overall discussion. The timing of this readiness model in an organisation's circularity journey is crucial. This criterion is really for the leader/s of the organisation to interpret strategy from the diagnostic feedback. This model is not

	designed to tell organisations what or how to become circular, it assumes they know their business and have a varying degree of CE understanding.
Community or customer readiness for the innovation	This is covered within the barriers in terms of supply and demand networks. How can an organisation influence their supply chain is the challenge. This is part of the coaching/strategy.
Worth thinking about the 'Collective commitment' being aided by co-creative opportunities to influence the purpose, and direction of an 'end state'.	Again, hugely important comment. This falls into the supply and demand networks and how they can co-create or collaborate specifically industrial symbiosis. This would be the ideal kind of output from engaging with the diagnostic.
You need to add time for change and the "business case"	Incredibly important. This will be a long game for most SMEs and therefore keeping momentum will be a challenge. This diagnostic is designed to inform the business case strategy and can be repeated over time as necessary. The beliefs of individuals about the planning and strategy will also pick up on the timings of what is perceived to be feasible.
Urgency and novelty may also be added.	Urgency and novelty will be part of the perception of the leaders and senior team. This is also tied into the discrepancy, the belief and desire for change due to a recognised need.
According to my opinion, the following criteria are somehow redundant: Appropriateness, Organisational Factors / Valence, and Structural and contextual Factors. In detail, they could be merged into a single criterion, for example, called "Organisational environment", and	I think this comment is a little misguided as the whole idea of this readiness model is to measure the readiness of individuals and collectively as an organisation in terms of their beliefs and attitudes. I would expect strategies to be formed based on their feedback. I agree that this diagnostic may

indicating how the change is managed within the organisation and what the attitude of the main stakeholders involved (both internal and external).	well form part of another much bigger diagnostic. However, it is not designed to cover external aspects, only the internal perspective of the external environment.

13. What do you believe?

An SME's success in adopting a Circular Economy relies on its leader, senior management, and employees' behaviour/actions.



93% of participants either agree or strongly agree making this aspect a consensus. This is significant in justifying the use of all three questionnaires in the instrument or diagnostic. The perception of all of the workforce matters in terms of readiness for change.

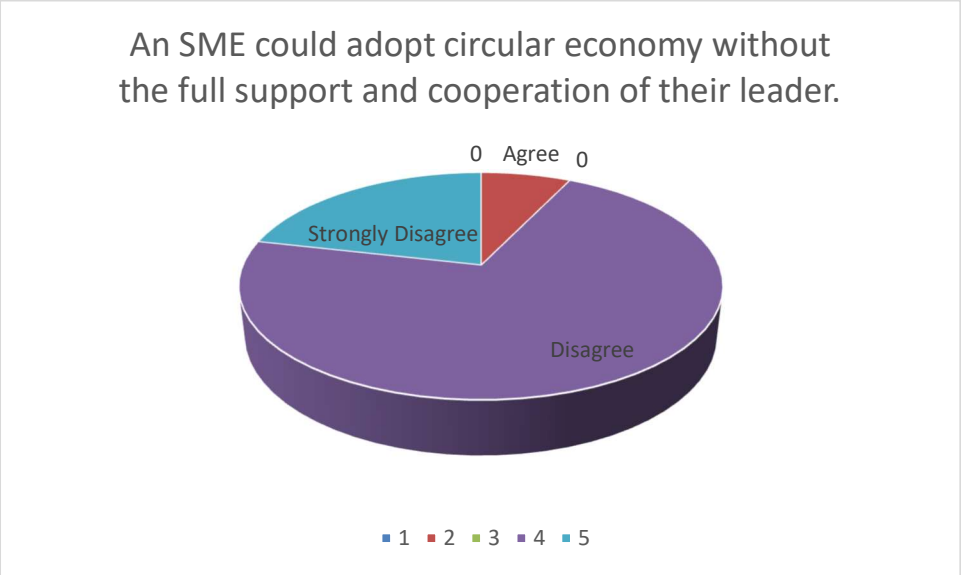
14. Justify your answer

Anonymous Response	Analysis
In an SME organisation, the leader and senior management controls closely all the activities of the firm. Hence, if their behaviour does not align with the objectives	Agreed.

of the Circular economy - the organisation itself will not be oriented to continue the practice even if started once.	
Too many times, the shop floor, and manager wish for change, yet Directors ONLY site cost benefit. This is the angle I always push now, not climate crisis.	This is an important point which strengthens the argument for the leader's commitment. It also strengthens the support for employees' feedback on leadership commitment and their general involvement in the process.
Change requires engagement, purpose, communication, direction, and momentum and this requires collective multi-level action.	This supports the notion of an engaged workforce with strong leadership. It also means congruency between leadership and goal setting across the organisation.
In many cases, top-down actions result in organisational change	Agreed.
Change is constant and based on my research and experience to create a norm understanding behaviour and associated factors that lead to making it a habit is the key.	Agreed. This relates directly to leadership, awareness, and mindfulness. It also supports the notion of an inclusive process involving senior management and employees.
Leaders and employees are key ingredients for change implementation and success. If both are qualified, trained, committed, and determined to adopt and implement change, change implementation is highly successful. The adoption of a circular economy in SMEs will be greatly affected by the behaviour of employees and leaders.	Agreed. This is a hugely supportive narrative endorsing the use of an inclusive process for change readiness.

Without the participation of leadership and staff, CE's implementation cannot be successful.	Agreed. This is more validation of a narrative endorsing the use of an inclusive process for change readiness.
As underlined by Bag et al. (2019) *, the fact that governments develop models and policies aimed at promoting circular economy within SME contexts is certainly useful. However, the company's immediate stakeholders play a key role in driving change at the firm level. Reference: Bag S, Gupta S, Foropon C (2019) Examining the role of dynamic remanufacturing capability on supply chain resilience in circular economy. Manag Decis 57:863–885.	I think this relates to supply and demand networks, which of course, if positive towards this change can help an SME change too. It also supports the notion that change in any SME must come from within.
Adopting a Circular Economy is something that affects companies on various levels - it starts with the procurement process, but goes until the end-of-life (considering a traditional manufacturing company) - it is important to have everyone onboard and aware of the potential	Agreed. The conforms to the whole organisation playing a role in the change. This should also include staff members such as Sales and Marketing.
Circular Economy is everyone's responsibility.	As above.
It requires leaders and employees to be involved and committed	Leaders again require commitment. But also, the readiness of the workforce to make the transition.
This feedback gives consensus, (over 70%), to the requirement for all of the organisations to play their part in adopting CE. It also supports the notion of leadership commitment, qualities, and subsequent behaviours.	

15. An SME could adopt a Circular Economy without the full support and cooperation of their leader.



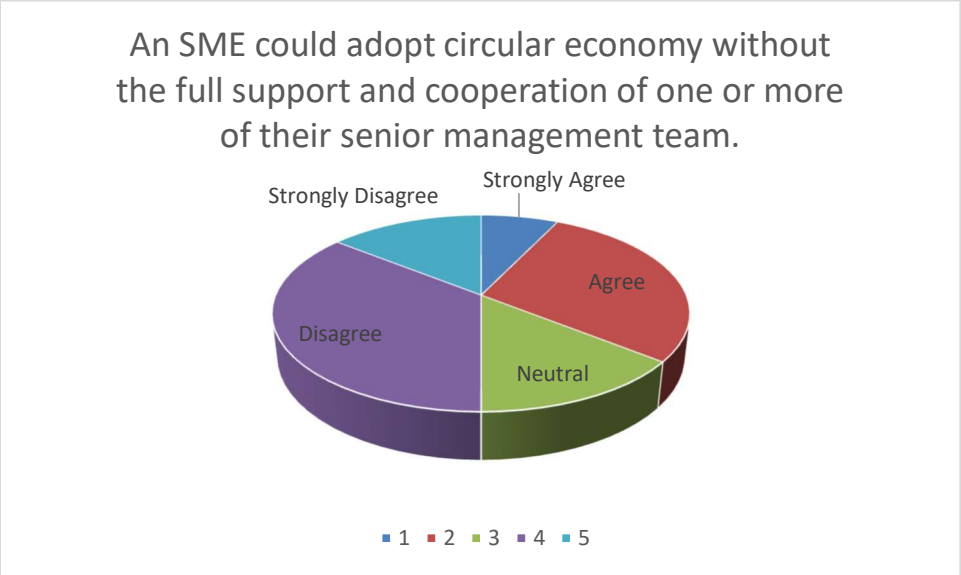
16 Justify your answer

Anonymous Response	Analysis
It is highly unlikely to do some new thing in SMEs without consent and cooperation from their leader.	Point taken. This comment strengthens the argument for strong leadership and commitment.
Yes, at a small scale, a paper bin is possible to start. However, R&D, investments and cultural change MUST be from a charismatic leader.	Seems to agree with the first comment. There can be some low-level change, but not at the investment or cultural level.
Much harder if the leadership is missing!	Agreed. Again, this supports the leadership importance.
Many factors would allow that to happen, but structural change (e.g., procurement rules) will need senior sign-off	Comments concur with the above, that structural and cultural change requires full leadership commitment.
One of the key factors in establishing longevity is developing cooperative behaviour, which could be initiated at any level, nonetheless, requiring embedding throughout the value chain.	Interesting comment. This requires leadership at some level. However, quite rightly it needs commitment at all levels.

Leaders and employees are key ingredients for change implementation and success. If both are qualified, trained, committed, and determined to adopt and implement change, change implementation is highly successful. The adoption of a circular economy in SMEs will be greatly affected by the behaviour of employees and leaders.	Agreement that both leaders and employees are required to support the change.
As CE can require investments of capital and time, it is essential to have leadership's support.	More agreement on leadership necessity.
Leadership is key to the adoption of CE principles. But not necessarily only top-level leadership, but also mid and low-tier leadership - it is important to have sustainability 'champions' on different levels	This is a really important point. I think it merits further thought into questions for the diagnostic in terms of interventions
Although everyone's responsibility, the leader needs to lead by example. They need to show commitment and support.	Agreed on leadership again.
SMEs need a support structure to help them	Agreed again on leadership.

There is consensus here that 92% either disagree or strongly disagree with the statement that SMEs can adopt CE without the full support of their leader. This confirms the author's thinking, that CE is essentially a nonstarter without the leader and therefore the feedback from their (questionnaire instrument) must be taken alone before engaging the entire workforce.

17. An SME could adopt a Circular Economy without the full support and cooperation of one or more of their senior management team.



The results show no consensus here, with 50% in disagreement just 36% in agreement and 14% neutral.

18. Justify your answer.

Anonymous Response	Analysis
This is possible, if the top boss (as CEO or MD) wants an activity of circular economy to continue or initiate and one of senior management does not want to - then also its implementation is possible	Ok, Agreed. It is made more difficult but can still be achieved.
LOL, there is always one or more managers who will offer. "This is a waste of time" YES just ignore and focus on champions.	Good Point. I agree on a coalition of the willing.
You can make change without consensus but the best and most effective with it - depends on leadership and management modus in the organisation concerned.!	Leadership again here!
It does depend on the organisation	Leadership and culture will be key to any success.

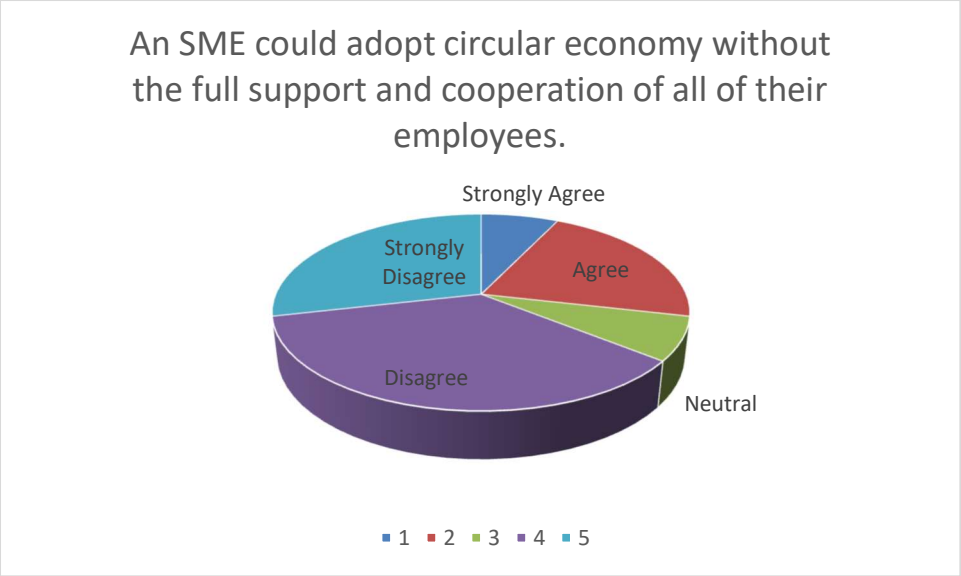
For attaining circularity in long-term embedding awareness, knowledge and behaviour among leaders and organisations is essential.	Strong leadership and a change of culture are required/changing minds!
Leaders and employees are key ingredients for change implementation and success. If both are qualified, trained, committed, and determined to adopt and implement change, change implementation is highly successful. The adoption of a circular economy in SMEs will be greatly affected by the behaviour of employees and leaders.	Again, this relates to Leadership and culture including commitment and competence.
It depends, it can be yes if there are departments which are independent in their decision-making.	Culture is key here.
The same reason as explained above (16)	As above
Again, leadership is key to the adoption of CE principles. But not necessarily only top-level leadership, but also mid and low-tier leadership - it is important to have sustainability 'champions' on different levels	This is leadership, but at all levels which indicates the culture and similar points to the above of leaders at all levels. This will certainly play a role in the intervention section of the diagnostic as stated earlier.
Everyone needs to support the initiative. It should be company policy.	Leadership and culture
Need a champion from the senior management team to help see the concept through and encourage all to adopt it	Again, leadership skills, influence and can be used in the intervention stage.

Evaluation:

Some very good points are well-made which tend to support the need for sound leadership setting the tone for a cultural shift supported by leaders at all levels. There

is no consensus on this point, however, on reflection of this type of question and the series of responses above relating to leadership and culture it is considered a superfluous aspect as this type of scenario will be evident from the instrument. Therefore, the strategy and any intervention formed accordingly will deal with such anomalies. Therefore, this question will be removed from future questions.

19. An SME could adopt a Circular Economy without the full support and cooperation of all of their employees.



Again, this is split between 65% in disagreement and 28% in agreement with 7% neutral. The responses are below.

20. Justify your answer.

Anonymous Response	Analysis
Though this will be difficult to achieve it is possible in a practical scenario	Cultural challenges, again required at the intervention stage
OH, this can be achieved as part of an employee's work procedures, etc. However cultural change, empowering employees, and championing their contribution are essential to catapult and succeed in adaption and change.	Cultural change and leadership qualities again. Again, this pertains to the intervention stage after the initial questionnaire has been analysed.

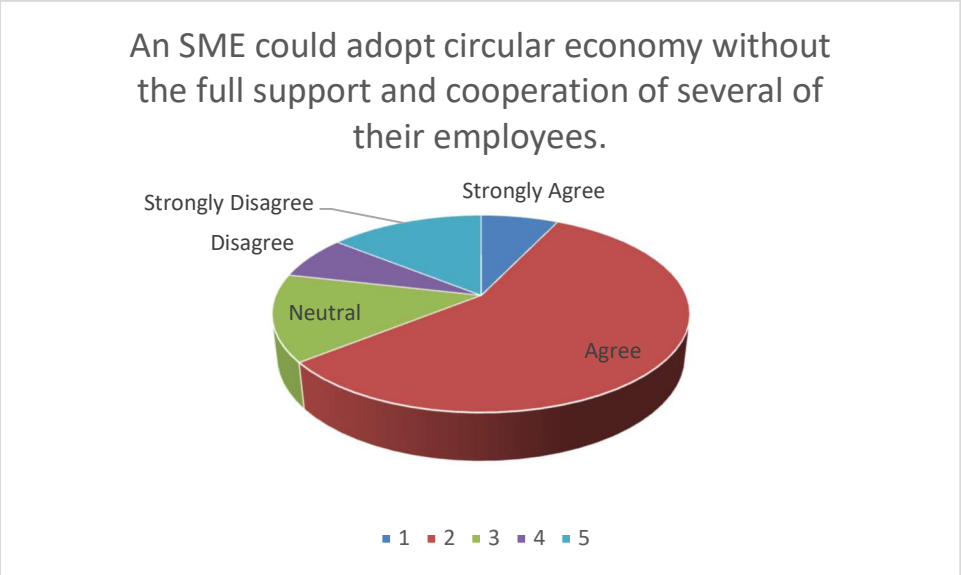
Yes, but less effective. I believe it can happen in all circumstances above to a greater or lesser degree except where the leadership is not supportive.	Cultural challenge. Again, leadership attributes are required here. This can be teased out in the intervention questions.
CE is about organisational change, all levels need to embrace	Culture and leadership
Not necessarily 'all' employees since every individual has different aspirations and preferences in life.	Realistic comments on culture change down to an individual. This recognises individual change. This can be addressed in the intervention questions but is also measured in the diagnostic
Employee support is necessary for the adoption and implementation of new initiatives such as the circular economy	This comment recognises the need for culture change.
Employees are the hands and feet of the organisation. if they are not on board, it would be impossible to implement CE.	Culture challenge and change from leaders.
In this case, CE strategies could be adopted but, of course, without the full cooperation of human resources validity and efficacy would need to be periodically checked (and strategies reconsidered and/or better communicated/discussed).	Cultural challenge and leadership again here.
Leadership is key to the adoption of CE principles. But not necessarily only top-level leadership, but also mid and low-tier leadership - it is important to have sustainability 'champions' on different levels	Strategy and culture change with leaders at every level again. Again, this will be addressed in the intervention questions.
Everyone is responsible.	Culture challenge and leadership

Employees need to understand and buy into the concept, even having an employee champion	Culture and leadership

Evaluation:

Again, some very good points are well made. Whilst there is no consensus on this point, there is a sense from all the comments that it is best to take along the employees and that the culture and leadership play a key role. However, on reflection of this type of question and the series of responses above relating to leadership and culture, it is considered a superfluous aspect as this type of scenario will be evident from the instrument and the strategy and intervention formed accordingly. Therefore, this will be removed from future questions.

21. An SME could adopt a Circular Economy without the full support and cooperation of several of their employees.



22. Justify your answer

Anonymous Response	Analysis

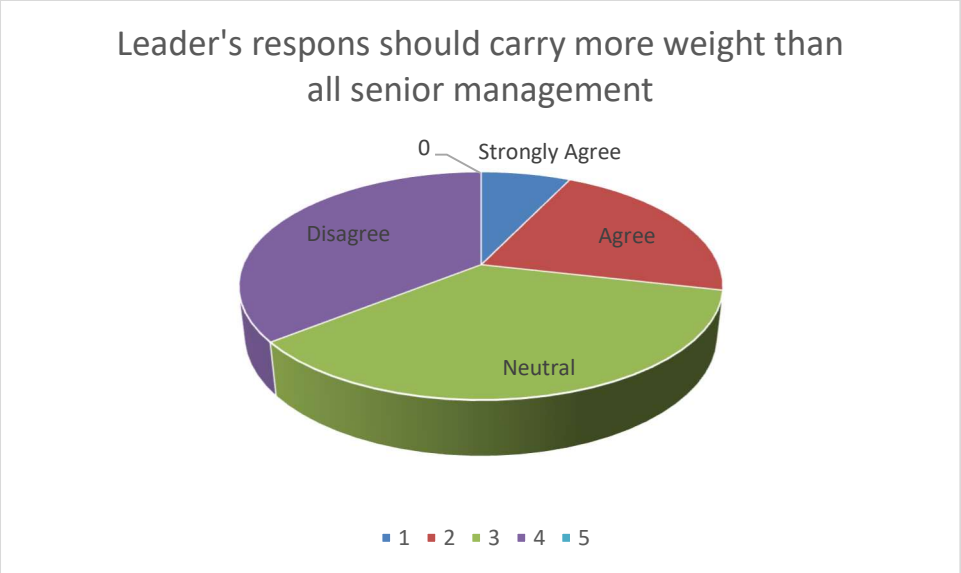
This is also possible - when one particular set of employees is given dedicated responsibility for the implementation of circular economy activities	Agreed. There will always be a range of slow uptake and some resistance but has to be managed by leaders and change makers.
This is the fun part. Those who at first show no interest, will soon realise the fun and "a game worth playing" is being championed by others, and soon feel out of the community. Maslow's Hierarchy of Needs. People do want to be seen as accepted. and reasonable.	Again, these comments are a challenge for leadership at all levels.
Per 20.	Ok
Yes, but it might not be as effective	Again, this is a challenge for cultural change
The leaders in the organisation need to have motivation, it could be created in a bottom-up, middle, or top-down approach. The leaders could be employees who are heading the departments or managing staff.	Again, leadership at all levels and culture change.
If support from maximum employees is not guaranteed, it will ignite politicking and resistance, therefore change may fail.	Cultural change is key. Leadership from the top.
Again, it depends, if the employees are not related to activities directly linked with CE-related decisions, then yes.	Agreed. Some attitudes can be developed over time.
Usually, SMEs do not have many employees (up to 250). So, it would be very hard if you do not have everyone onboard	Agreed, the more that resist the harder it becomes. This will also be part of the intervention questions

Need full support to ensure compliance	Agreed, culture changes over time
If the majority of their employees understand the benefit of doing this, others may follow in time	Agreed.

Evaluation:

Again, some very good points are well-made relating to leadership and culture. However, whilst there is no consensus on this point, there is a sense from all the comments that it is also associated with leadership and culture change. As stated previously, this type of scenario will be evident from the instrument and the strategy and intervention formed accordingly. Therefore, this will be removed from future questions.

23. Leaders' responses should carry more weight than all senior management.

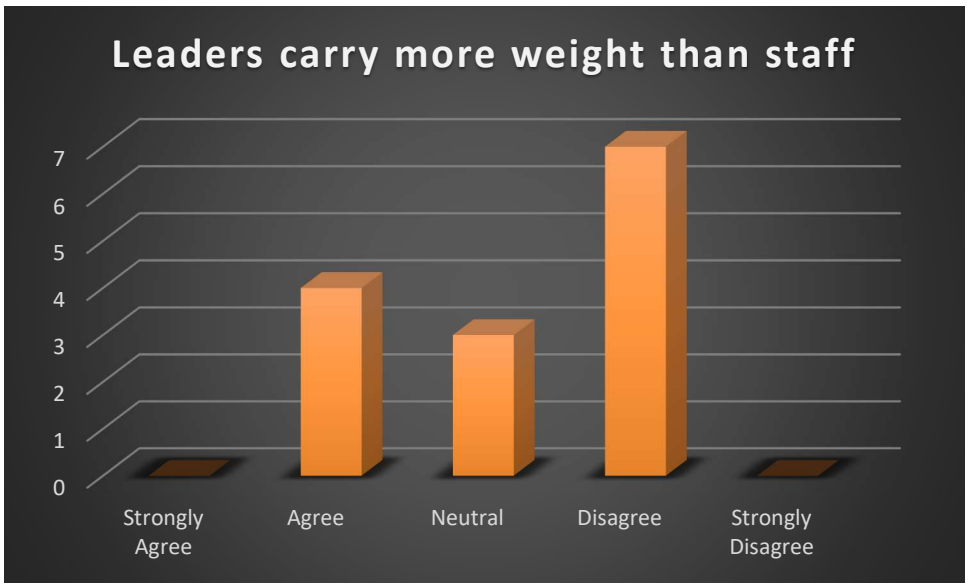


Evaluation:

This question has not reached a consensus. The interpretation of this feedback is that it depends on the company, the culture and the individuals involved. The weight

placed on the leader's response will be for the organisation and leader to reconcile and decide on their level of readiness. One must assume that if the leader agrees to use the readiness tool, they are prepared to act on their feedback and that of others. For this reason, this question will be removed from the next iteration. Any judgement about the feedback will be made by the leader and senior team and will be addressed in the questions for the intervention.

24. Leaders' responses should carry more weight than all the employees and staff



Evaluation:

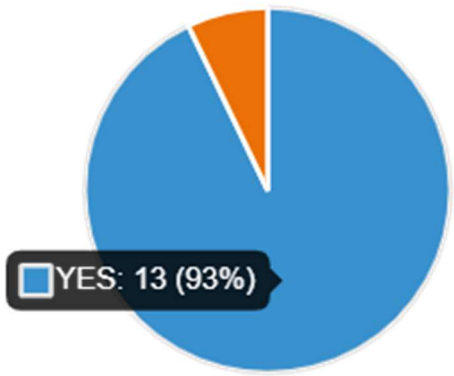
This question has not reached a consensus. The interpretation of this feedback is that it depends on the company, the culture and the individuals involved. On reflection, the weight placed on the leader's response will be for the organisation and leader to reconcile and decide on their level of readiness. One must assume that if the leader agrees to use the readiness tool, they are prepared to act on their feedback and that of others. For this reason, this question will be removed from the next iteration. Any judgement about the feedback will come from the intervention questions in the diagnostic.

25. Senior Management should be weighted more than employees and staff

Evaluation:

This is an interesting result. It appears there is no consensus at all, but there are equally no strong agreements or strong disagreements. This question has not reached consensus and the interpretation is the same as the previous points.

26. Do you believe an **individual's perception** of these three factors below, *Knowledge and skills alignment, support climate and facilitation*, will influence readiness for change in an organisation adopting a circular economy?

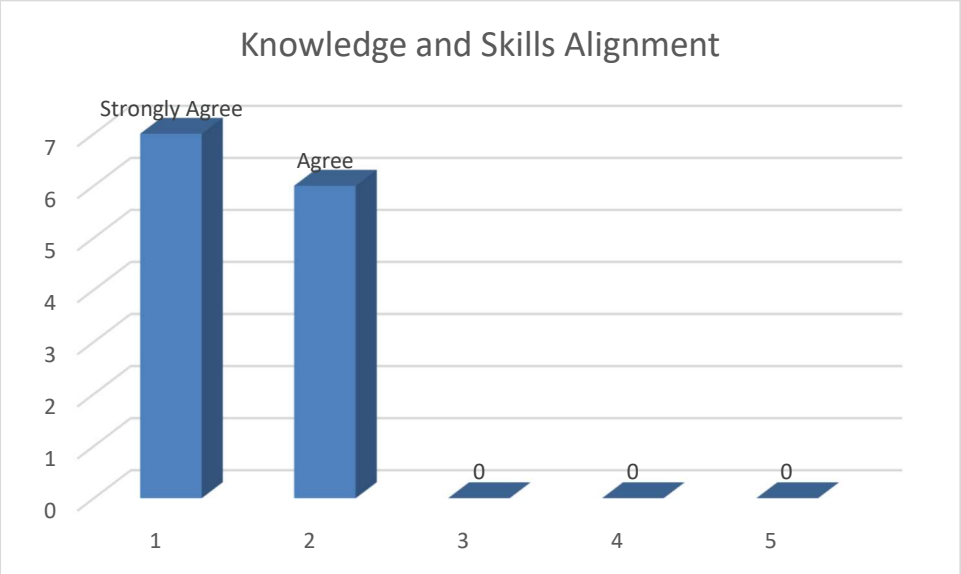


Consensus has been achieved in this perspective and the question will now be removed from the second iteration.

27. Who do you feel is best placed within the organisation to answer these questions?

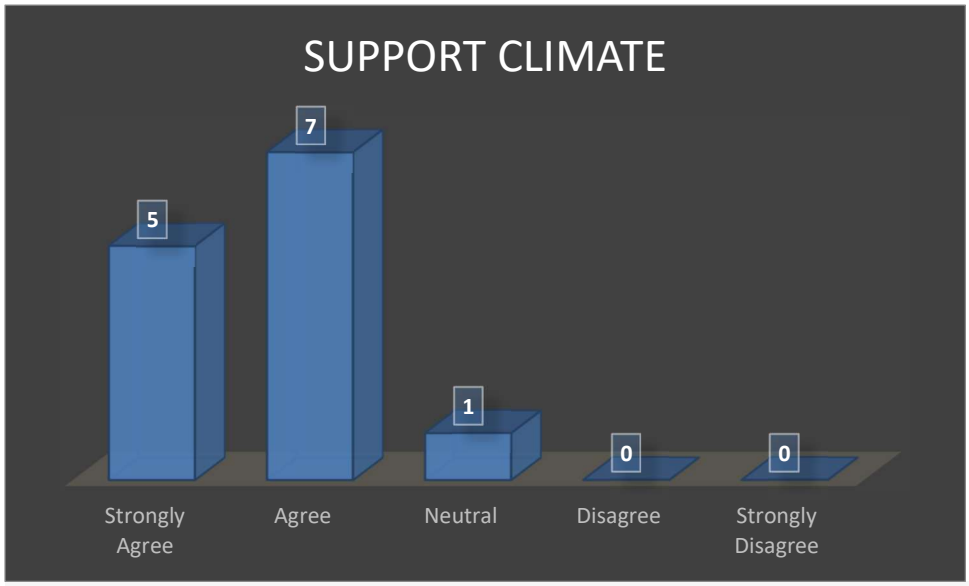
There is no consensus achieved here. On reflection, the question may be interpreted in different ways. If it is simply answering the questionnaire questions is one way and reviewing the feedback is another.

28. **Knowledge and Skills alignment** – the degree to which the employees believe their knowledge, skills and abilities align with the change is very likely to impact the readiness for change to the Circular Economy.



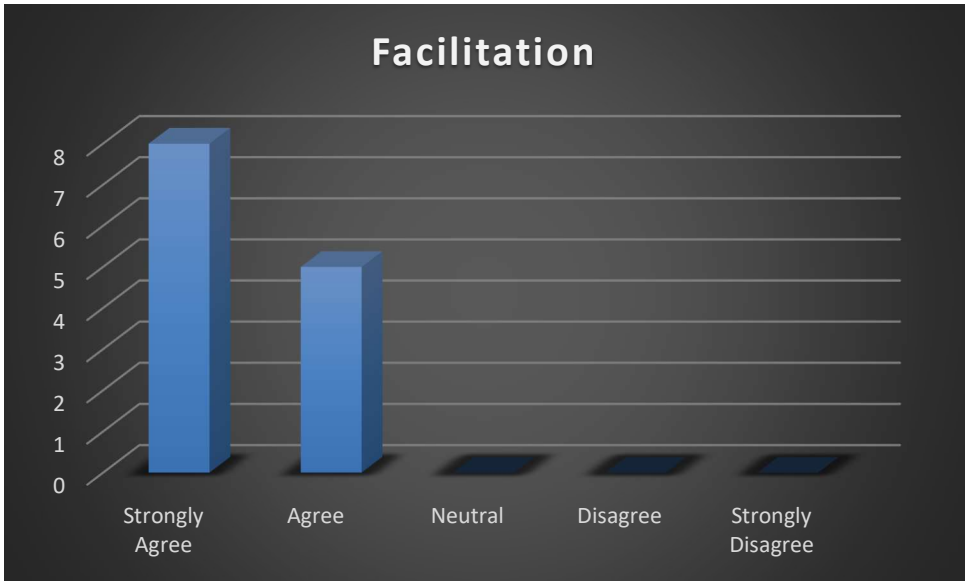
This has consensus in that 100% agreed and strongly agreed that employee beliefs about skill and knowledge alignment would have an impact on readiness for change.

Support climate - sufficient tangible (e.g., funding, reward, and incentive systems) An employees' belief that there is a supportive culture and climate to determine readiness for change to Circular Economy



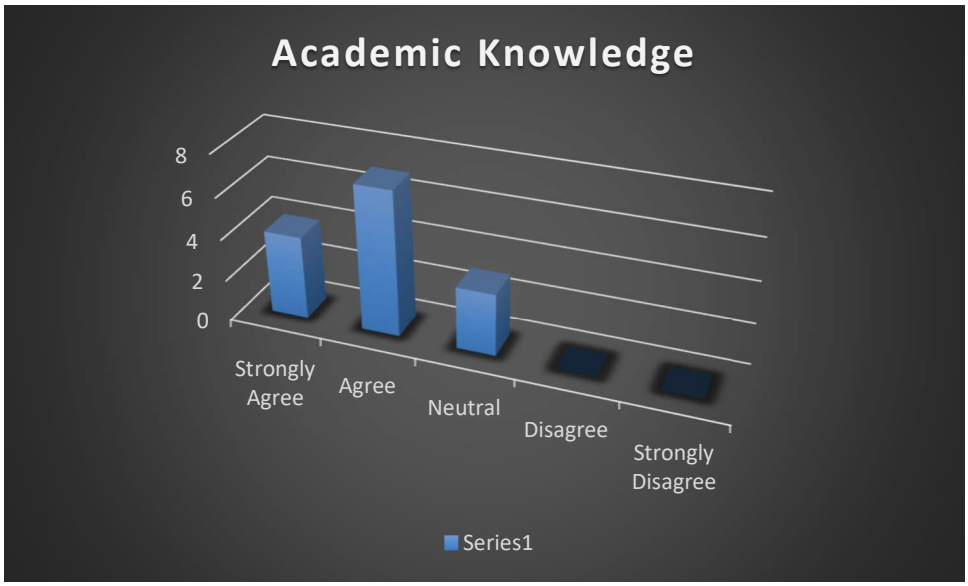
This has consensus in that 92% of recipients agreed or strongly agreed that beliefs around support climate are a predictor in the readiness for change model.

Facilitation - a set of clearly articulated goals and objectives that are supported by a detailed implementation plan defining roles and systems to measure progress that are imperative to an SME achieving a state of readiness for CE.



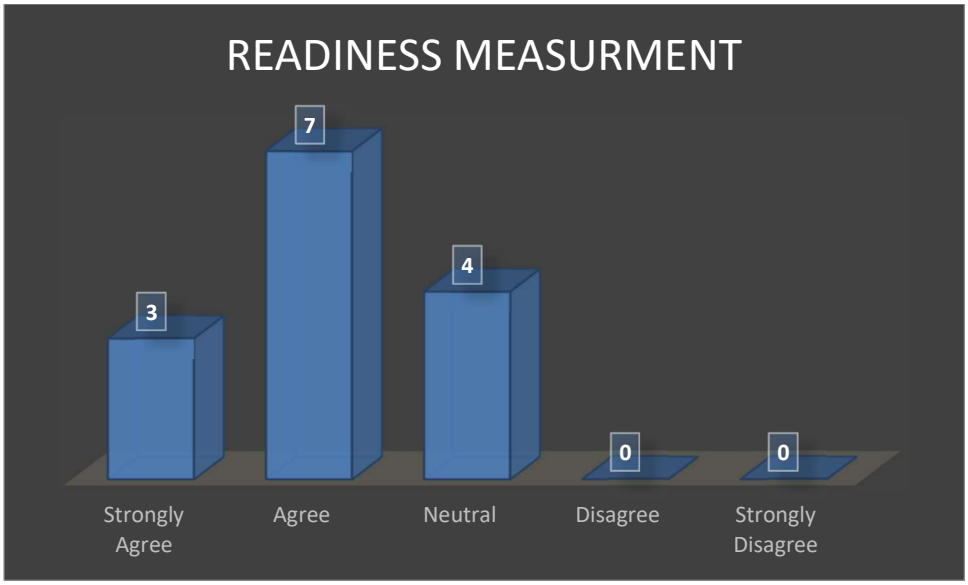
Again, there is consensus here at 100%.

29. This conceptual model contributes to academic knowledge through a combination of readiness models, CE barriers and organisational context.



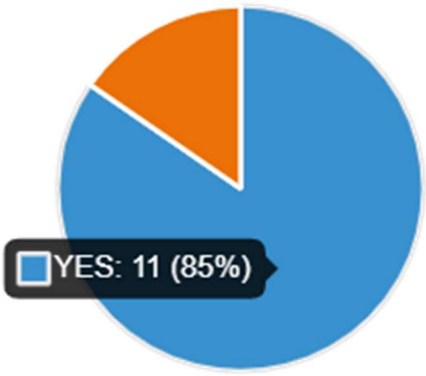
Consensus is achieved at 78.5%

The questionnaire can measure the level of readiness for an SME to adopt a Circular Economy.



Consensus has been reached at only 78% and 71% respectively of participants responded with strongly agree and agree. There were 29% neutral to this perspective.

30. Are the barriers to CE adequately covered in the questions from each instrument (questionnaire)?



Consensus has been reached in that more than 70% have agreed, moreover 85% with the statement.

31. If No to the above, what is missing? Justify your thoughts below.

Anonymous Response	Analysis

I find all areas covered here	Agreed
TBH it's more about presentation. There is so much detail and the presentation of the Qs means it is not at all engaging	This is something to consider for the next round and wider dissemination.
Per earlier points on wider strategic and systemic frameworks.	OK
nil	OK

32. Is there anything that needs to be added?

Anonymous Response	Analysis
No	OK
As above	OK
Consumer incentives (responsibility) are made clearer.	Not sure exactly how to interpret this.
No	OK
According to my previous suggestions	OK
Please consider the median of the sample - it gives a better statistical picture	This was considered but disregarded at this time
Maybe a practical example of circular economy in the introduction that the participants can relate to?	An improved explanation will be considered here.

33. Is there anything that needs to be removed?

Anonymous Response	Analysis
No	OK
With SME experts in mind - some of the terms (valence) and language are overly	This is a significant point both for the next round of the Delphi and more importantly for the validation.

academic. Plus, the weight of the material makes it very difficult to stay engaged.	
No	Ok
No	OK
According to my previous suggestions	Ok

6.5.4 Conclusion and Summary from Iteration 1

Changes made after the first Delphi iteration were as follows by question number:

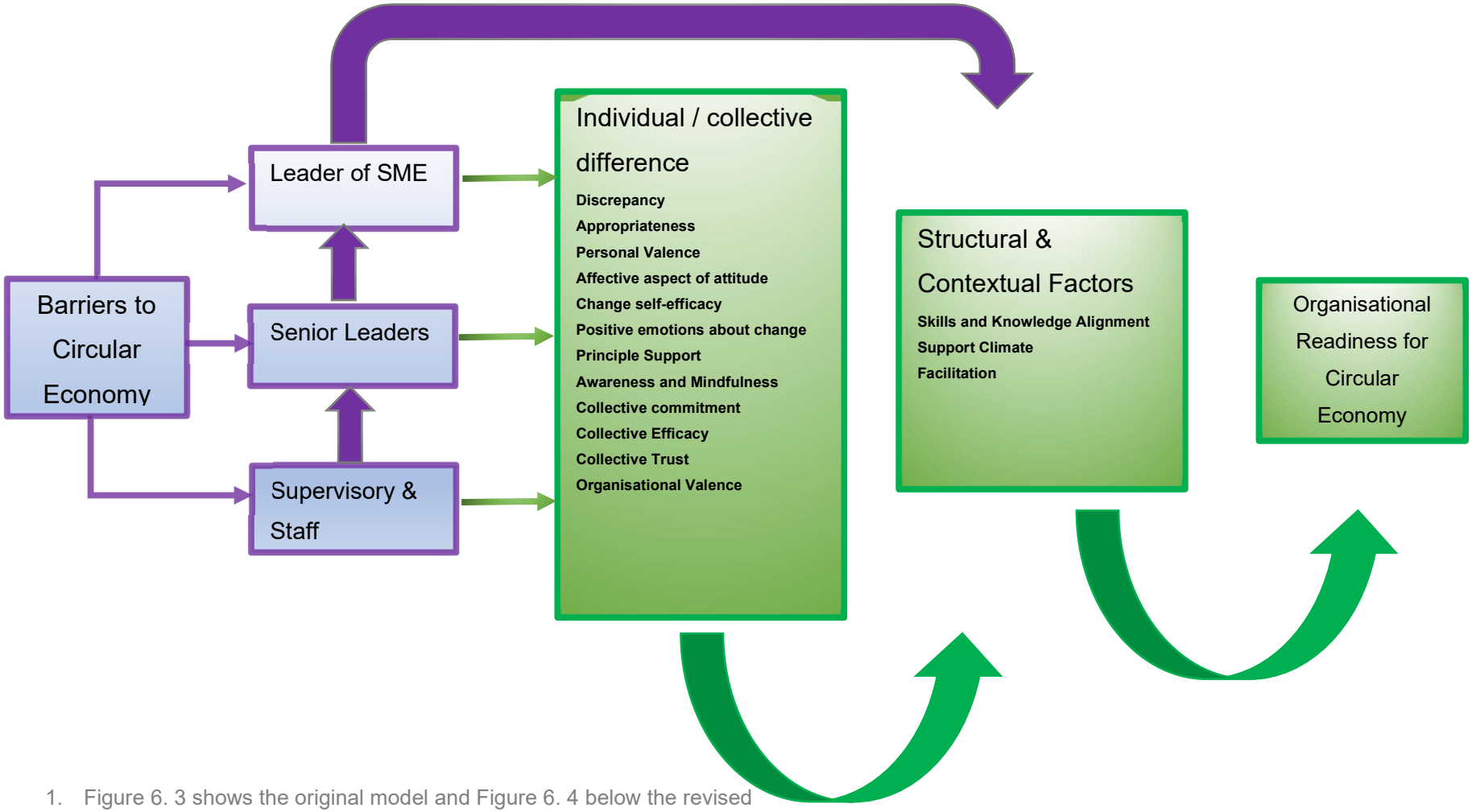
Questions 6 and responses 7 resulted in changes to the explanation of the model and the model itself. These can be seen below. Question 8 and response 9 were removed from the second iteration. Whilst this did not show a consensus, the responses in 9 were overly concerned with other factors such as regulatory frameworks, incentives, expertise, legislative measures, policies, time, logistics and space. Whilst these are all valid concerns about adopting CE, they are not perceived to play a role in this particular model. It is designed to address the readiness of internal beliefs, attitudes and intentions of the organisations' individuals and collective mindsets. It is designed to inform internal strategy and inspire change intervention such as raising awareness, training and development of staff, and strategy for informing and educating suppliers. For these reasons and the analysis of the responses in 9, this question was removed from the second iteration. Questions 10 and 11 were removed as the responses in 12 were deemed to be relevant to the wider change initiative, but not specific to the model or instrument. Again, the analysis of the specific responses is given in 12. Where consensus has been achieved, (13, 15) the question has been removed from iteration 2. There are questions (17, 19, 21), that whilst they do not have consensus, the very questions, on reflection, would be addressed in the intervention part of the diagnostic. The instrument itself is designed to assess the attitudes, beliefs and intentions of the leaders, senior management, and staff. Similarly, questions (23, 24, 25), are removed as it is evident that the instrument itself will reveal to the leadership what course of action to adopt relating to differences in feedback from the categories of leader, senior management, and staff and further addressed in the intervention part of the diagnostic. Questions (26, 28, 30) have consensus and whilst question 27 only has 64%, it has

been deemed possible to interpret the question in more than one way. Further reflection will be deemed to become evident from the engagement with the diagnostic and intervention stage.

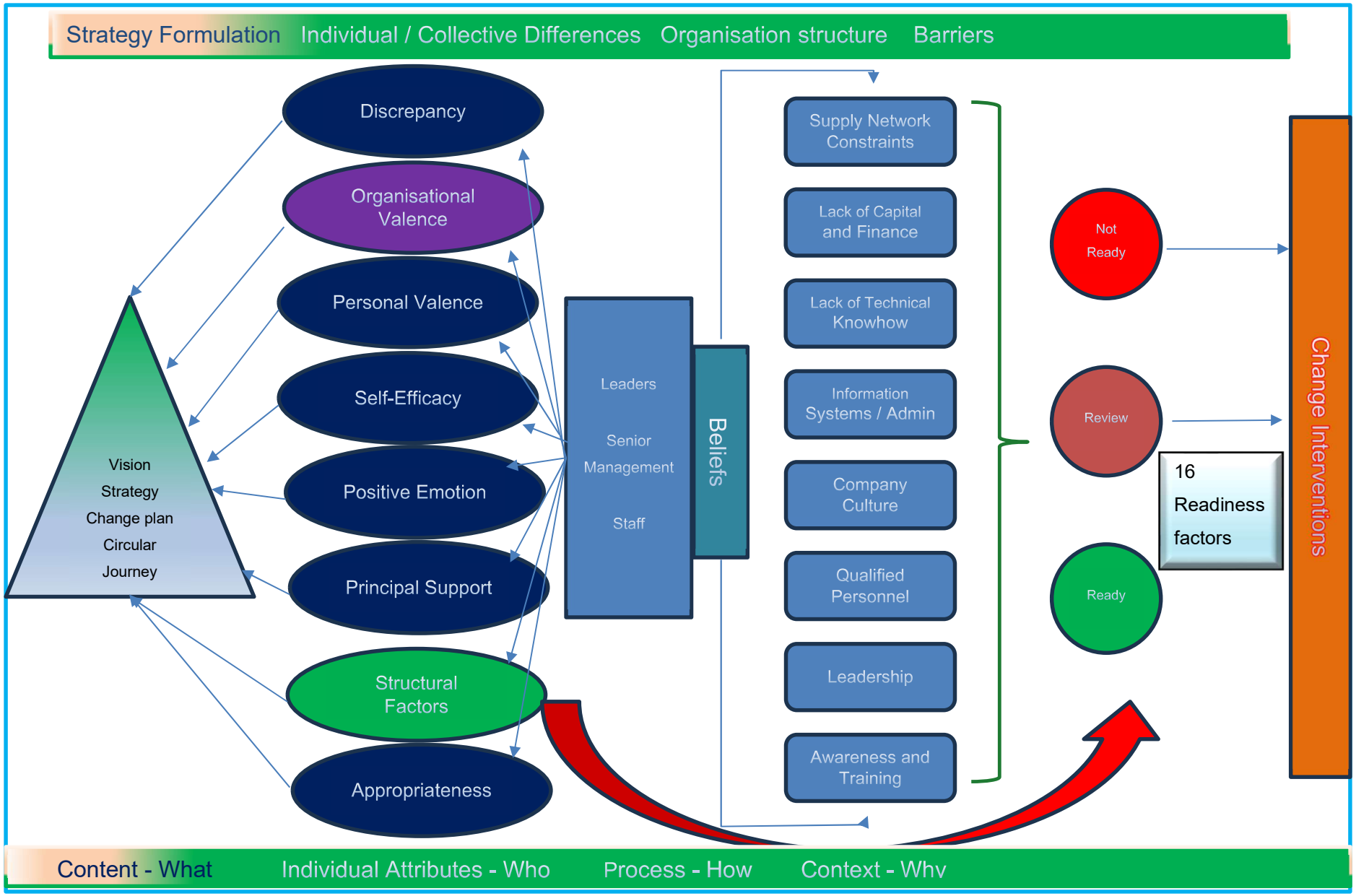
The model and instrument have been revised as a result of feedback and reflection from iteration 1 of the Delphi. In summary, there has been some repetition removed by consolidating some of the readiness factors and subsequently reducing the number of questions in the questionnaire.

Organisational Valence = the combination of Collective Trust, Efficacy and commitment. This is now depicted as just one readiness factor. There are now just six core individual differences, Discrepancy, Appropriateness, Personal Valance, Self-Efficacy, Principal Support and Positive Emotion, choosing to remove the Affective aspect of attitude and Awareness and Mindfulness which removes duplication in these differences but also barriers. Some of the barriers have been consolidated, the administration burden has been combined with a Lack of information/information management systems and a Lack of customer/consumer interest in the environment / Rigidity of consumer behaviour and business routine has been combined with a Lack of support in the Supply and Demand Network. The structural Factors include questions from 2 points, facilitation and skills/knowledge. Again, some duplication was experienced with other factors such as Principal Support, and the Support Climate so questions have been streamlined to reflect this.

Below are the two conceptual models. First is the original model shown in iteration 1. This is followed by the revised conceptual model for iteration 2. The two explanations used can also be seen below. Iteration 2 can be seen below.



1. Figure 6. 3 shows the original model and Figure 6. 4 below the revised


Strategy Formulation
Individual / Collective Differences
Organisation structure
Barriers
Discrepancy
Organisational Valence
Personal Valence
Self-Efficacy
Positive Emotion
Principal Support
Structural Factors
Appropriateness
Vision
Strategy
Change plan
Circular
Journey
Leaders
Senior Management
Staff
Beliefs
Supply Network Constraints
Lack of Capital and Finance
Lack of Technical Knowhow
Information Systems / Admin
Company Culture
Qualified Personnel
Leadership
Awareness and Training
Not Ready
Review
Ready
16 Readiness factors
Change Interventions
Content - What
Individual Attributes - Who
Process - How
Context - Why

6.5.5 Original Explanation

This conceptual model seeks to measure the level of readiness of individuals through understanding their beliefs about a variety of factors associated with the specific change. These individual/collective beliefs are based on the perceived barriers to SMEs adopting Circular Economy (CE). Different individuals are assessed, starting with the main leader, CEO, Chief exec, or business owner to ascertain their particular views. The change readiness criteria are defined by several factors that are related to the barriers to SMEs adopting Circular Economy. A questionnaire instrument has been developed to gauge their attitudes and beliefs towards these criteria. It is intended that the measurement will be using a traffic light system. The model works by using the change readiness criteria including the contextual factors and also linking into the barriers for developing questions to ask the SMEs' leader, senior management, and staff. It seeks to understand their attitudes and beliefs about factors associated with a specific organisational change.

6.5.6 Iteration 2 Explanation

This conceptual model seeks to measure the level of readiness of individuals by understanding their beliefs and attitudes about a variety of factors associated with the specific change. These individual/collective beliefs are based on the perceived barriers to SMEs adopting Circular Economy (CE). Different individuals are assessed, from the main leader, CEO, Chief exec or business owner to the senior management and employees. The change readiness criteria are defined by several factors listed in the model that are also related to the barriers for SMEs adopting a Circular Economy. A questionnaire instrument has been developed to gauge the leader, senior management and employees' attitudes and beliefs towards these criteria. It is intended that the measurement will be using a traffic light system for each of the groups. It is intended to validate the questionnaire (instrument) in an industrial setting. The terms used in the instrument will be changed accordingly for a better understanding of the field.

Leader / Red, Amber Green
Senior / Management Red, Amber, Green
Employees / Red, Amber, Green
The purple arrow simply indicates an input, and the green arrow is an output.

6.5.7 Responses and analysis from the second iteration

Introduction

Circular Economy is a model of sustainability which has captured the attention of both academics and practitioners alike. Core activities associated with Circular Economy are built on the notion that no waste goes unrecovered and all materials can be reused, recycled, re-purposed etc. It aligns with the United Nations - Sustainable Development Goals, UN-SDGs in that it endeavours to promote renewable energy, helping to address the climate change crisis. The key aspect of this study is to understand how SMEs are able or not, to make the transition from a linear economy to a Circular Economy through circular thinking. A few examples of circular practice would be to re-design a product with an end-of-life strategy as a key component. Another idea would be to procure recycled materials for inputs into your processes or more use of sustainable materials.
Readiness for change is when individuals of an organisation are collectively primed to embrace a change and are motivated to execute the change. The beliefs, emotions and attitudes of these individuals are key to assessing this level of readiness. Additional factors are the circumstances and context of the change and the level to which these circumstances and context support or hinder the implementation of change. Below is the conceptual model of change readiness for SMEs to adopt a Circular Economy. This conceptual model is facilitated by a questionnaire (instrument), that is designed to assess the readiness of various members of an organisation. It is designed to establish individual readiness and collective readiness as well as categorise the readiness of the Leader, the senior management, and the staff. Defining readiness into three categories.

Red = Not Ready, Major Intervention.

Amber = Need some intervention.

Green = Ready.

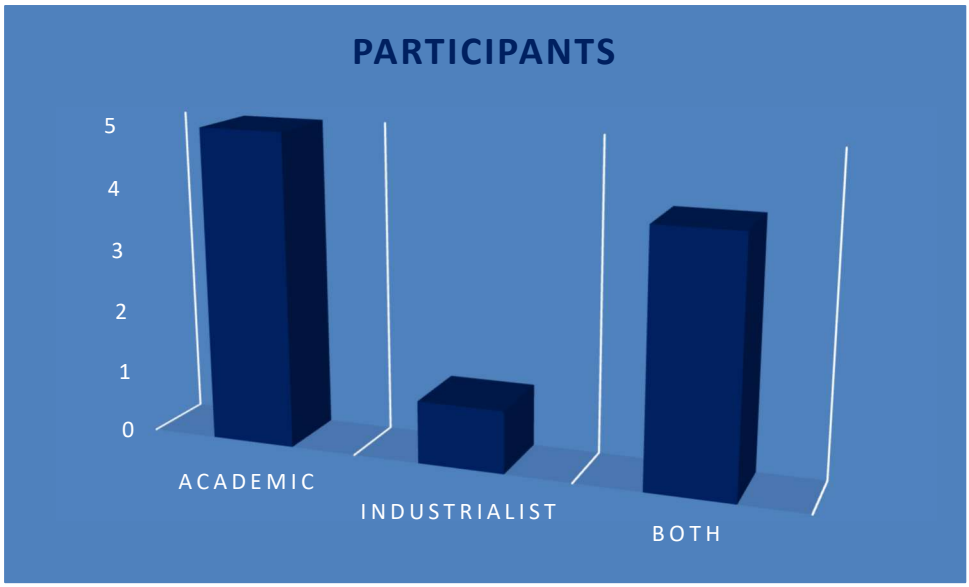
1. What is your Company/institution Name?

1	anonymous	SUEZ Recycling and Recovery UK Ltd
2	anonymous	Lindhurst Engineering
3	anonymous	MDI Gurgaon, India
4	anonymous	Czech Academy of Sciences
5	anonymous	Eastern Mediterranean University
6	anonymous	University of Strathclyde
7	anonymous	University of Derby
8	anonymous	Software Strategy, Tools and Consulting
9	anonymous	PUCPR
10	anonymous	National Institute of Technology Rourkela Odisha

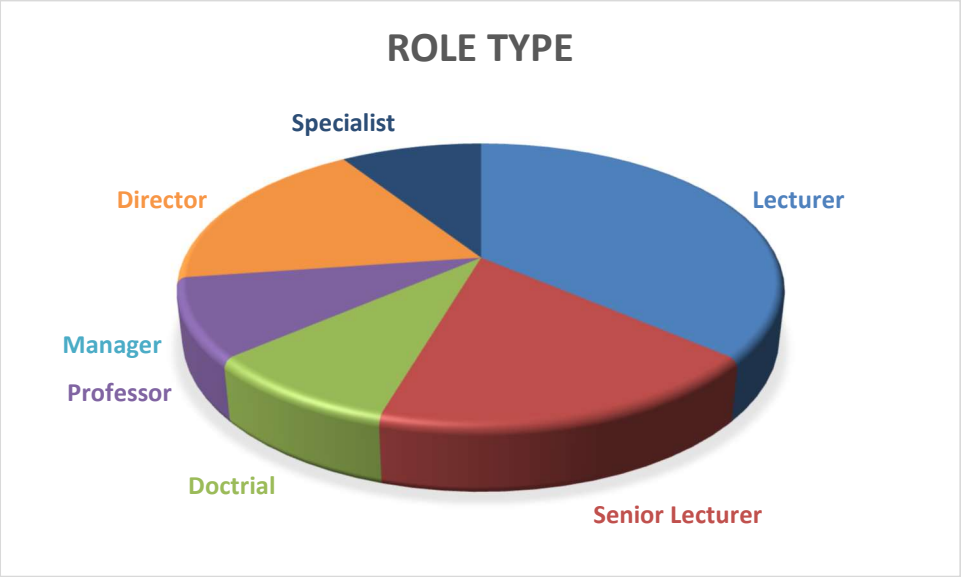
2. Country of residence

1	anonymous	England
2	anonymous	England
3	anonymous	India
4	anonymous	Czech Republic
5	anonymous	TRNC
6	anonymous	United Kingdom
7	anonymous	England
8	anonymous	Uk
9	anonymous	Brazil
10	anonymous	India

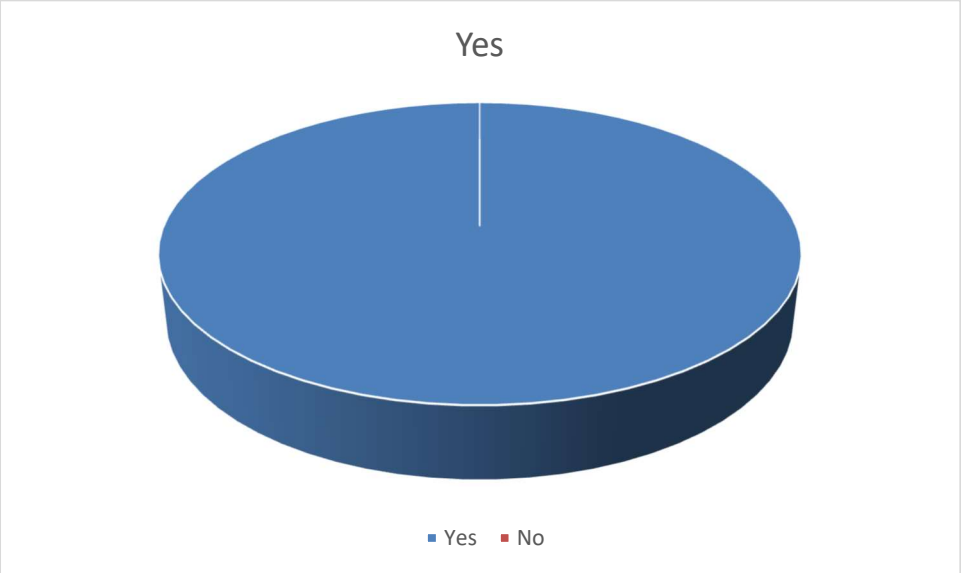
3. How would you describe yourself?



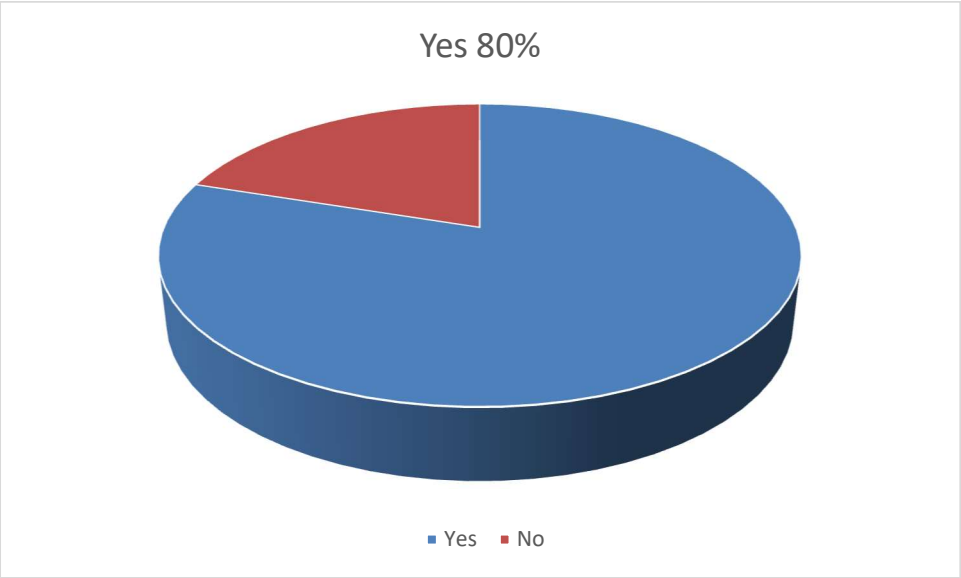
4. Position or role type.



5. To proceed with the Delphi study, you must be considered an expert in the field of Circular Economy and/or change. Have you had managerial experience of 2 years or more or academic research of two years or more in Circular Economy or management of change?



6. Does the conceptual model and explanation above make sense?



7. If this does not make sense, please elaborate on what is not clear.

Anonymous Response	Analysis
It is difficult to see the link between the individual/collective differences and the structural factors and barriers	OK. This might need some thought. This must be made explicit in the descriptors, as this is the feedback given to the leaders. It is accepted that with the barriers and change criteria, there will be some overlap.
Nil	Ok
You branch into three at the start and have 3 exit values but the branch condition and exit values are not linked.	This must be made explicit in the operation of the instrument. There are three questionnaires and three different outcomes that can be viewed together for interpretation and evaluation.

6.5.8 Broad Barriers Definition

Lack of support supply and demand network/constraints to adopting new circular business models. i.e., Procurement opportunities, opportunities for co-creation and collaboration, and the support of customers and suppliers.

Lack of capital / financial support Government support / economic and financial drivers, support from public institutions, misaligned incentives.

Administrative burden.

Lack of technical know-how / technical resource / Lag between design and diffusion or lead time to market.

Lack of information/information management systems.

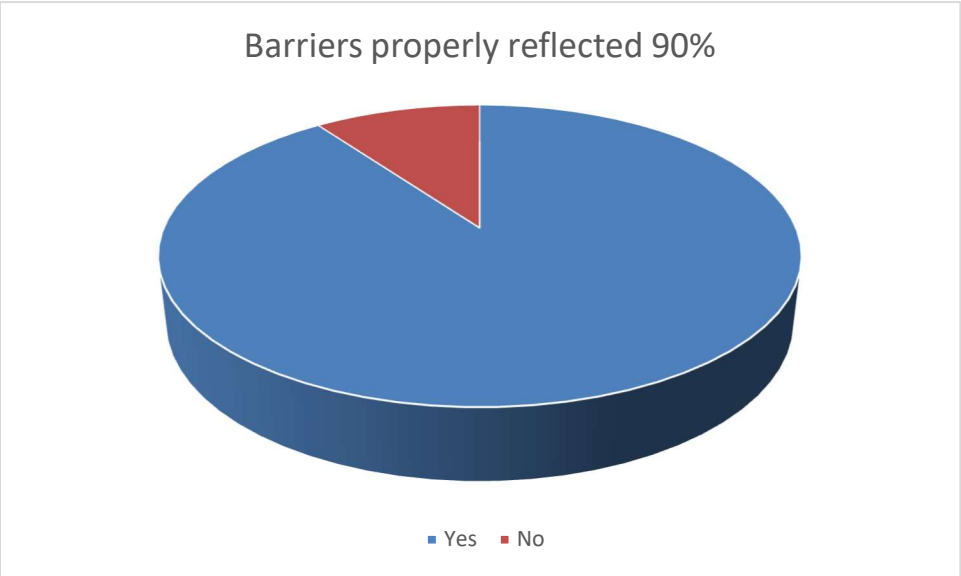
Company environmental culture / internal conflict.

Lack of customer/consumer interest in the environment / Rigidity of consumer behaviour and business routine. Community, consumer and customer readiness or lack thereof.

Lack of qualified personnel in environmental management.

Lack of leadership commitment.
Lack of environmental awareness, training and support

8. Do you believe the barriers are represented effectively in the instrument?



9. If not, what barrier needs more representation, explain below.

Anonymous Response	Analysis
Lack of vision, which might come under the leadership (seeing the big picture)	This is under leadership, certainly being able to effectively communicate the vision.
Comprehensively covered	Ok
My perception is that marketing activities are both ahead of the market and appealing to only a fringe. Companies are probably responding to investor pressure rather than market pressure. People are still generally making buying decisions based on price. However, costs avoided in one generation may be Bourne in the next and we need public policy tools to apportion those costs.	Agreed to some extent. However, it is the same rule for all SMEs in the UK, whether investor pressure or market pressure. Some do better than others, it is this difference that is of interest.

6.5.9 Change Criteria sent in the form

Discrepancy - a belief that there is need for a change. There is a difference between the current and future state (Rafferty & Minbashian, 2019; Holt *et al.*, 2007) Effectively, the same as Kotter's Sense of Urgency

Appropriateness - the change is an appropriate response to organisational or external issues (Daniel T. Holt and Vardaman, 2013)

Personal Valence - an individual's belief that change has intrinsic and extrinsic benefits including the perceived benefits of a change for an individual (Holt & Vardaman, 2013).

Positive emotions about change - the emotions that are present in response to change, such as joy, happiness, excitement, curiosity, enthusiasm, and pride (Rafferty and Minbashian, 2019).

Change self-efficacy - Confidence in your ability to affect change (Holt & Vardaman, 2013).

Principal Support - Provisional support from a range of leaders, moreover senior leadership, direct line management, formal, informal and one's peers (Holt & Vardaman, 2013).

Awareness and Mindfulness - being attentive to, aware of, and mindful of how a change is unfolding in the present, awareness of their routine behaviours and how they need to change (Gondo, et al., 2013).

Organisational Factors / Valence - A belief that the current change is good for the organisation as a whole.

Collective commitment - shared belief and resolve to pursue courses of action that will lead to successful change implementation. Commitment based on 'want to' motives reflects the highest level of commitment to implement organizational change. It is these I want to motives, that the instrument questions are based on (Holt & Vardaman, 2013), (Weiner, 2009) on A shared sense of confidence in collective capabilities.

Collective Efficacy - a shared belief in their conjoint capabilities to organize and execute the courses of action required to implement change successfully (Holt & Vardaman, 2013).

Collective Trust - shared belief that leaders will act in the best interest of the organization's stakeholders (Holt & Vardaman, 2013).

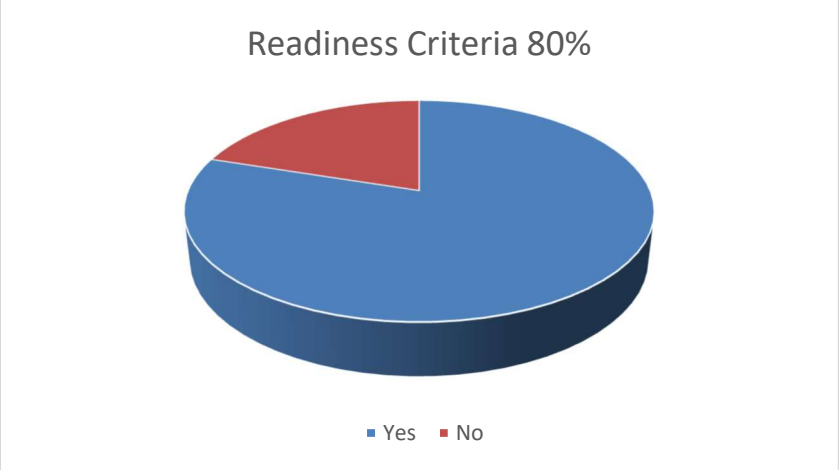
Structural Factors.

Knowledge and Skills alignment – the degree to which the employees' knowledge, skills and abilities align with the change (Holt & Vardaman, 2013).

Support climate - sufficient tangible (e.g. funding, reward, and incentive systems) and an encouraging intangible environment (i.e. culture and climate) to support implementation (Holt & Vardaman, 2013).

Facilitation - a set of clearly articulated goals and objectives that are supported by a detailed implementation plan defining roles and systems to measure progress (Holt & Vardaman, 2013).

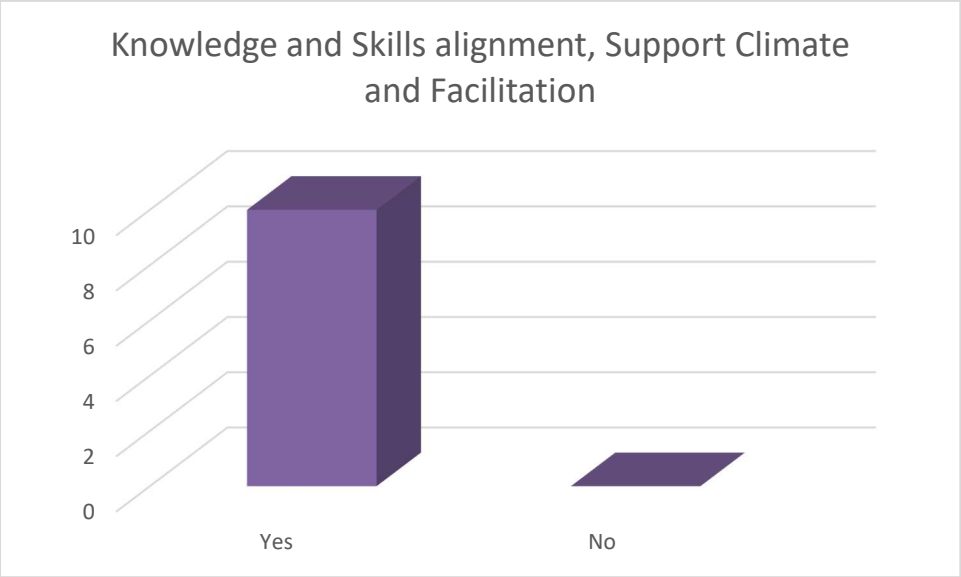
10. Do you believe these change readiness criteria are fully supported in the questions in the instrument?



11. If no, what additional questions should be included?

Anonymous Response	Analysis
Nil	OK
The Questionnaire can be expanded to think about the complete picture of readiness. For example, customer or Consumer behaviour point– You can ask How far your business influences the market readiness for the 2nd life product. Or something similar.	A good point to consider. Whilst consumer and customer routine is perceived as a barrier, it could be that the strategy developed from the diagnostic and subsequent feedback reflects on what leaders can do to influence the market.
It was not in the questions. It was much more basic in that in posing a set of questions I expected to be able to determine readiness level which was not obvious.	This aspect will be more apparent in the feedback stage of the diagnostic and was not part of the Delphi stage.
Monetary benefits are not shown in personal or organizational factors which motivate CE readiness.	Monetary aspects are part of the readiness criteria in as much they refer to the barrier Lack of capital / financial support Government support / economic and financial drivers etc.

12. Do you believe, *Knowledge and skills alignment, support climate and facilitation*, are represented sufficiently within the instrument (PDF).

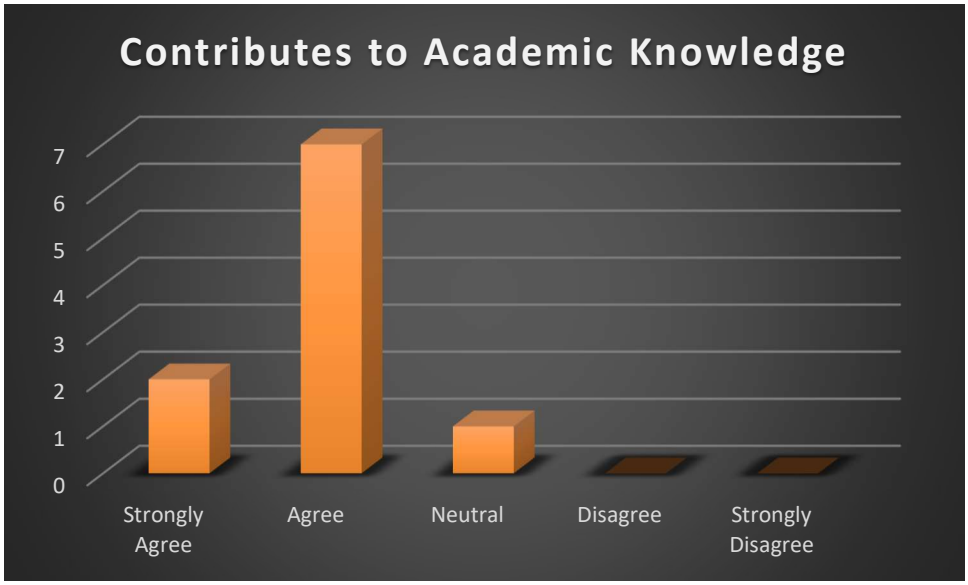


This has achieved 100% consensus.

13. If not, what questions would strengthen this section

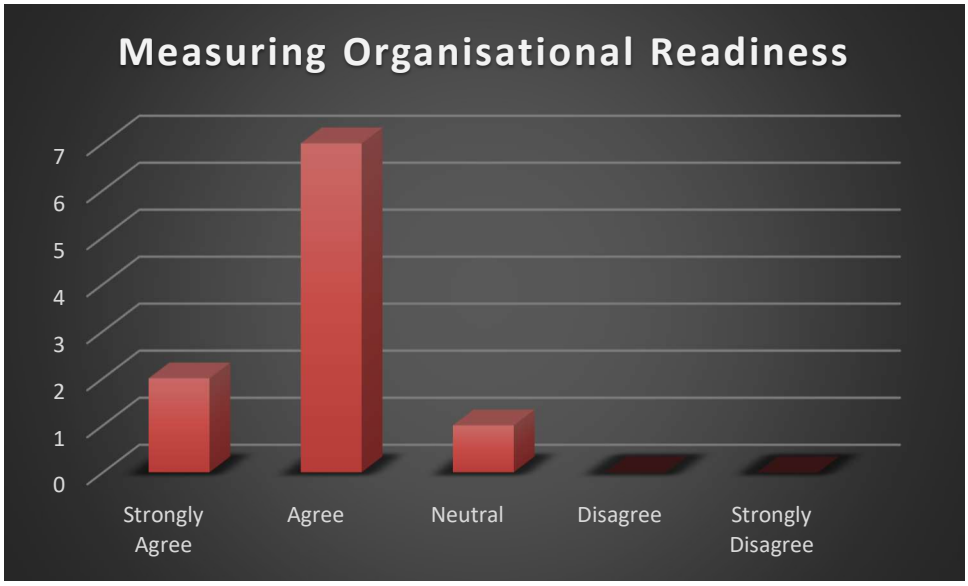
Anonymous Response	Analysis
Could the skills come from external/professional agencies, you simply need to know that you need help and where to look.	This is essentially the thinking that a leader would be hopefully contemplating based on their evaluation of results from barrier 8.
Nil	ok

14. This conceptual model contributes to academic knowledge through a combination of readiness models, CE barriers and organisational context.



This has achieved consensus at 90%

15. The questionnaire is capable of measuring the level of organisational readiness for an SME to adopt Circular Economy?



This has achieved consensus at 90%.

6.6 A summary of the Verified model

Based on feedback and comments from both iterations, changes are made to the verified model and also to the (instrument) questionnaire that constitutes the development of a diagnostic. A copy of the original questionnaire and the revised questionnaire and the descriptors can be seen in Appendix 6.4 and 6.6 respectively. It is worth noting that regardless of this feedback the presentation of the idea remains a challenge.

This Readiness Model is essentially a diagnostic tool for understanding the beliefs, values, attitudes and intentions of leaders, senior management, and staff to ascertain whether they are indeed ready, (in terms of mindset), for adopting CE practices. It is specifically designed to highlight areas within the organisation where employees' responses are measured to provide feedback to the leaders of the change compared with the leaders' and senior management's responses. This tool was specifically designed for the measurement of mindset, rather than actual results or the actual capacity to change. This research is entirely based on the theory that successful change starts with the mindset of the leaders and then continues with the senior team and staff. The tool was also specifically designed to be as short as possible as it is aimed at SMEs where all of the research suggests they have little time and resources. This means that it can be executed with minimum intrusion into daily business. The diagnostic is specifically designed for the leaders and change agents to receive feedback about how the organisation is thinking about the change and how they might prioritise change interventions based on the feedback from the diagnostic. For example, if the average score for the discrepancy indicates RED, then there is a case to be made for changing the mindset of the organisation. They must decide how to communicate convincingly why that change is necessary and the consequences of not doing so. The feedback from this diagnostic is delivered with a coaching style of questioning against each of the readiness factors. Of course, it is only the ones that are "red" that need to be discussed. It is not designed to tell the leaders of the organisation what they should do but to ask what the leaders think about the feedback and develop their change strategy accordingly. It is designed to enable targeted interventions to improve the possibility of a smooth transition to CE.

6.7 Conclusions

The consensus was achieved from both iterations using a Delphi survey method that utilised experts from academia and industry. In some cases, the process has enabled further thinking by the author in shaping this model and therefore some changes were made to the second iteration even though consensus was not achieved. The participant's comments and input were a valuable asset to the further development of this Readiness Model and instrument/diagnostic. As a result of participant comments, further changes were made to both the model and instrument / diagnostic as well as the method and thinking around the operation of this diagnostic tool. In summary, the model is a visual representation of the readiness for change diagnostic. It is operationalised by 3 separate questionnaires that are completed by the team members, senior leaders, and the leader. The results from this activity are collated and essentially result in providing a reading of red, amber, or green for each of the 23 readiness factors. An image of this can be seen in Chapter 7 and also in the Appendix 7.1. For each readiness factor, there are a series of questions and considerations that are designed to stimulate thought and discussion for the end users of the Diagnostic. This essentially enables the development of change interventions to create readiness for the transition to CE. To improve the relevance and practical aspects of this diagnostic, it must be validated in an industrial setting. The process of the validation stage and the outcomes from this stage are presented in the next Chapter 7.

Chapter 7 Validation of the verified Readiness model.

7.1 Introduction

This chapter aims to explore and apply a validation method to the previously verified Readiness Model and instrument for change readiness. It was previously verified through a Delphi method, using a survey to attract expert opinion from academia and industry alike. There have been modifications to both the model and the questionnaire (instrument) as a result of this feedback. This Readiness Model effectively creates a report/diagnostic that the user of the instrument would receive. It is this diagnostic that enables the change agents/ leaders or end users to develop change interventions. Therefore, this chapter aims to present an overview of the Readiness Model, that incorporates the instrument, diagnostic and operation, which is to be validated. This chapter also includes research to ascertain what validation is and the methods by which it can be achieved for this verified Readiness Model. This chapter adopts a method to follow to validate the Readiness Model and test its usefulness and whether it is deemed fit for purpose.

One approach, to validating a Readiness model, is for the developer to decide as to whether a model is valid. However, if the team is small, it is usually better to have the user(s) of the model heavily involved with the model development team in deciding the validity of the model (Sargent Robert G, 2010). However, the practicalities of engaging a third party to validate this verified Readiness Model are also discussed in this chapter. So, this chapter will discuss the validation approach, document learning and the revised approach using partial validation for practical purposes.

7.2 Validation

A conceptual or verified model is a representation or mimic of the problem entity conceived for specific research Sargent R., (1984, p115), defines conceptual model validity as “determining that the theories and assumptions underlying the conceptual model are correct and that the model representation of the problem entity is reasonable for the intended use of the model”. The evaluation of scientific knowledge involves three key theories, specifically, validation, reliability and generalisation (Sousa, 2014). Validity is a profoundly important concept in all forms of research methodology, with a primary aim to increase the accuracy and usefulness of the research findings. This allows for greater confidence in the findings of a given study (Godwill, E. A. 2015).

There has been significant research in the literature dedicated to the topic of validity, but much less on validation processes (Inglis, 2008). There is no standard method or accepted guidelines for appraising the quality of conceptual models, and little agreement in the literature as to what makes a ‘‘good’’ model (Moody, 2005).

However, Inglis, (2008) suggests validation is a process by which a judgement is made as to whether a tool is fit for purpose. If accurate, or meaningful, results are to be obtained and used, it is imperative to ascertain levels of confidence in model results. The end users must be assured that the model matches the system being studied. This process of providing the required assurance of the correspondence has been referred to as model validation (Power, M. 1993). Whilst there are many methods for validation of a model, it is not intended to discuss and compare many different approaches. Some of the approaches according to Sargent Robert G, (2010) are Comparison to Other Models, Degenerate Tests, Event Validity, Extreme Condition Tests, Historical Data Validation, Historical Methods, Internal Validity, Multistage Validation, Operational Graphics, Face Validity and Predictive Validation to name a few. The one that is closest to what is considered to be practical and of a robust nature for this research validation is Face Validity, defined by Sargent Robert G., (2010, p171), as “Individuals knowledgeable about the system are asked whether the model

and/or its behaviour are reasonable. For example, is the logic in the verified model correct and are the model's input-output relationships reasonable".

However, according to Moody, (2005) there is an absence of consensus as to how the quality of a conceptual / verified model should be evaluated and that practitioners continue to evaluate conceptual models in an ad hoc and subjective way, based on common sense and experience. Martis, (2006) asserts that a model cannot have total validity, but it should be valid for the purpose for which it is built. Furthermore, it should be judged for its usefulness rather than its absolute validity and whilst there can be no one test with which the model validity can be judged, as a model meets expectations, confidence in the model is improved. According to Rykiel E. J., (1995) validation is not about testing scientific theory or revealing truth, but a model that is acceptable for its intended use because it meets specified performance requirements.

Because the objective and subjective components of validation are not mutually exclusive, disagreements over the meaning of validation can only be resolved by establishing a convention (Rykiel E. J., 1995). The ideal convention for this validation of the verified model is to develop specific criteria by which it will be evaluated.

All conceptual / verified models exist only as a construction of the mind, and therefore Moody, (2005) argues, that whilst its quality cannot be as easily assessed, the finished product can be evaluated against some form of specification. It is this specification that is required to validate this verified model through subjective measures that address the key theories of validation, reliability, and generalisation, through developing a specification that considers the trustworthiness of the method, coherence of the results and repeatability and application of the results (Hill CE. et al, 1997).

7.2.1 Specification for Validation

For validation, it is important to be clear on what is being validated. The Readiness Model consists of 3 questionnaires to be completed, one by the leader, one by the senior managers and one by the team members. This then gives feedback by way of a diagnostic which measures 23 readiness factors, of which they are evaluated as red

= “not ready”, amber = “needs attention” and green = ready. All of these 23 readiness factors have questions and statements against each one that are designed to elicit a response and discussion from the recipients using the Readiness Model. In summary, this validation is for the process and operation of the Readiness Model.

Whilst there is an international standard for software products, there is no equivalent standard for validating conceptual models. Therefore, conceptual models continue to be validated in an ad hoc way, based on common sense, subjective opinions, and experience (Moody, 2005). There are no universal standards for selecting what test procedures or criteria to use for validation, therefore the validation criteria must be explicitly stated Rykiel E. J., (1995 pp241 -242) suggesting “the modeller must specify three things: (1) the purpose of the model, (2) the criteria the model must meet to be declared acceptable for use, and (3) the context in which the model is intended to operate” and that without them, a model cannot be validated.

In the context of this Readiness model, (1) the purpose was to measure the readiness of SMEs to adopt CE from the perspective of their collective mindset. The (2) criteria or specification is outlined below which is what the model must adhere to for acceptance. Then (3) the context in which the model is intended to operate which is in the field using action research for an SME planning the strategic path to circularity.

Moody, (2005) reviews five possible methods for empirically validating conceptual models; Laboratory experiment, Action research, Field experiment, Survey, and Case study. Action research was chosen as it is a collaborative approach to testing and refining research ideas by applying them in practice. Action research:

1. Allows research ideas to be tested in real-world settings.
2. Facilitates knowledge transfers between research and practice.
3. Allows research ideas to be refined via an iterative learning process.

It is the practical considerations that need to be measured to determine the value of using the Readiness model, such as the end user’s needs and expectations. It is of most importance for this model to have an impact on the purpose for which it is intended to be used. Therefore, this model must be validated by SMEs that are

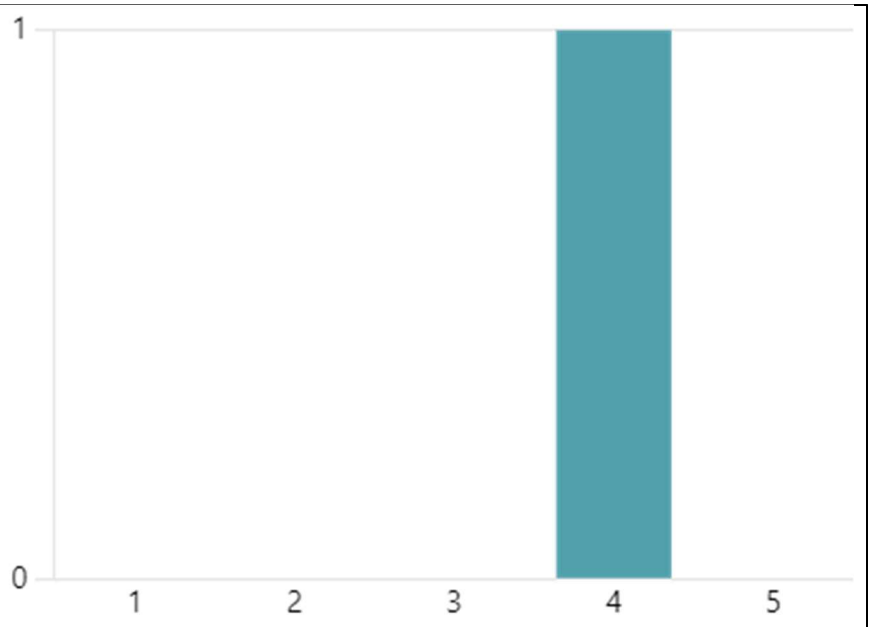
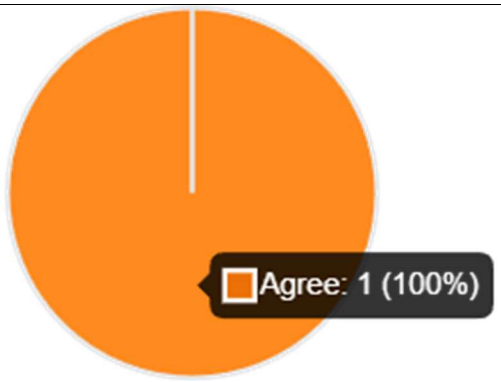
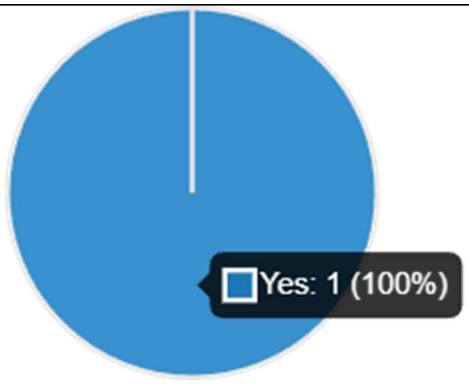
engaged in a journey of change to adopt circular practices. To this end, in this context, the definition of impact is that the Readiness Model and its operation will be measured by the following specification criteria relating to validation acceptance:

1. The ease by which the end user can understand the descriptors (feedback) and terminology (questions) built into the questionnaire, scale easy to hard
2. How relatable the instrument is to the scenario that they are facing, scale relevant to irrelevant.
3. The level of perceived value that it adds to developing the strategy, scale value added to non-value added.
4. The perceived level of disruption (time and resource), in carrying out the organisational Readiness model, scale time consuming to efficient operation—ease of dissemination.
5. The level of confidence the user has in the Readiness model, from No belief in the tool to total belief in the tool.
6. It must be considered fit for purpose; in that it meets the user's expectations and that it outweighs the cost of doing so. One factor that will be difficult to measure is the cost of not using this model and the subsequent impact of trying to deliver a change strategy towards CE. In other words, the cost of resistance or apathy if there are no interventions put into place to develop readiness.

Validation is considered complete when the Readiness Model meets the requirement specification. As stated by Rykiel E. J., (1995) the best that can be done is to state explicitly what the validation specifications are and let the end user judge if the criteria are adequate. These specifications were designed based on experience, common sense, and subjective opinion. However, they will be judged by the end user in the validation process as to whether the Readiness Model is acceptable for its intended purpose. To determine whether the Readiness Model is considered valid, each category has to score a minimum of 75% on average from the respondents. Using a Likert scale from 1 to 5 means that all participants would need to score 4 for all questions (equating to 80%), for validation of the Readiness model in this particular context. The average is taken and used for the validation of each part of the specification. Where the measure is per participant, then clearly 75% is the validation threshold.

7.2.2 Validation strategy and implementation

The initial strategy was to validate using a case study or two. This would essentially mean finding two organisations who were prepared to implement the diagnostic in full throughout their workforce and then to use these findings to discuss and reflect and then operationalise their findings through the implementation and measurement of their change interventions such as training, communication, development, recruitment, partnerships, or collaboration etc. The key challenge with this is to attract willing organisations to participate in what would be a significant commitment and relationship. The author knows only too well how SMEs operate and that engagement with an organisation and convincing them to trial the Readiness Model, which is perceived to take time and effort across the organisation, will not be easy. This challenge was first attempted by hosting an event called “The Journey to Circularity” and advertised using the Eventbrite platform. This event was circulated by several organisations known to the University of Derby and also on appropriate social media. On the first occasion, there were 17 companies registered to attend the event. On the day, only 4 participants turned up for the event. The event included an introduction to CE and a discussion about perceived challenges. It was concluded with a demonstration of the Readiness Model. This concluded essentially with a call to action to engage SMEs in considering working together for validation. Just one participant completed a feedback form and expressed an interest in following up on the discussion and the instrument. The results from this feedback can be seen below.

How would you rate the ease of use of the tool? 1 being hard - 5 being very easy	
The RED, AMBER, and GREEN categories in the descriptor are easy to understand.	
I believe there is value in using this tool	
If you answered No, to the previous question, what does the tool need	No Response

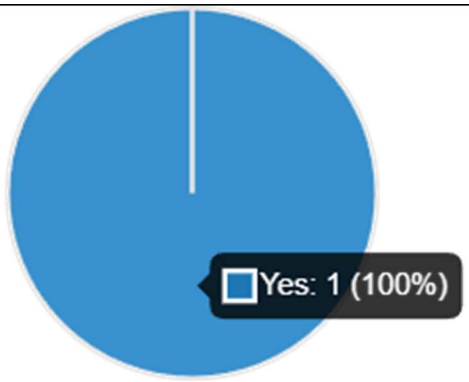
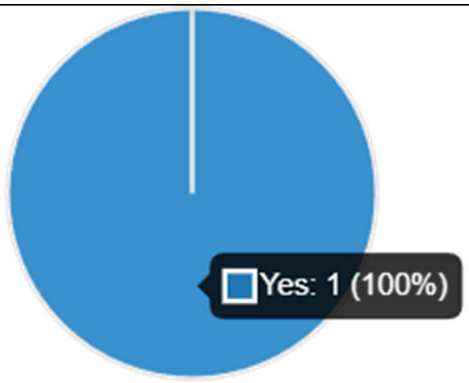
to provide better value?	
Do you have any general comments about the instrument or process?	Looks simple
Are you in a position to use the complete tool in your organisation?	
Would you like to discuss how we can take this entire readiness model into your organisation?	
If you answered yes, please leave your company name, your name and email address in the space below.	*"philip.mason@tidyco.co.uk"*

Table 7. 1 shows questionnaire feedback for interest in the Readiness model

TidyCo manufacture and sell hydraulic hoses and stainless-steel fittings. They also do refurbishing work for the Rail industry in terms of HVAC systems, which is indeed a circular activity. They have no design department and very little in terms of

manufacturing, more fitting and assembly work. A visit took place at TidyCo in Derby, which led to several activities looking into CE possibilities, but there was ultimately resistance to using the Readiness Model across the organisation based on the leader's perception of value compared to time and effort in administering the tool. It was clear that the company director preferred to understand what he could do, "quick wins", being informed as opposed to already having a strategy that would be worked through the organisation using the circularity Readiness Model.

The Journey to Circularity event was advertised again using the Eventbrite platform but unfortunately only attracted 3 participants and was postponed before delivery. Another event was held with a colleague and a similar presentation was made to a slightly larger audience of 9 participants. Again, engaging and following up with these participants proved to be problematic and did not have the desired outcome. This time, the feedback form was not used, but there was a call to action. The overwhelming feedback was that there were not enough good reasons/benefits to engage in an untested strategy. Additionally, it would appear that these participants represented a company that was not ready for such a strategy or that they were not the decision-makers for that organisation. Planning and delivering these events and then following up with potential participants is extremely time-consuming and took around 8 months in elapsed time, which led to zero progress. However, learnings from these activities helped to gauge future strategies and the approach taken.

The learning here was twofold. First, an alternative strategy was necessary to engage potential organisations because holding the events was not successful and was extremely time-consuming. The second point of learning was there would need to be a new approach to validating the Readiness Model. The validation process was deemed to be too intrusive with too much time and resource commitment on behalf of the organisation.

7.3 Strategy to Engage SMEs for Validation

Other methods for engaging an SME were followed through by networking with different individuals and departments within the University of Derby. Events were attended such as speaking at the supply chain conference in Milton Keynes, numerous net zero events held at the University of Derby as well as seeking support from a personal network. There were several lines of enquiry to follow, most led to a lack of commitment from any one organisation. One additional strategy was to apply for funding to support this work. If funding could be attained, then there could be better ways to engage with organisations by offering some kind of incentive whether that be monetary or otherwise. However, one funding application was administered but failed. Again, this was a heavy distraction from carrying out the validation process and was extremely time-consuming.

Three key fundamental barriers to engagement were identified. Often, it was trying to find exactly the right person to speak with. It would be that there would be a referral to another person in the organisation but finding the relevant decision-maker with enough authority to make any commitment, was difficult. The right person is someone with the authority to decide to do it and with a mindset that is prepared to consider the value of the research. Another barrier to commitment from an organisation was believed to be that there was too much time and effort required from an organisation and there was no proof of benefits as this was effectively a trial for a Readiness / diagnostic. The third barrier was to find an organisation that was positioned “just right” to feel the need to trial this Readiness Model. This company would need to be knowledgeable about CE and engage with the principles. They would need to have started their journey to circularity or at least move in that direction and be aware of the challenges. In summary, to effectively engage an organisation one must have the three key aspects aligned.

1. The right person
2. Time and Resource
3. Position to act (journey to circularity status)

7.3.1 Validation simplification to encourage Participation

If for practical reasons the first choice of validation could not be achieved due to lack of engagement from 3rd parties, other plans would need to be actioned. Several alternative validation approaches were considered. A choice of validation method could be compared to other models. According to Sargent Robert G, (2010) various results and outputs of the verified model being validated are compared to results of other models that have been validated. This approach did not appear to be practical and realistic in terms of this specific research. Six concepts are suggested to be able to help control the validation of qualitative research in psychology: intentionality, the psychological phenomenological reduction, eidetic psychological analysis, syntheses of identification, phenomenon versus individual, and invariant structures Sousa, (2014), but were immediately dismissed as inappropriate for this research. For validation and instrument development, qualitative approaches such as interviews with experts are widely used to define the construct and to provide the content (Zhou, 2019). This style of approach seemed a more practical and appropriate method of engagement. Whilst it still requires interaction and input from an organisation, it could be less intrusive and time-consuming than the initial plan.

This now highlighted a different approach altogether which was to explore an idea for partial validation. Essentially, partial validation is checking the fitness for purpose for the model and diagnostic but doing it in such a way that there is more likelihood of engagement whilst maintaining the validity criteria.

Following research and discussions a decision was taken to aim for partial simplified validation as opposed to completely running the full Readiness Model in an organisation, which feedback suggests is not practical. Partial validation would be much simpler and far less time-consuming for organisations to participate. It would effectively still be testing the Readiness Model's fitness for purpose without applying it across an organisation at scale, which would help to alleviate the second barrier of time and resources. It would also be measured in the same way in terms of the validation specification outlined earlier. To develop this partial validation strategy, it was decided to use a smaller version of the initial questionnaire for several personnel

to complete. Instead of 76 questions, there would be 20. Instead of 150 people completing the questionnaire, there would be 5 or 6. This would still develop the same "report style" where it created feedback for 23 readiness factors. However, it must be clear, that there would only have been several participants included in the full validation of the Readiness model, which are senior managers and leaders of that organisation. To expect an entire workforce to feedback on the validity of the Readiness Model would not give any additional benefits. The entire workforce would only be included if the Readiness Model was rolled out in full as participants in the strategy, just completing the initial questionnaire. So, in any case, having 5 or 6 participants complete the shortened questionnaire will deliver a simulation of the report and that report would look the same but would not be an accurate reflection of that organisation. However, it is not the questions that necessarily need validation, but the descriptors, the 23 Readiness Factors, and the insights from the report itself, the approach! After much work to adjust these questionnaires and make the whole feedback report as slick as possible, it could now be delivered face-to-face in a company or remotely with a team meeting. The process followed the criteria below:

1. Administer the three questionnaires by email using MS Forms.
2. Once the 3 questionnaires were completed, the data would be manually input into the spreadsheet that generated the report/diagnostic.
3. The 3 reports would be sent via email to the recipients before the 90-minute meeting.
4. At the 90-minute meeting, there would be introductions, and a general presentation of the research and Readiness model, with Q and A session.
5. Finally, there would be feedback on the whole approach from a further MS Form taking just 6 minutes. This would be completed after the meeting finished.

This validation process was carried out with Futaba Manufacturing UK. Futaba Manufacturing UK (FMUK) are a Japanese Tier One automotive manufacturer renowned for working at the forefront of technology to produce high-quality automotive components. They were chosen because of their involvement and current strategy of implementing Digitisation and IOT strategies into their organisation. There are similarities between CE and the change process with these initiatives, so therefore

was perceived as a good fit. In practical terms, they agreed to participate to see how there may be synergy in terms of what they are currently doing and what they could be doing in the future. Below are the results from the validation process. Firstly, the three questionnaires were administered by email. There were five participants taking part. Two participants were taking the team member shortened questionnaire, two participants taking the Senior Management questionnaire and 1 taking the leader questionnaire. A short version questionnaire for leaders can be seen in Appendix 7.2.

Once the 5 participants from Futaba had completed the shortened questionnaires, the report below was created from the data to simulate using the entire set of questionnaires for the workforce. The combination of their responses was aggregated and fed into the diagnostic for each questionnaire set. An extract of the diagnostic for leaders at Futaba can be seen below. Note, this is for illustrative purposes only!

FEEDBACK	Maturity Index	Strategic Insights
Discrepancy - a belief that there is need for a change. That there is a difference between the current state (what is happening now) and future state (what must be happening in the future). **If your maturity index is red or amber there is a lack of belief about the need for change to a circular operation. This is likely to lead to apathy and resistance or at least poor performance if it is not addressed.**	3.5	How can you change, improve or increase the message to the organisation? How can you influence others that there is a need to adopt circular practices? How can you best present an organisational vision of the future? What are your competition doing?
Appropriateness - the change is an appropriate response to organisational or external issues. In this case, is the perceived plan for adopting circular economy and new ways of working the right response to the challenge? **If your maturity index is red or amber there is a lack of belief about the style of the approach to the issue. If individuals consider this is the wrong approach, it is likely to lead to resistance from some or at least poor performance if it is not addressed.**	3.3	Is there any thing you must understand better from others to re-align your approach? How can you convince others that this apprach is for the best? People seldom resist change for no reason and often just want to have a voice! Listening and reasoning may enable an improved approach. What intervention could be put into place to facilitate input into the approach?
Personal Valence - an individual's belief that change has intrinsic and extrinsic benefits including the perceived benefits of a change for an individual. An individual has a sense that they will be also moving to a more personal favourable position. It has a motivational factor if an individual believes the change is good also for them personally. **If your maturity index is red or amber individuals feel there is nothing in it for them and will therefore be less likely to engage wholehartedly with the proposed changes. Even worse, if individuals feel a sense of loss, it is likely to lead to resistance or at least poor performance if it is not addressed.**	3.5	People are your greatest asset. What can you do to communicate the high value you hold for them? Are there any incentive to offer team members? How can you re-assure them their future is a positive one! How will the wider employees benefit from this transition to circular economy? What motivates members of the organisation? What do they value? Can you give more responsibility? Can you provide training and development? Mutual goal setting? Flexible hours?
Positive emotions about change - the emotions that are present in response to change, such as joy, happiness, excitement, curiosity, enthusiasm, and pride. There is a genuine positive emotion attached to the change and the way they have perceived it being managed. **If your maturity index is red or amber there is a lack of positive emotions, which are a key driver of motivation. Without a positive feeling of emotion for the change, team members are unlikely to fully embrace the change let alone champion the cause. Understanding emotions from the team / employees is key to knowing whether they will engage, conform, become an advocate or even champion the change effort.**	2.0	Being mindful of individual emotion towards the changes will be a key indicator of the likely success of the plan. How can you marshall more positive emotion within your team or teams towards the change strategy? Sending an anonymous survey might enable employees and staff to vent any emotion enabling approriate responses from leaders. These new insights may enable new leadership approaches and strategies.

Figure 7. 1 shows an extract of the leaders' simulation feedback report with strategic insights,

A more legible version of the full feedback report with insights for the leader can be seen in the appendix (7.1). The report is split into 3 columns, the descriptor of the Readiness Factor in the first column, the maturity index or measure of readiness in the second column and insights for stimulation of discussion about future strategy and change interventions in the third column. As part of Futaba's validation of this Readiness Model, the shortened leader questionnaire was completed along with the

senior management questionnaire by 2 participants and Team Members by two participants, in total 5 participants. The feedback from 4 of those participants can be seen below. There was one participant dropout on the day due to events unfolding within the organisation. Whilst this was not ideal, these remaining 4 responses were from leading management participants at Futaba. They were significantly experienced, in executive and senior roles and responsible for the ongoing change currently at Futaba.

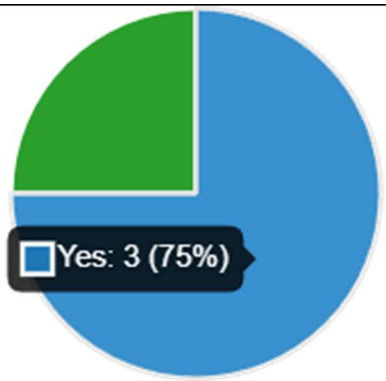
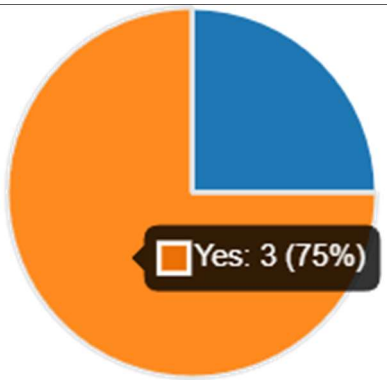
7.3.2 Readiness Model Validation Feedback

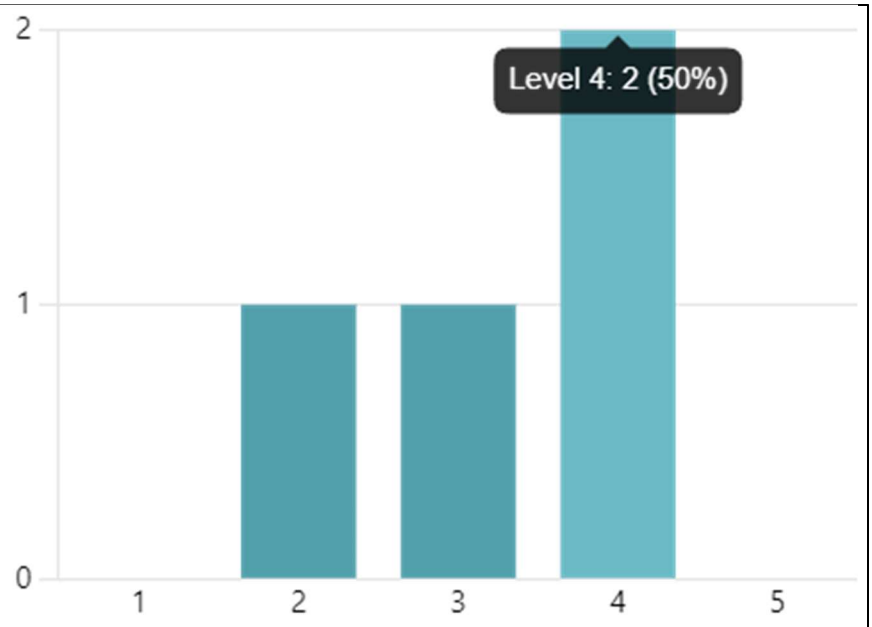
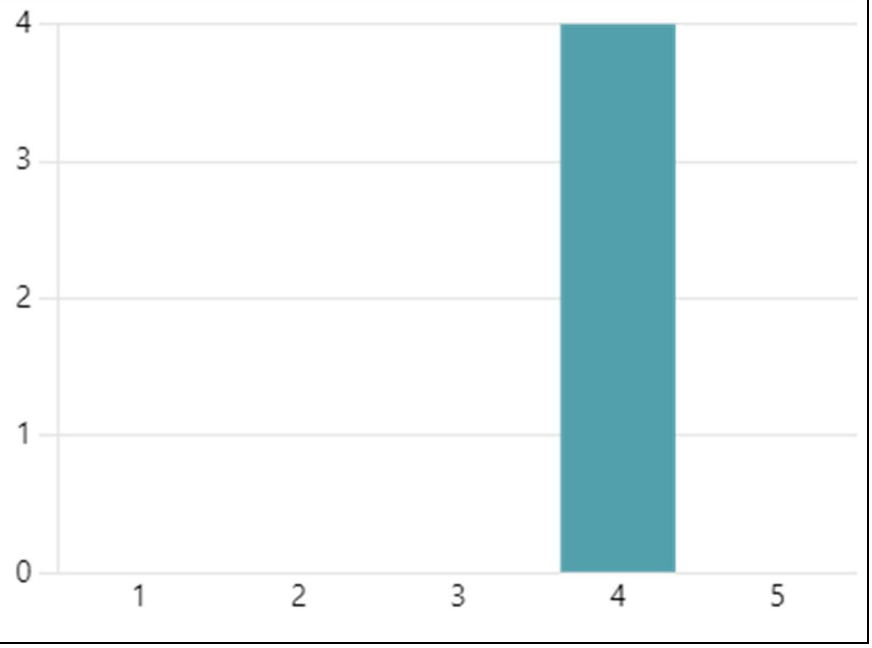
After the initial engagement of administering and completing the questionnaires and then providing the reports, there was an event. At this event, there was a full presentation showing the report and explaining the operation of the Readiness Model in full. There was an opportunity to ask questions and gain clarity surrounding its operation and perceived value. An in-depth discussion took place with questions and clarifications around the operation of the Readiness Model. Once this was complete, the participants were invited to complete the feedback questionnaire and the results from their comments can be seen below.

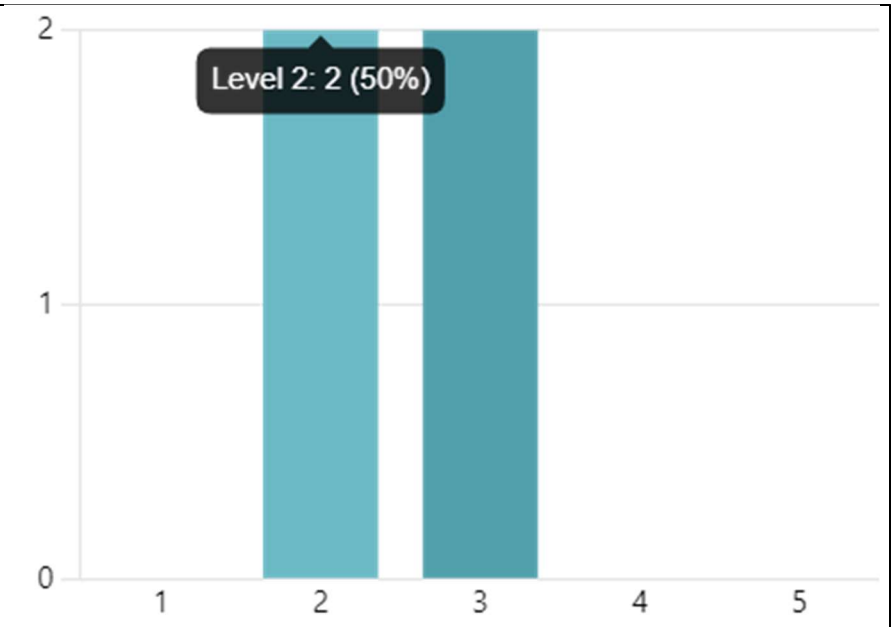
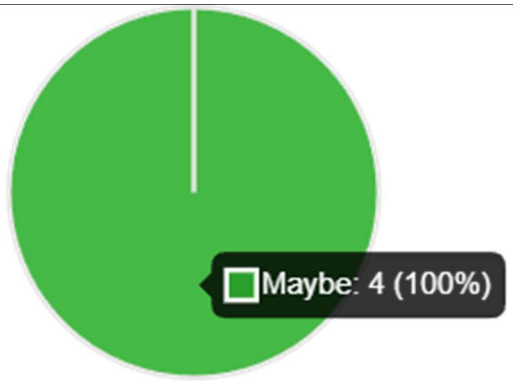
Thank you for participating in the presentation event today

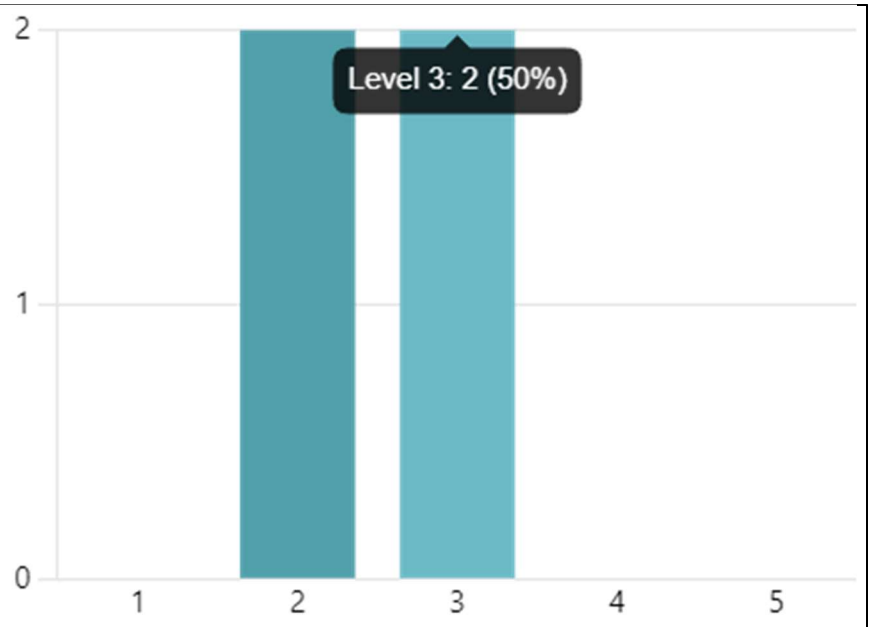
Please take time to feedback on the merits (or not) of this Readiness model. Constructive feedback is most appreciated. Please be mindful, that this readiness model is intended to be delivered as part of a greater strategy and assumes an organisation has begun their circularity journey and communicated initial plans to the workforce.

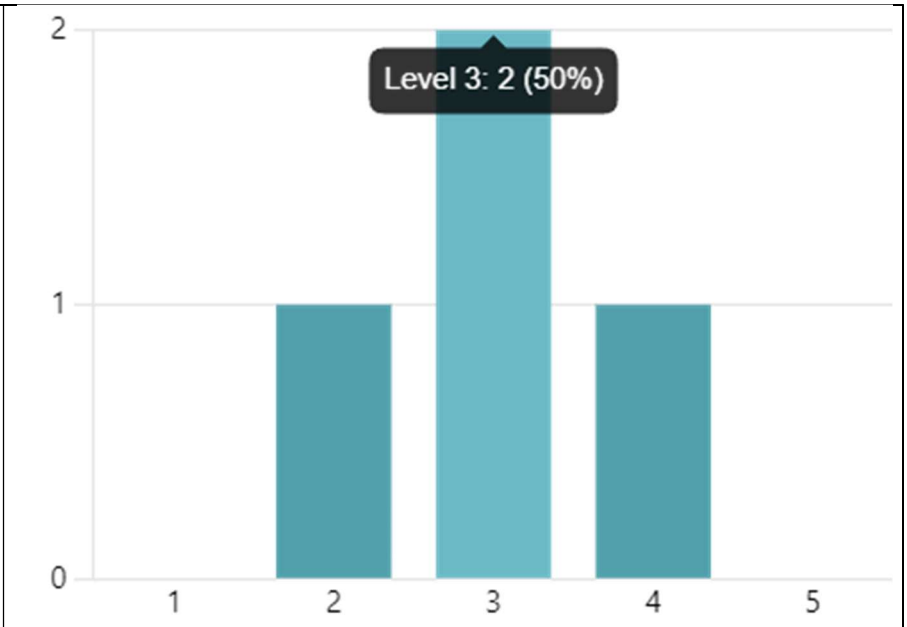
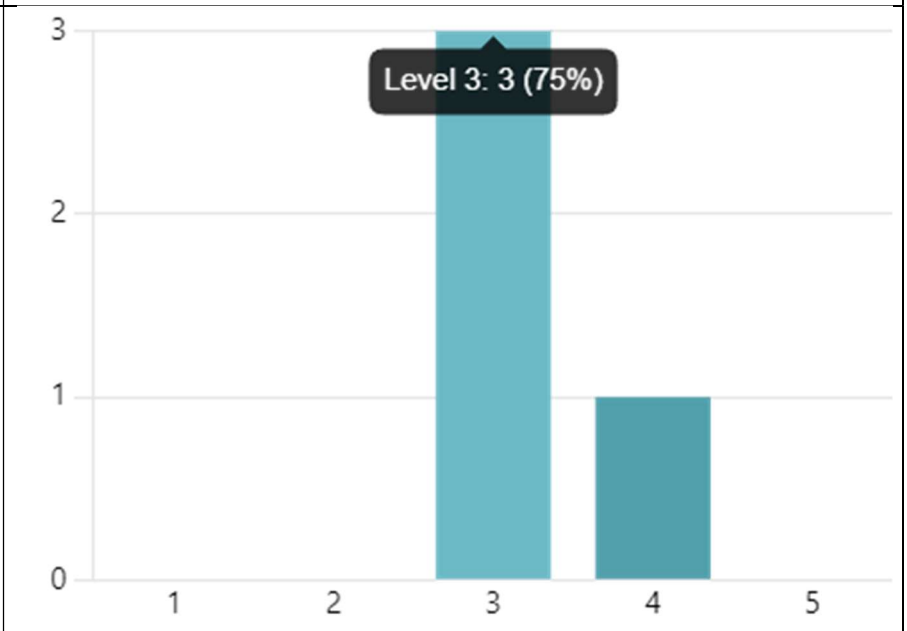
1. Company Name	1 anonymous Futaba Manufacturing UK Ltd Derby 2 anonymous Futaba Manufacturing UK Ltd Derby 3 anonymous Futaba Manufacturing UK Ltd Derby 4 anonymous Futaba Manufacturing UK Ltd Derby

2. Approximate number of employees	1	anonymous	200
	2	anonymous	200
	3	anonymous	200
	4	anonymous	200
3. Type/nature of industry	1	anonymous	Automotive Tier 1 Manufacturing
	2	anonymous	Automotive Tier 1 Manufacturing
	3	anonymous	Automotive Tier 1 Manufacturing
	4	anonymous	Automotive Tier 1 Manufacturing
4. Your type of role	1	anonymous	NPI Engineer
	2	anonymous	Manager
	3	anonymous	Engineering Manager / Deputy Plant Manager
	4	anonymous	Plant Manager
5. Did you receive feedback from one questionnaire, two or all three?	1	anonymous	All 3 questionnaires
	2	anonymous	All 3 questionnaires
	3	anonymous	All 3 questionnaires
	4	anonymous	All 3 questionnaires
6. Do you believe it adds more value, the more inputs you have, i.e., from all 3 questionnaires?			
7. Do you believe the concept of change readiness to be worth consideration			

8. How easy is the tool to understand? 1 = easy to 5 = hard	
9. Would this be too disruptive to a workforce if the initial survey was 76 questions (25 minutes) per individual? 1 = not too disruptive to 5 = extremely disruptive	

10. Do you believe this diagnostic has relevance to circular economy and organisational change? 1 = Strongly Disagree to 5 = Strongly Agree	
11. Do you believe the time and effort involved with the diagnostic is worth it for the insights received?	
12. If you answered no or maybe, please elaborate on your perspective about adopting this diagnostic.	1 anonymous It will be good to present the insight graphically for ease of understanding. 2 anonymous Whilst the insights can kickstart the conversation, this could only really be at the management level to help direct considerations when rolling out the strategy. More tailored results, with clear direction, could be helpful, with the remaining insights available for supporting data. e.g. what currently works, what do you need to improve, where should the focus be? - a "one-page" report.? 3 anonymous It needs more definition and insights - it is too generic and wordy in its current format and cannot follow a path or a process flow.

13. Do you believe the insights within the feedback offer real value? 1 = little value to 5 = Excellent Value	
14. How could more value be designed into the strategic insights?	1anonymous Evaluated per customer and made specific to the business or industry 2anonymous A way to graphically compare the insight from all 3 levels. 3anonymous As per Q12 4anonymous Giving practical examples of a process flow type of approach
15. What could be changed or improved about this diagnostic?	1 anonymous Tailored response based on the insight result. as per the answer of Q12, alongside a "front page" summary review of the total responses. 2 anonymous Simplification.

16. Would this be practical to use with your suppliers?	
17. How practical is this to use alongside forming a strategy for circular economy, 1 = not practical to 5 = extremely practical.	
18. Is there anything you would like to add in terms of constructive feedback about this approach?	1 anonymous For constructive feedback, showing some real-life examples of things that have been completed for other companies. We spoke about some examples but seeing this visually I think would help with engagement 2 anonymous It has the bonus of being a useful tool to drive considerations for all aspects of the required strategy. Additionally helps with considerations for future / current pitfalls, unsure as to whether it directly drives a business to develop a strategy. Some "benefits/risks" assessments and examples at the front end could be beneficial to win support

	3 anonymous I think from the presentation and the questionnaire - there wasn't a defined outcome or reason shown. The process did not tell a story - it needed an objective and a target setting following a process of grasping the situation. The process did not engage me directly as a Senior member to understand what value this was going to give me.

Table 7. 2 shows the feedback on the diagnostic from Futaba UK

7.4 Evaluation from validation feedback

It was stated that the validation specification criteria were to address six points as stated earlier in 7.2.1. Below is a matrix Table 7.2 of how the validation criteria/specifications are represented in the feedback questionnaire.

Specification	Related questions for validity measurement
The ease of understanding of the process and terminology.	8
The relatability of the Readiness model	7, 10
Perceived Value of the Readiness Model	6, 13, 14
Perceived Disruption	9,
Level of confidence in the Readiness model	11, 12
Fit for Purpose	15, 16, 17, 18

Table 7. 3 shows the relationship between the validation specification and the feedback question

Below is the Interpretation of the feedback based on the validation criteria as follows. From the feedback given in the Likert scales, an average was taken. To deem any of the specification criteria validated, it must average at least 80% which is indicated by 4.0 on this scale. The evaluation from the feedback questionnaire for validation is summarised below in Table 7.2.

1. The ease by which the end user can understand the descriptors (feedback) and terminology (questions) built into the questionnaire, scale easy to hard

.

Evaluation

This feedback for question 8 is averaged as 2.75 (reversed Likert), which suggests the Readiness Model is not at all straightforward to understand. This would mean being clear when presenting the Readiness Model to potential users. The method by which this Readiness Model is executed would be imperative, whether face-to-face or from a digital platform as a first draft indicator.

The context of when and why the tool is used is paramount in determining its usefulness and acceptance. Terminology will also need to be explained. This is discussed later in the Chapter.

2. How relatable the instrument is to the scenario that they are facing, scale relevant to irrelevant.

Evaluation

In question 7, 75% believe change readiness is a worthy consideration. This validates that Readiness for change in this context is worthy of finer scrutiny. This feedback for question 10 is averaged at 2.5 which suggests it is not obvious how the Readiness model relates to CE and strategic change. The context here is to be able to articulate why the Readiness model has value for this transition to CE. It needs to relate the problem statement to the goal statement. Value Proposition is discussed later in the Chapter.

3. The level of perceived value that it adds to developing the strategy, scale value added to non-value added.

Evaluation

This feedback for question 6 is averaged at 75% which validates the use of using 3 questionnaires in the Readiness Model. Perceived value is recognised in having feedback from all areas of the business to better understand their beliefs and attitudes regarding the transformation to CE. In question 13 the average is 2.5 suggesting there is limited perceived value from the Readiness Model. In comment 14, there is a lack of clarity about how the insights and results are displayed.

Comparing the results from the 3 levels of the business must be clearer and easier. The way the insights and maturity index are understood is also key to improving the way value is internalised. The comment being “made specific to the business or industry” suggests participants are not making connections with the challenges and that the context and relevance are achieved through the co-creation of value. Again, the comment “giving practical examples of a process flow type of approach” suggests more guidance and knowledge are required at the start of the process. How this Readiness Model is introduced into an organisation and how the value is proposed is paramount to the success of employing it. The Readiness model assumes knowledge and strategy have already been determined, but from anecdotal evidence, many SMEs are not in this position of knowledge and formed strategy. This concept of Value proposition and Value co-creation are discussed later in the Chapter.

4. The perceived level of disruption (time and resource), in carrying out the Readiness model, scale time consuming to efficient operation. The trade-off for dissemination against the insights received is depicted in question 9.

Evaluation

This feedback for question 9 is averaged at 2.0 (reversed Likert), equating to 40%. This essentially states that 76 questions for all employees and senior management would be far too disruptive to administer for the entire organisation. Reducing the number of questions down to as many as 46 would be possible without losing the integrity of the Readiness model. There may also be possibilities for rationalising the number of Readiness factors.

5. The level of confidence the user has in the Readiness Model, from no belief to total belief. This is considered in question 11 and comments in 12

Evaluation

The specification around confidence in the Readiness Model received 100% “maybe” for question 11 which equates to a degree of potential confidence but also uncertainty. In the comments from (12), it suggests improvement in how the report is presented. More importantly, it suggests direct results and clear direction would be helpful. Also, they wanted to know what currently works, what they need to improve, and where should the focus be all summarised. This suggests a lack of

knowledge and direction could be commonplace with SMEs and their journey to circularity. They suggest it is too generic and wordy in its current format and cannot follow a path or a process flow. Again, this suggests SMEs are likely to need support in terms of knowledge, guidance, and direction.
6. It must be considered fit for purpose; in that it meets the user's expectations and that it outweighs the cost or resistance to doing so.
Evaluation This is effectively all of the other specifications as well as questions 15, 16, and 17 for improving the Readiness Model. Question 15 responses suggest guidance, summarised, and simplified. Question 16 asks about to use with suppliers, which averaged at 3.0. Again, this has not been communicated effectively as a potential for co-creation through the supply chain—question 17 averages at 3.25 which deems this impractical to use alongside any strategic endeavours. All of the feedback suggests that there is a lack of clarity around the purpose of the Readiness Model and therefore it is currently unfit for purpose. Having real-life examples of CE in action would enhance engagement according to the comments in question 18. Having actions visually displayed and with cost/benefit information would further create engagement. Additionally, a target objective and narrative were missing from the presentation. It does appear that much of the engagement or buy-in was around the presentation and subsequent understanding of both the challenge and potential solutions. The value is perceived by the recipient and therefore they must have a full and comprehensive appreciation of the value proposition to determine if this is indeed fit for purpose. This value proposition is only realised with full engagement in the process and is the consequence of co-creation as discussed later in this chapter.

Table 7. 4 shows the evaluation of the validation specification criteria

7.5 Discussion of Validation

It is evident from the feedback that this Readiness Model and the approach are not validated according to the specifications set out. What is crystal clear, is that there is a need for much more work to sell the benefits and value and adapt it to be more meaningful to SMEs. The results show that this Readiness Model has been validated in terms of surveying the entire workforce using three questionnaires and that in the context of an SME's journey to CE, change readiness is worth the scrutiny. However, this feedback also shows it has not been validated in terms of clarity and understanding of the operation, relatability, perceived value, levels of disruption, confidence in the Readiness Model and essentially being fit for purpose which is all of the main specification criteria. In summary, this Readiness Model is neither validated nor is it invalidated. Rykiel E. J., (1995) argues that models can indeed be validated as acceptable for pragmatic purposes, and that validation can be a useful model evaluation activity regardless of whether the model is declared validated or invalidated. This validation process has certainly enabled much learning about its usefulness and whether it would be deemed fit for purpose in its current form. To improve the current state of the Readiness Model, several quick wins could be achieved.

Specification	Recommendation for improving Validity
The ease of understanding terminology	Have a written explanation of the Readiness Model and the operation before applying the model explaining CE and examples of good practice.
Relatability to change and CE	Following on from the above, examples of what prevents individuals from making the changes necessary to engage in the circular activity.
Perceived value	Providing the end user with a flow chart to essentially provide a roadmap of engagement and roles and responsibilities.

Perceived level of disruption (time and resource)	Reduce the questions from 76 to less than 46. Potentially, reduce the Readiness Factors by merging some and simplifying.
The level of confidence in the Readiness model	Review all insights for clarity and simplify where appropriate.
Fit for purpose	Present the value proposition and the concept of value co-creation

Table 7. 5 shows how each specification of validity could be optimised.

The philosophy underpinning this research and the Readiness Model was that the Directors and senior management team of SMEs would know about CE, be immersed in the implementation of a strategy and be creative and flexible enough to use the tools in the way it was intended, as a coaching philosophy, that teased out some additional, perhaps hidden challenges within the workforce. It would have the impact of raising awareness throughout the organisation and specifically with the senior team who were responsible for strategy. It is designed to focus the minds of those responsible for the strategy. It is designed to engage their minds and challenge their assumptions and beliefs about how the organisation as a whole see the challenge and the strategy. It is designed to be a catalyst for change in the way the senior team see themselves and their need to change, think and act differently to enable, influence and motivate their workforce. This message of what the Readiness Model was designed to do and how it was designed to work was not apparent, visible, or obvious from the way it has been marketed or presented in the past. The true validation would therefore be under controlled conditions where the concept was first understood and the ideas of how it is operationalised are accepted by the leadership of the SME.

In many cases, maybe, this journey to circularity is not perceived as a priority for SMEs right now and many of these organisations are not yet at the stage where they can apply this Readiness Model. This seemed to be implied not only by the validation process but also by the lack of engagement from all of the events that were indeed designed to sell the idea of the Readiness Model for circularity measurement. The timing of such an intervention is crucial and the context of the application is also key.

Below is a strategic model of how this Readiness Model might be positioned from a higher-level perspective. Any strategy starts with a vision and normally has several broad objectives and measures. As depicted below, the Readiness for change and the Readiness Model are placed alongside the implementation plan.

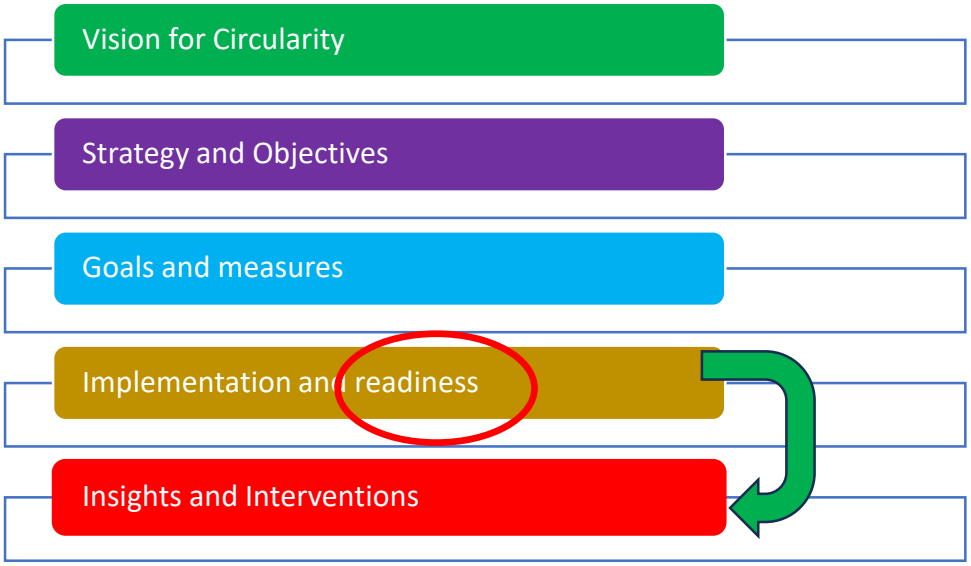


Figure 7. 2 shows where this diagnostic would fit into an SME's journey to circularity.

This Readiness Model assumes several criteria, which are summarised above. It assumes that the SME leaders will have some knowledge and understanding of CE and that they will have developed a vision for the future and a strategy to establish the pathway. It also assumes they will have developed goals and methods by which they will measure success. Once this strategy and goals have been communicated to the workforce, it is at this point that the Readiness Model would be applied. It could arguably be used at the senior leader level as a guide to developing strategy and then further used with the staff members of the organisation to garner their individual and group perspectives. The feedback from all three questionnaires is designed to indicate how the different groups may see the challenges. It can even be broken down by department, so the attitudes and beliefs of the design engineers could be compared to those of sales and marketing. This information can be crucial to the targeting of training, awareness, development, communication, expertise, and specialist knowledge development.

However, the barrier to true validation resides in the lack of a value proposition. It was clear from all of the feedback during the validation process that there was a serious lack of purpose, and perceived value for the Readiness Model. Whilst there were other quick wins previously summarised, the value proposition and concept of co-creation will be what deems this Readiness Model valid for its intended purpose.

7.6 Value proposition

Potential end users must understand the value proposition in utilising this Readiness Model and approach. If they do not see the value, then they are unlikely to engage with it. Often, it can be said that any tool or diagnostic should be designed to solve a problem. Whilst this problem or challenge of adopting circular practice is certainly perceived academically, organisations may not have the same perception or at least feel CE is a priority right now. However, identifying potential users of this Readiness Model that are in a position to create value by using this approach is paramount to true validation.

According to Lusch et al., (2007, p13) a value proposition can be defined as "a promise the seller makes that value-in-exchange will be linked to value-in-use." The value proposition is regarded as a promise that customers can harvest value from offerings from a service (Grönroos & Voima, 2013; Lee & Park, 2023). Essentially, there must be a belief by a customer, that once they exchange money with a seller, they will implicitly assume the value-in-exchange will result in added value-in-use that exceeds the value-in-exchange (Lusch, Vargo and O'Brien, 2007).

According to Shamsuzzoha et al., (2023), It is imperative to ascertain a deep customer understanding of the value proposition which can reduce the possibility of failure in the market. Research on value communication accentuates that sellers often find it difficult to communicate a customer's value proposition (CVPs) that resonates with their customer firms' various needs (Bischoff *et al.*, 2023). During the adoption of CE strategies, Shamsuzzoha et al., (2023) argue, it is paramount to consider the creation and measure the corresponding customer value. CVPs can potentially support

multiple goals since customer goals are diverse which means the constituent parts of CVPs must be understood (Bischoff *et al.*, 2023).

Lee & Park, (2023, p 3) provide an example of a value proposition, “an exhibition/show organiser (i.e., a firm) explains to exhibitors and visitors (referred to as customers) the reasons (value propositions) why they need to attend an exhibition. Value propositions cannot be realised until customers attend the show (value-in-use) and determine its value together with the organiser (value co-creation) through interaction”. In the same way for this Readiness Model, the users are the customers and the “value in use” cannot be realised until the customers use the diagnostic and in turn interact with their organisation’s strategy and change interventions to determine the “value co-creation”. To better understand the value proposition of the Readiness Model, an event was arranged with Professor Mark Gilman to try and identify the underlying perceived value of using the Readiness Model.

7.7 Event for Identifying the Value Proposition

This event was a relaxed coaching style of interaction to elicit hidden motivations, values, and beliefs about the operation of the Readiness model. It was essentially, a 1:1 brainstorming session organised in the form of a coach and coachee. In the first instance, questions were asked by Prof Gilman specifically about the Readiness Model. The style of questions such as why it was conceived what the purpose is and what might be the benefits of applying the Model. This process incorporated some 15 questions and lasted for around 45 minutes. Initially, during the questioning, the responses to such questions were captured as keywords and phrases and recorded on Post-it notes randomly spread across a table. Once complete, the keywords and phrases were reviewed for how they related to each other and put into 4 themes as per the affinity diagram that can be seen in Figure 7.5.

The themes that originally came out of this activity were:

Impact

Learning Organisations

Individual

Insights

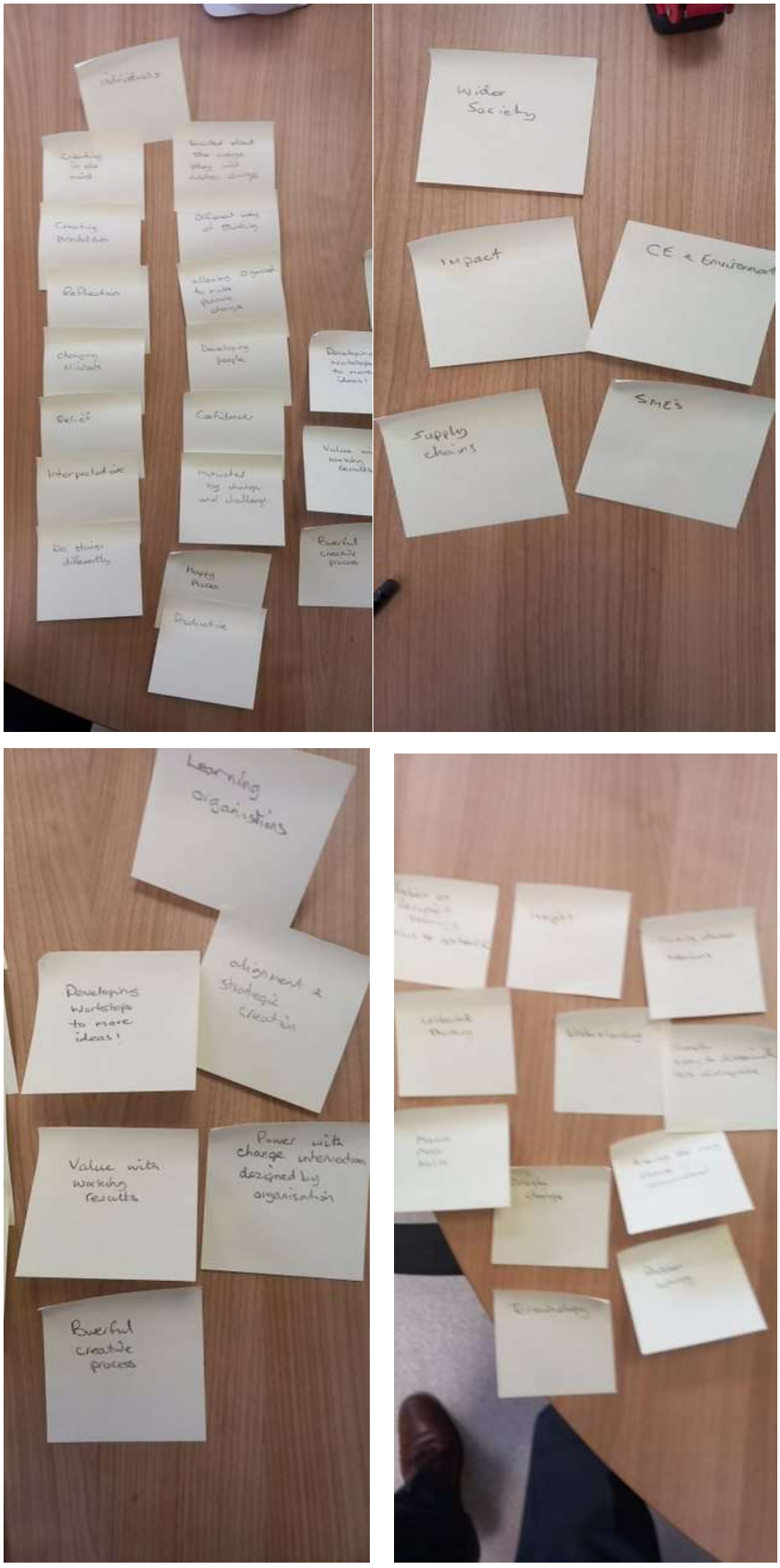


Figure 7. 3 shows an affinity diagram for identifying the value proposition for the Readiness Model

From this initial brainstorming exercise, key powerful words and key phrases were collated on a sheet for further analysis and evaluation of how to identify the true value proposition for using the Readiness Model for circularity. This was very much a co-creative and subjective approach. Several attempts were made to articulate the value proposition and several of the more favourable variations can be seen below.

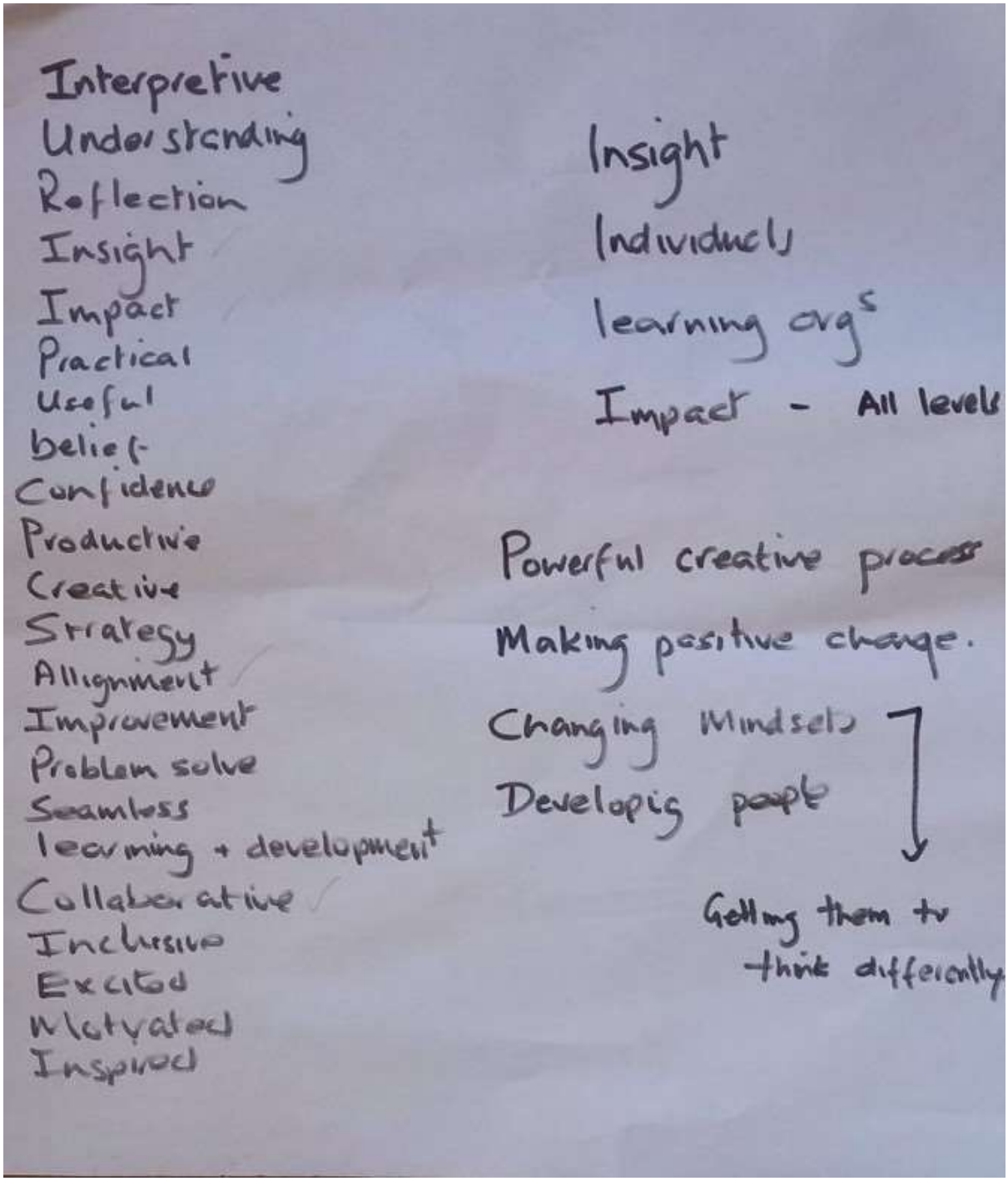


Figure 7. 4 shows themes for identifying the value proposition for the Readiness Model

Variations of the value proposition can be viewed below. These can be used for communicating the value to potential end users of the Readiness Model and help foster collaboration and value co-creation.

Value Proposition 1

'A powerful creative process that gives you insights into how to make positive change that impacts every part of your organisation. It gets everyone to think differently and alters mindsets so that you can develop the organisation and its people to deal with all levels of transformation as a collective force for the future. You will become a strategic and efficient organisation that is sustainable and inspirational to all of your stakeholders.

Value Proposition 2

Gain valuable insights using a creative process that will align and develop individuals to create a learning organisation. Produce positive change through developing new mindsets, inspiring impact, and results at all levels.

Value Proposition 3

A powerful creative process that reveals new insights to solve problems and transforms all areas of the business. A practical approach enables team members to make a shift in their thinking, resulting in an inspired and engaged workforce ready and capable of doing things differently. You will accelerate your journey to circularity leading the way strategically across the supply chain and wider society.

7.8 Conclusion

The validation of the readiness Model/diagnostic is inconclusive. The verified model was neither validated nor invalidated. The specification that was considered to ascertain whether the Readiness Model was valid was essentially not validated. Certain aspects of the Readiness Model, such as addressing readiness and doing so throughout the organisation were validated. Interestingly, Rykiel E. J., (1995, p230) argues, “validation can be a useful model evaluation activity regardless of whether the

model is declared validated or invalidated" It has become evident that true validation is formed by the co-creation of value from the Readiness model (in use), and the subsequent results gleaned by the user.

This validation process has highlighted several communication issues and interpretation issues. It is not completely clear to participants in this validation where, when, and how this Readiness Model is to operate. This Readiness Model plays a significant role in a much larger strategy depicted in Figure 7.2 and must be applied in a timely way. It is only when a strategy has been communicated to the workforce, that their minds will be engaged with the questions posed in the Readiness Model. Therefore, it is the value proposition that is required to essentially engage potential users of the Readiness Model and co-creation that would provide a true validation.

According to Grönroos & Voima, (2013) the extant literature emphasises a process that consists of actions from both the service provider and customer resulting in the service provider and the customer being the co-creators of value. "Collaboration with customers contributes to service offerings by integrating their resources and competencies into service development" (Lee & Park, 2023, p3).

In other words, there must be a better hook to attract potential SMEs that gives them much more potential benefit upfront, and then they will be more likely to engage with the Readiness Model. Grönroos & Voima, (2013) assert that the service provider develops potential value, and the "real value" is generated by the interaction of the service provider and the customer becomes co-created value. The value proposition is now established and can be deemed potential value. According to Shamsuzzoha et al., (2023) there is a rationale for reconciling the challenges of CE strategies such as lack of support from government subsidies, lack of resources and skilled workforce, and less communication and cooperation between firms, which essentially advocates the use of a Readiness Model representing the barriers to circularity readiness. Interestingly, Shamsuzzoha et al., (2023) concluded that there needs an iterative effort between educational institutions and various types of organisations/companies to facilitate the opportunity of CE with certain theories and principles. It is concluded that the way forward is to promote the potential value of the Readiness Model using the value proposition and realise the actual value through co-creation.

Chapter 8 Conclusions, Limitations, Recommendations and Future Directions.

8.1 Introduction

This thesis contains 8 chapters in total and is organised in the following way. Chapter 1 was the introduction that determined the research background and rationale, including the aim and objectives. Chapter 2 carried out an in-depth literature review of CE and identified the gap in the knowledge for manufacturing SME readiness for CE. Chapter 3 explored the human side of an organisation in terms of change and change readiness and how the literature supported the development of a conceptual model of change readiness for CE. Chapter 4 set out the approach to the research, and justified the methods chosen. Chapter 5 created a conceptual model of readiness from the literature in chapters 2 and 3. Chapter 6 used a Delphi survey process for verification of the conceptual model and Chapter 7 partially validated the verified model through partial simulation into industry. Now, Chapter 8 takes a reflective position on the overall research and concludes on the merits and development of this process.

8.2 Conclusion with Research Questions

CE is at the forefront of academic activity with many authors and researchers engaged in furthering the knowledge, possibilities, challenges, and scope of CE in different industries and at different levels, micro, meso and macro. Whilst this level of research has increased hugely over the last few years, it does not necessarily translate into raised awareness of CE at the industrial level and specifically with manufacturing SMEs. Some other complementary terms and themes take centre stage within industry bodies, Government-led initiatives and funding streams, institutions, and wider society such as Net zero, climate change, and De-Carbonise etc. These terms

resonate much more with senior leaders of SMEs than the need for and clear understanding and strategy towards CE.

There is much work to do in promoting CE with SMEs and communicating examples of successful application of CE demonstrating economic value. There are many barriers to SMEs' engagement with CE and knowing where to start for them is a fundamental position that must be addressed. So, quite clearly, SMEs must be able to identify, what is possible for them, how will they measure their progress, benchmark themselves against other actors, and more importantly realise the benefits of doing so. Whilst there is a plethora of knowledge-based research about the above, there is a lack of diffusion and sense-making of such knowledge. It must be noted that an SME can have little impact on their own and this will be best approached from communication across the supply chain and other actors within their sphere of work activity. An SME acting alone may capture some of the low-hanging fruit such as making better purchasing decisions, solar panels, and planting trees. However, for the higher order activities such as re-design, using renewable materials, designing for end of life, using new business models etc, the task and strategy to achieve this has just, not only become more complex but requires a broader perspective from a variety of stakeholders. All leaders, senior management personnel and team members within SMEs have one thing in common. Also, like academics, they have lived in, worked in, and operated in a linear economy and always have. Moving away from a linear economy towards a CE requires not only a paradigm shift in re-thinking what we do but also a monumental drive to change the “Status Quo”. This in itself, requires new ways of thinking, persuading, influencing, enabling and new ways of acting. It is not business as usual and therefore requires an approach and strategy that is also, “not business as usual”.

1. What drives the micro-behaviours necessary for overcoming barriers to CE transition?

It is clear from researching the literature that there are several change readiness factors that drive micro-behaviours for overcoming CE transition. The change readiness factors are both individual factors but also collective factors. These individual factors are based on beliefs one holds about him/herself, the change in

general and perceived consequences. The collective factors are individual beliefs about the commitment, trust and likelihood of others in the organisation delivering their part of the change. It is the confidence in the whole to succeed. There are also structural factors that influence an individual's perception of whether success is likely. Such things as incentives, rewards, commitment, support, resources and plans. These are all of the attributes that lead an individual to believe in the journey and the seriousness by which it is held by leaders.

2. What change readiness theory applies to a transition to CE?

In this context, the change readiness theory that has been applied to the transition to CE is purely around mindset. It is people who change first. To make a transition to CE, the organisation must overcome the barriers and therefore not allow such barriers to create resistance amongst the workforce. Therefore, being aware of and actively seeking to prepare mindsets, (readiness) for change is the fundamental foundation for CE transition. When one considers mindset, it can include such aspects as motivation, values, emotion, beliefs, intentions, ethics and attitude.

3. To what extent do an individual's position in the organisation and their mindset influence CE readiness?

It is clear from the research that all members of an organisation will play a role. However, the more responsibility a person has, the more influence they have around the success or failure of the transition. If their mindset is positive, then this will be evident in their behaviours, language and attitude towards the change. These attributes, in turn, influence another member of the organisation. Therefore, the higher an individual in the organisation structure, the more influence and subsequently their micro-behaviours contribute to the social norm and structural elements such as facilitation, support climate and indeed leadership.

The Readiness Model has not been fully validated. There were elements of the Readiness Model validated in terms of change readiness being recognised as a relevant factor and the approach to survey the entire organisation. It is also considered

that, with minimal adjustments to the model and effective marketing of the value proposition, it could be much closer to becoming a choice of tool for SMEs to use on the journey to circularity. The specification that deems this Readiness Model fit for the purpose for which it was intended, such as increasing ease of understanding and explaining terminology, minimising disruption of dissemination, making it more relatable, increasing perceived value, and building confidence in the model are all possible through some relatively small changes in the presentation and design.

8.3 Recommendations and Future Directions

Recommendations for the Readiness Model are to market this tool and process using value propositions as identified in the validation chapter. The greatest challenge is to convince and persuade senior leaders that this Readiness Model will be beneficial and add value to their strategic approach on their journey to circularity. Of course, identifying particular organisations that may be willing to engage is also key and can be best achieved by being part of the wider offering at the University. Without a vehicle to engage the industry, this will become a fruitless task. As part of this vehicle, it is believed that building a digital platform from which the University of Derby can survey, target and market the University services to enable conversations with local SMEs is a good step forward. It is believed that this Readiness Model is only part of the "solution to CE implementation" and essentially, many actors within the industry are not at this stage of implementation. The Readiness Model is part of the much broader strategy for an organisation to realise the benefits of going circular. Pulling back from the research and getting a full understanding of where manufacturing SMEs are in terms of their comprehension and intentions to engage with CE is paramount. We must "meet them where they are" to enable them to move forward. The future direction of both research and industry engagement has to be enhanced ways of realising tangible benefits of engaging with CE activities. It is for this reason that this particular Readiness Model must form part of a larger offering from the University.

SME leaders must be able to see hard-case examples of how engaging with CE principles will better position their organisation strategically, but crucially, provide economic benefit. There will always be leaders and organisations experimenting with

new concepts and ideas and it is those leaders that will provide the stories and approaches where benefits have been sought. Of course, as stated earlier, the higher-order activities associated with CE will require huge change, not just with an SME, but across many stakeholders, customers, suppliers, consumers and so on. Changing their perspectives and taking those stakeholders with you will be paramount to CE success for those SMEs.

One approach to ascertaining a better understanding of where organisations are on their journey to circularity would be to survey them. However, the return rate on surveys is often poor, giving a limited response and ultimately, a small target area. A better way might be to work across the supply chain with the larger organisations to identify and target all companies that are effectively in their supply chain. Working together with these larger companies means the survey communication would appear to come from this larger customer and therefore result in a better return rate and engagement. A company like Rolls Royce would typically have a plethora of suppliers all at varied stages of comprehension and intention towards CE. It is by identifying and working with these actors in the supply chain, where advances in the journey to circularity might take place.

In terms of future research, the author has an appetite for action research. In this way, there is more chance of impact, which is of huge value, it makes something worth doing! This approach and this thinking are aligned with the values and background of the author, insomuch as Lean business improvement has been achieved with this kind of approach. According to the literature, the approach to progress towards a CE requires Universities and organisations to work together on finding solutions. This will form the author's strategy going forward, working with other people both internally and externally who have the same aspirations.

Once there is a sense of where organisations are in terms of their journey, only then can we target them for the readiness for change model. By engaging with this Readiness Model and other offerings from the University, there may be the opportunity for commercial activity, to provide workshops and development events to promote CE in industry.

8.4 Contributions to Research

The Readiness Model has contributed to the literature by offering a Readiness tool or Diagnostic to be used in terms of a better understanding of attitudes, beliefs, values and intentions of individuals and collective perspectives on the journey to circularity. It combines well-established theories of change readiness with emerging challenges and barriers associated with SMEs making a transition to CE. An in-depth review of change readiness theory and models from other disciplines enabled a combination of theories to be applied in a new context, thus advancing existing theories. This new theory highlights the necessity to consider individual and collective mindsets related to how they need to change to overcome and adapt to new business models and ways of conducting business for a CE. The application of this Model assumes the organisation has already developed a Vision and Strategy for a transition to CE. This Readiness Model is then applied to measure their readiness across 16 Readiness Factors. This Readiness Model includes the need to challenge the organisations' mindsets toward the barriers to CE, as they form Readiness factors. In total, there are 8 Readiness Factors from change theories and 8 from barriers to CE. This model is novel and provides new insights, in that it does not view the barriers directly, but the organisations' perception of the barriers. It is this "perception" that dictates readiness to act within the organisation. Readiness is further reinforced in the way the model compares different mindsets throughout the organisation. This comparison enables the development of strategic interventions to inform and challenge old, embedded behaviours and paradigms. This new Readiness Model directly relates the beliefs of the organisation's members to the barriers (Readiness Factors) emerging in the literature. This Model serves to identify any Readiness Factor perceived by different parts or people of the organisation in terms of their readiness to act. For example, if the procurement team believe there are no relevant "green" substitute products available in the supply chain, then they are unlikely to follow this line of inquiry. It is then down to the leadership and change agents to develop an intervention and strategy to aid the development of this endeavour. This novel Readiness Model measures perceptions across an organisation and also offers feedback using a traffic light system. Based on the perception of Leaders, Senior Management and staff, the Readiness Model / Diagnostic will return a measurement of readiness for each of the

16 readiness factors including the perception of barriers. After the initial traffic light system has been concluded, coaching-style questions are offered as part of the feedback to help the end user think differently about that particular Readiness Factor that averaged Red or Amber. These coaching style questions within the Readiness Model / Diagnostic are designed to provide a stimulus to the change team and effectively start a discussion on possible interventions.

The key proposition based on data and findings from this research is that first and foremost, the value of this Readiness Model / Diagnostic is through the application and engagement of the end user. It is not the intention to direct or attempt to lead on the strategy, merely helps those involved to self-determine their course of action. This model further contributes to knowledge by offering a diagnostic tool to help practitioners break down barriers and make a transition to CE.

Furthermore, the SME's successful transition to CE is directly influenced by the organisation's beliefs and attitudes to the vision and strategy as well as the barriers. It is not necessarily the strategy or the barriers themselves, but individual and collective mindsets that process such ambition and subsequently choose to resist or embrace such change.

It is clear that depending on the role individuals play in an organisation, the more this may influence that organisation’s transition to CE. The higher up in any organisation of an individual, the more responsibility they have, and the more influence their mindset has on the delivery of the strategy. If their mindset is positive and their attitude is good, then they will be a driving force for the CE transition. However, if their mindset is negative with a poor attitude, then this will hinder the transition. The contribution to knowledge brings together common barriers to CE and directly relates them to individual and organisational mindsets. In essence, this is the starting point of the journey for an SME’s journey from linear to circularity.

This Readiness Model brings together the perceived barriers to adopting CE as well as multiple layers of readiness, including individual readiness, collective readiness and structural factors. It also operates at different layers of the organisation gaining different perspectives to see how they vary as well as offering change intervention

stimulus. It provides a practical tool, that could be further developed, adapted, or integrated into other strategies supporting SMEs' transition to CE. According to Holt and Vardaman, (2013, p 15) including this “multilevel perspective in studies of readiness should be of value since interactions across levels appear to be both a cause and a consequence of readiness.” The case for continual change readiness is recognised as a critical success factor by Galagan, (2010) stating the purpose of managing change is to perform rather than conform.

This Readiness Model helps to interrogate SMEs' internal challenges and their journey to circularity by combining readiness for change criteria and contextualised CE barriers. This Readiness model was partly adapted from the work of Holt and Vardaman, (2013), who indicate, that researchers will need to adapt and refine their approaches to measurement. This Readiness Model also uses some of the barriers to SMEs' transition to CE identified by Rizos *et al.*, (2016) who suggests developing a better academic understanding of the barriers and the resistance and of better ways to address and lower these barriers. This Readiness Model provides new insights by helping organisations understand this resistance and offers solutions for lowering the barriers and resistance, by first recognising resistance and challenging attitudes, beliefs, and intentions.

Whilst implementation practices aligned with the CE principles have been studied, researchers could also investigate the factors triggering the adoption of these practices (Masi *et al.*, 2018). It is worth investigating how SMEs set their vision for CE such as organisational culture (Shou *et al.*, 2020), the role of strong attitude and increased social pressure (Singh, et al, 2017), awareness of the market environment and likely organisational changes (Lopes de Sousa Jabbour, 2018), and managerial mindset (Lieder and Rashid, 2016). There is a broad scope for future research on the instrumentation matters associated with CE adoption (Mishra, et al, 2022). This Readiness Model addresses this gap by bringing together all aspects of change readiness in preparation for SMEs' circularity strategic change. It addresses the fundamental fact that all SMEs have operated in a linear economy thus far and to make a transition to CE requires a paradigm shift from all parts of an SME.

There must be an iterative effort between educational institutions and various types of organisations/companies to facilitate the opportunity to develop CE with certain theories and principles (Shamsuzzoha *et al.*, 2023). This Readiness Model contributes to research knowledge by aligning with other tools, instruments, and strategies to build a suite of offerings to enable successful change from a linear to CE. Specifically, there has been very little work on how the attitudes and beliefs of employees, senior management and leaders impact the transition to a CE. More research is required to disseminate this knowledge and develop this new way of thinking in SMEs (Bassi and Dias, 2019).

Senior management and leaders within a business impact its ability to embark on fundamental changes to business practice and policy. This Readiness Model helps to focus academic research towards the issues and challenges around how individual and collective mindsets contribute to successful change and a transition to CE, from the leader to the employee. It is people who are the real source of change, who will either embrace or resist change. So, for an organisation to change, it is essential that the employees also change (Abdel-Ghany, 2014). Additionally, the changing and re-configuring of that mindset in the face of such fundamental challenges to the way business must be conducted is a critical factor. Gusmerotti *et al.*, (2019) suggest exploring why SMEs fail to notice the need for more circularity in their industry and, in particular, which attentional extent would enable them to fully respond to CE issues.

In the absence of a clear engagement of management to overcome CE barriers related to know-how, resistance to change and positive attitude towards CE Ghenţa and Matei, (2018) recognise that the understanding of the behaviour of SMEs could be deepened.

In summary, the contribution to research is:

1. Linking barriers to CE to resistance and readiness for change.
2. Recognising the impact of readiness criteria on an organisational paradigm shift.
3. Developing a diagnostic to assist practitioners in breaking down barriers.
4. Creating stimulus for creative leaders to open discussion on strategic objectives associated with CE transition and develop interventions.

5. Enable practitioners to Identify and recognise areas for change interventions to be applied.
6. Enable practitioners to compare and contrast mindsets across the organisation from the leaders to senior management to staff and supervisory team.

The novelty of the research is the fact that whilst the barriers to CE have been linked to readiness for change theoretically, they have not been combined in a model or diagnostic which measures the levels of readiness. Whilst there is evidence in the literature to link whole organisation participation and engagement in the change, there are no diagnostics that do this for CE readiness. This research is original in that it only uses the aspects of readiness that are related to mindset and behaviours, (soft skills). Whilst it relates to some elements such as finance, operations, knowledge and information systems, it is the perception of such things rather than the capability of them that endeavours to measure and then change. It includes external factors, not as they are, but how they are interpreted and internalised by individuals within an organisation. The entire Model and Diagnostic is built around first measuring and changing beliefs, awareness and understanding. It is about the change in preparation of individuals and the organisation collectively to be primed, motivated and capable of contributing their part of the change. It enables the accurate targeting of change interventions to accelerate the transition to CE.

8.5 Future Research

In terms of future research, personal change and aspects of sustainability remain at the core of the author's interest. Regarding sustainability, research areas have to be along the lines of the measurement of CE and specifically in finding ways for SMEs to measure circularity without being overly embroiled with effort and work to collect the data. Again, being mindful of the time and resource constraints of SMEs is paramount in finding acceptable solutions. In other words, a solution to give a perspective on how circular an SME is, without excessive effort, time, and cost to realise the measurement. Additionally, industrial symbiosis is an area that will be key to understanding how SMEs can work with other organisations in different ways and what changes and risks are associated with this.

In terms of change, personal change is also something that is still interesting and topics such as mindfulness and neuroscience offer an area of exploration. This can be combined with leadership styles and ones that are considered conducive to leading an organisation through a journey to circularity.

8.6 Limitations of Research

This research is limited in several ways. Whilst the Readiness Model and diagnostic have been verified it has only been partially validated (in part) in only one particular industrial setting. It has not been rigorously tested and fully applied with thoughtful and enthusiastic leadership. For this to be truly validated it must be applied in the right context and by the type of leadership that will seek to create value by using the diagnostic and acting on the feedback. This diagnostic can only realise value through co-creation, when used authentically, with passion and commitment to their journey to circularity. Of course, it is expected there will be criticism and constructive feedback enabling newer and improved versions of the Readiness Model using this process.

The research is also limited concerning bias. Although the author has taken measures to compensate and be aware of personal bias, personal bias remains a factor. This bias deems that effective change comes from people playing a part in such change and that readiness is a far better approach than accepting resistance and adopting an authoritarian leadership approach to making change happen. This remains a profound personal bias that has essentially shaped the research approach, topic, and content. Whilst this personal bias has been tempered for years through personal industrial experience, further reading and research, it remains, to be a personal perspective and may be biased. This subjective view of reality may not be an accurate account of reality.

8.7 Final comments

This has been a long journey with significant levels of learning along the way. For the most part, it has been enjoyable. On reflection, many things would be done differently in the future. There is a raised level of awareness in terms of academic research in terms of carrying out research and indeed presenting it. This learning has certainly been worthwhile and is set to continue to grow and develop in the future as well as it already informs teaching.

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Appendices

Appendix 5.1 Leader Questionnaire

Questionnaire – *Organisational Leader*

Discrepancy

1. There is an impending need for our organisation to adopt circular economy principles as we are behind other similar companies.
2. Currently our organisation has a gap between what it currently does and what it could and should do in terms of circular economy activity?
3. Other companies are far better than ours in terms of meeting sustainable goals and implementing a circular economy. **--**
4. We need to improve our performance in sustainability by implementing an organisational change for the circular economy.
5. The time we should be spending on change should not be on sustainability and circular economy but on something else. **–**

Appropriateness

1. Given the external pressures for sustainability in today's world, this kind of change to adopt a circular economy is the right response for our organisation.
2. The change in our operations toward a circular economy will improve the performance of our organisation.
3. There is support from the supply and demand network to support new business models. (1)
4. Our customers and/or consumers have a real interest in the environment and are ready to positively change behaviour or business routine. (1) (7)
5. When I think about these changes to our sustainable practices and circular economy, I realise it is appropriate for our organisation.

Personal Valence

1. This change to adopt a circular economy will benefit me.
2. With this change in my job based on circular activity, I will experience more self-fulfilment.
3. I will earn higher pay from my job after this change to a circular economy.
4. The change in my job assignments will increase my feelings of accomplishment.
5. When this change to circular economy is implemented, I don't believe there is anything for me to gain. **--**

Positive Emotions about change.

1. I feel elated that our company is now getting involved in more sustainable and more specifically circular economy activities.
2. I am curious about adopting circular economy practices.
3. It makes me happy to know my organisation is heading toward a circular economy and more sustainable approach.
4. I am up for the challenge that a circular economy will present in my organisation.
5. This new change to a circular economy is exciting.

Change Self-Efficacy (confidence)

1. We have adequate resources to administer whatever is necessary to achieve a transition to a circular economy. (3)
2. I have the skills to lead this organisation in this field. (9)
3. As an organisation we have the capability and technical know-how to adopt a circular economy. (4)
4. As an organisation we will find the funding and also invest significantly to build our business around a circular economy. (2)
5. Our suppliers and customers are also on board and there will not be any constraints with our transition to circular economy. (1)
6. There will be a minimum internal conflict with this type of change. (6)
7. Our customers and/or consumers have an interest in this area and will easily change their business routines/behaviour. (7)
8. We have the right number of qualified people in environmental management. (8)
9. Our IT systems and information systems will be able to easily support this transition to a circular economy.
10. As an organisation we are very aware of what is needed and trained and primed ready to act. (10)

Principal Support

1. There are not enough qualified personnel in environmental management to respond positively to change to a circular economy. (8)
2. Our company culture is adaptable and will easily make the change to circular economy practices. (6)
3. I have full confidence in my senior management team in their skills, ability and knowledge to make the necessary changes to adopt a circular economy. (10)
4. This organisation's most senior leader is committed to this change. (9)
5. We are spending a lot of time on this change to a circular economy when the senior managers don't even want it implemented. **--** (9)
6. We do not have the support of customers and suppliers with any endeavours for adopting a circular economy. **--** (1)

Awareness and Mindfulness

1. There is a lack of awareness in the supply and demand networks of the supply chain to adopt new business models around circular economy. **--** (1)
2. I am completely aware of how my leadership, congruency and communication impact the behaviour of senior management and staff. (9)
3. Our customers and/or consumers have a lack of awareness of the need to change their behaviours and business routines. **--** (1) (7)
4. I am fully aware of what behaviours I must change to satisfy the organisational shift to a circular economy.
5. I am mindful of the behaviour changes being asked of us and mindful of how some employees may struggle with the behavioural changes required.

Organisational Factors:

Collective Commitment

1. I have a good relationship with my team, and I know they are ready to follow my lead on a change transition to a circular economy.
2. When my organisation has committed to change in the past, they see things through, and this change transition to a circular economy is no different.
3. As an organisation we are committed to making the necessary changes to adopt a circular economy.
4. I want to encourage all staff to be involved with Circular economy practices.
5. The company culture is primed to step up and commit to the changes necessary to achieve a circular economy.

Collective Efficacy

1. This organisation can find the capital through Government funding and/or financial means internally necessary to successfully follow through and change to a circular economy. (2)
2. I am confident our senior leaders will be steadfast in their resolve to implement all that is necessary to adopt a circular economy. (9)
3. Our organisation has the technical know-how and ingenuity to develop new skills to adapt to circular economy practice. (4)
4. Our management information systems will cope with any demands from a transition to a circular economy. (5)
5. Our company culture, (the way we do things) is supportive of a transition to circular economy. (6)

Collective Trust

1. My leadership style is authentic towards a circular economy which engenders out the organisation. (9)
2. I'm passionate about circular economy and associated activity which will be evident from the way I communicate to my organisation. (9)

Structural & Contextual Factors.

Knowledge and Skills Alignment

1. All of the organisation's employees have the appropriate skills, knowledge and ability or capability to step up for their revised role as we transition to a circular economy. (10)
2. This organisation has enough qualified staff in environmental management. (8)
3. This organisation has the technical know-how and resources to adopt a circular economy. (4)

Support climate

1. There are financial incentives to promote a transition to a circular economy. (2)
2. There is sufficient capital to contribute and invest in circular economy business models and activities. (2)
3. some financial drivers make a circular economy and associated activity attractive. (2)
4. We have sufficient information to administer circular economy activities. (3)
5. There is little internal conflict in our company which in turn makes it adaptable to change to the circular economy. (6)
6. We can count on funding to assist with investment costs for the circular economy. (2)
7. Our management information systems are flexible enough to cope with circular economy activities. (5)

Facilitation

1. I am clear about the strategy I am moving this organisation in terms of circular economy.
2. There is a detailed implementation plan around the transition to a circular economy.
3. There is clear expertise and strong leadership around the environmental issues and challenges we face. (8)
4. All new roles have been clearly defined and aligned to this new circular strategy.

	Readiness Factor / Barrier	Maximum score	Actual score	Sample Average
1	Supply network constraints	30		
2	Capital, finance and finance options	30		
3	General administration	10		
4	Lack of technical know-how	15		
5	Poor information systems	10		
6	Company culture	20		
7	Customer/consumer behaviour/routines	15		
8	Qualified personnel	20		
9	Leadership	35		
10	Awareness & Training	15		
11	Discrepancy	25		
12	Appropriateness	25		
13	Personal Valence	25		
14	Positive emotions about change	25		
15	Change self-efficacy	50		
16	Principal Support	30		
17	Awareness and Mindfulness	25		
18	Collective commitment	25		
19	Collective Efficacy	25		
20	Collective Trust	10		
21	Knowledge and Skills Alignment	15		
22	Support climate	35		
23	Facilitation	20		

Table 1 shows the evaluation of the leader's questionnaire.

Appendix 5.2 Senior Management Questionnaire

Questionnaire – *Senior Management*

Discrepancy

1. There is an impending need for our organisation to adopt circular economy principles as we are behind other similar companies.
2. Currently our organisation has a gap between what it currently does and what it could and should do in terms of circular economy activity?
3. Other companies are far better than ours in terms of meeting sustainable goals and implementing a circular economy.
4. We need to improve our performance in sustainability by implementing an organisational change for the circular economy.
5. The time we should be spending on change should not be on sustainability and circular economy but on something else.

Appropriateness

1. Given the external pressures for sustainability in today's world, this kind of change to adopt a circular economy is the right response for our organisation.
2. The change in our operations toward a circular economy will improve the performance of our organisation.
3. There is support from the supply and demand network to support new business models. (1)
4. Our customers and/or consumers have a real interest in the environment and are ready to positively change behaviour or business routine. (1) (7)
5. When I think about these changes to our sustainable practices and circular economy, I realise it is appropriate for our organisation.

Personal Valence

1. This change to adopt a circular economy will benefit me.
2. With this change in my job based on circular activity, I will experience more self-fulfilment.
3. I will earn higher pay from my job after this change to a circular economy.
4. The change in my job assignments will increase my feelings of accomplishment.
5. When this change to circular economy is implemented, I don't believe there is anything for me to gain.

Positive Emotions about change.

1. I feel elated that our company is now getting involved in more sustainable and more specifically circular economy activities.

2. I am curious about adopting circular economy practices.
3. It makes me happy to know my organisation is heading toward a circular economy and more sustainable approach.
4. I am up for the challenge that a circular economy will present in my organisation.
5. This new change to a circular economy is exciting.

Change Self-Efficacy (confidence)

1. I have the skills that are needed to make this change to circular economy work. (4)
2. When I set my mind to it, I can learn everything that will be required when this change to a circular economy is adopted.
3. some tasks will be required when we change; I do not think I can do well.
4. I am apprehensive about all the tasks I will have to learn because of this change to circular economy.
5. I do not anticipate any problems adjusting to the work I will have when this change to circular economy is adopted.

Principle Support

1. There are not enough qualified personnel in environmental management to respond positively to change to a circular economy. (8)
2. Our company culture is adaptable and will easily make the change to circular economy practices. (6)
3. As part of the senior management team, I will continually support my staff to adapt to this change to a circular economy. (9)
4. I am committed to this change to circular economy. (9)
5. We are spending a lot of time on this change to circular economy, but I don't even want it implemented. (9)

Awareness and Mindfulness

1. There is a lack of awareness in the supply and demand networks of the supply chain to adopt new business models around circular economy. (1)
2. I am completely aware of how our organisational collective behaviours must change if we are to adopt a circular economy.
3. Our customers and/or consumers have a lack of awareness of the need to change their behaviours and business routines. (1) (7)
4. I am fully aware of what behaviours I must change to satisfy the organisational shift to a circular economy.

5. I am mindful of the behaviour changes being asked of us and mindful of how some employees may struggle with the behavioural changes required.

Organisational Factors:

Collective Commitment

1. I have a good relationship with my staff as their line manager and believe them to be committed to following our lead on a change transition to a circular economy.
2. I am committed to seeing through this change transition to a circular economy.
3. As an organisation we are committed to making the necessary changes to adopt a circular economy.
4. My staff want to see and be involved with Circular economy practices.
5. I am ready to follow our leader on the organisation's journey to circular economy.

Collective Efficacy

1. This organisation has the methods to find the capital through Government funding and internal financial means necessary to successfully follow through and change to a circular economy. (2)
2. As a senior leader in this organisation, I have serious doubts about this change and whether we are capable of adopting a circular economy. (9)
3. Our organisation has the technical know-how and ingenuity to develop new skills to adapt to circular economy practice. (4)
4. As a senior leader of this organisation, I will do whatever it takes to make circular economy a success and continue to build on that success. (9)
5. Our management information systems will cope with any demands from a transition to a circular economy. (5)
6. Our company culture, (the way we do things) is supportive of a transition to circular economy. (6)

Collective Trust

1. My direct line manager will fully support my needs through this change to a circular economy. (9)
2. I know it may be tough for some of my team, but I am going to make sure they have everything they need to make the change to a circular economy. (9)
3. I know I will be empowered to provide adequate training and support to my team for them to carry out their duties in this transition to a circular economy. (10)

4. As a senior management team, we will ensure all stakeholders are aware of the changes that a circular economy brings and be supportive. (9)

Structural & Contextual Factors.

Knowledge and Skills Alignment

1. My team and I have the appropriate skills, knowledge and ability for my revised role as we transition to a circular economy. (10)
2. My team and I have the technical know-how or can at least obtain the technical resources and support from the organisation. (4)

Support climate

1. There are financial incentives to promote a transition to a circular economy. (2)
2. There is sufficient capital to contribute and invest in circular economy business models and activities. (2)
3. some financial drivers make a circular economy and associated activity attractive. (2)
4. We have sufficient information to administer circular economy activities. (3)
5. There is little internal conflict in our company which in turn makes it adaptable to change to the circular economy. (6)
6. We can count on funding to assist with investment costs for the circular economy. (2)
7. Our management information systems are flexible enough to cope with circular economy activities. (5)

Facilitation

1. My new role and expectations are clearly defined.
2. There is a detailed implementation plan around the transition to a circular economy.
3. Our management information systems will facilitate this transition to a circular economy. (5)
4. There is clear expertise and strong leadership around the environmental issues and challenges we face. (8)
5. All new roles have been clearly defined and aligned to this new circular strategy.

	Readiness Factor	Maximum score	Actual score	Sample Average
1	Supply network constraints	20		
2	Capital, finance and finance options	25		
3	General administration	5		
4	Lack of technical know-how	15		
5	Poor information systems	15		
6	Company culture	15		
7	Customer/consumer behaviour/routines	10		
8	Qualified personnel	10		
9	Leadership	40		
10	Awareness & Training	10		
11	Discrepancy	25		
12	Appropriateness	25		
13	Personal Valence	25		
14	Positive emotions about change	25		
15	Change self-efficacy	25		
16	Principle Support	25		
17	Awareness and Mindfulness	25		
18	Collective commitment	25		
19	Collective Efficacy	30		
20	Collective Trust	20		
21	Knowledge and Skills Alignment	5		
22	Support climate	35		
23	Facilitation	25		

Table 2 shows the evaluation from the Senior management questionnaire.

Appendix 5.3 Staff Questionnaire

Questionnaire – *staff*

Discrepancy

1. There is an impending need for our organisation to adopt circular economy principles as we are behind other similar companies.
2. Currently our organisation has a gap between what it currently does and what it could and should do in terms of circular economy activity?
3. Other companies are far better than ours in terms of meeting sustainable goals and implementing a circular economy.
4. We need to improve our performance in sustainability by implementing an organisational change for the circular economy.
5. The time we should be spending on change should not be on sustainability and circular economy but on something else.

Appropriateness

1. Given the external pressures for sustainability in today's world, this kind of change to adopt a circular economy is the right response for our organisation.
2. The change in our operations toward a circular economy will improve the performance of our organisation.
3. There is support from the supply and demand network to support new business models. (1)
4. Our customers and/or consumers have a real interest in the environment and are ready to positively change behaviour or business routine. (1) (7)
5. When I think about these changes to our sustainable practices and circular economy, I realise it is appropriate for our organisation.

Personal Valence

1. This change to adopt a circular economy will benefit me.
2. With this change in my job based on circular activity, I will experience more self-fulfilment.
3. I will earn higher pay from my job after this change to a circular economy.
4. The change in my job assignments will increase my feelings of accomplishment.
5. When this change to circular economy is implemented, I don't believe there is anything for me to gain.

Positive Emotions about change.

1. I feel elated that our company is now getting involved in more sustainable and more specifically circular economy activities.
2. I am curious about adopting circular economy practices.
3. It makes me happy to know my organisation is heading toward a circular economy and more sustainable approach.
4. I am up for the challenge that a circular economy will present in my organisation.
5. This new change to a circular economy is exciting.

Change Self-Efficacy (confidence)

1. I have the skills that are needed to make this change to circular economy work. (4)
2. When I set my mind to it, I can learn everything that will be required when this change to a circular economy is adopted.
3. some tasks will be required when we change; I do not think I can do well.
4. I am apprehensive about all the tasks I will have to learn because of this change to circular economy.
5. I do not anticipate any problems adjusting to the work I will have when this change to circular economy is adopted.

Principle Support

1. There are not enough qualified personnel in environmental management to respond positively to change to a circular economy. (8)
2. Our company culture is adaptable and will easily make the change to circular economy practices. (6)
3. Management has sent a clear signal this organisation is going to change to include a circular economy. (9)
4. This organization's most senior leader is committed to this change. (9)
5. We are spending a lot of time on this change to a circular economy when the senior managers don't even want it implemented. (9)

Awareness and Mindfulness

1. There is a lack of awareness in the supply and demand networks of the supply chain to adopt new business models around circular economy. (1)
2. I am completely aware of how our organisational collective behaviours must change if we are to adopt a circular economy.
3. Our customers and/or consumers have a lack of awareness of the need to change their behaviours and business routines. (1) (7)

4. I am fully aware of what behaviours I must change to satisfy the organisational shift to a circular economy.
5. I am mindful of the behaviour changes being asked of us and mindful of how some employees may struggle with the behavioural changes required.

Organisational Factors:

Collective Commitment

1. I have a good relationship with my line manager and I'm ready to follow their lead on a change transition to circular economy.
2. I am committed to seeing through this change transition to a circular economy.
3. As an organisation we are committed to making the necessary changes to adopt a circular economy.
4. I want to see and be involved with Circular economy practices.
5. I am ready to follow our senior leaders on the organisation's journey to circular economy.

Collective Efficacy

1. This organisation has the methods to find the capital through Government funding and internal financial means necessary to successfully follow through and change to a circular economy. (2)
2. I am sure that our senior leaders will change their minds before we implement any aspects of the circular economy. (9)
3. Our organisation has the technical know-how and ingenuity to develop new skills to adapt to circular economy practice. (4)
4. The leaders of this organisation will do whatever it takes to make the circular economy a success and continue to build on that success. (9)
5. Our management information systems will cope with any demands from a transition to a circular economy. (5)
6. Our company culture, (the way we do things) is supportive of a transition to circular economy. (6)

Collective Trust

1. My direct line manager will fully support my needs through this change to a circular economy. (9)
2. I'm not sure the senior management has my best interest at heart in terms of the change to circular economy. (9)

3. I know I will receive adequate training and support to carry out my duties in this transition to a circular economy. (10)
4. The senior management team will ensure all stakeholders are aware of the changes that a circular economy brings and be supportive. (9)

Structural & Contextual Factors.

Knowledge and Skills Alignment

1. I have the appropriate skills, knowledge and ability for my revised role as we transition to a circular economy. (10)
2. I have the technical know-how or can at least obtain the technical resources and support from the organisation. (4)

Support climate

1. There are financial incentives to promote a transition to a circular economy. (2)
2. There is sufficient capital to contribute and invest in circular economy business models and activities. (2)
3. some financial drivers make a circular economy and associated activity attractive. (2)
4. We have sufficient information to administer circular economy activities. (3)
5. There is little internal conflict in our company which in turn makes it adaptable to change to the circular economy. (6)
6. We can count on funding to assist with investment costs for the circular economy. (2)
7. Our management information systems are flexible enough to cope with circular economy activities. (5)

Facilitation

1. My new role and expectations are clearly defined.
2. There is a detailed implementation plan around the transition to a circular economy.
3. Our management information systems will facilitate this transition to a circular economy. (5)
4. There is clear expertise and strong leadership around the environmental issues and challenges we face. (8)
5. All new roles have been clearly defined and aligned to this new circular strategy.

	Readiness Factor	Maximum score	Actual score	Sample Average
1	Supply network constraints	20		
2	Capital, finance and finance options	25		
3	General administration	5		
4	Lack of technical know-how	15		
5	Poor information systems	15		
6	Company culture	15		
7	Customer/consumer behaviour/routines	10		
8	Qualified personnel	10		
9	Leadership	40		
10	Awareness & Training	10		
11	Discrepancy	25		
12	Appropriateness	25		
13	Personal Valence	25		
14	Positive emotions about change	25		
15	Change self-efficacy	25		
16	Principle Support	25		
17	Awareness and Mindfulness	25		
18	Collective commitment	25		
19	Collective Efficacy	30		
20	Collective Trust	20		
21	Knowledge and Skills Alignment	5		
22	Support climate	35		
23	Facilitation	25		

Table 3 shows the evaluation of the Staff questionnaire.

Appendix 6.1 Pilot Delphi Survey Invitation

I am writing to request your participation in a Pilot Delphi study. Delphi Study is a methodology that seeks to obtain consensus of expert opinion, using participants such as yourself using a series of questionnaires. Experts are defined as someone holding a senior position in an SME and at least three years' experience in sustainable endeavours and change or an academic at a Doctoral level with research in the field of a circular economy or organisational change or both.

This is an initial pilot for Delphi to identify any procedural issues as well as generally make suggestions as part of the review of the conceptual model and supporting instrument. The conceptual model can be seen in the Delphi questionnaire along with the three questionnaires that make up the supporting instrument. Predicted time to complete this questionnaire is estimated at between 15 and 20 minutes. In this particular case, Delphi is using experts to review the proposed conceptual model with the instrument and offer feedback and suggestions for change/improvement to the model and instrument. The instrument is a set of three questionnaires to be conducted in a company by 1, the leader, 2, senior management, and 3 staff.

This research aims to provide a comprehensive model by combining the barriers to a circular economy with several change readiness models from the literature. This model and instrument will then be further developed adding credibility to this verification process. After verifying the model, it will be empirically tested by validating it in an industrial setting.

Your expertise would be tremendously beneficial to add credibility to this model and instrument. I would like to express my deepest gratitude for your contribution to this Delphi study. I would be most grateful if you please respond no later than the 8th of October. Please access the questionnaire through the link below.

https://forms.office.com/r/raW0r4XDWM

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Appendix 6.2 Participant Feeback from the Pilot.

Participant 1

Overall, the Questionnaire seems accessible.
A key question for me is...will respondents know what CE or circular practices are?
In a few places, your items have twin foci. For example:
There is support from the supply and demand network [s] to support new business models. (1)
Our customers and/or consumers have a real interest in the environment and are ready to positively change behaviour or business routines. (1) (7)
From a reliability perspective, it's much better to separate these.
There are a few little typos:
I am apprehensive [about] the tasks I will have to learn because of this change to circular economy.
Should circular economy be capitalised or not? Be consistent.

Participant 2

- Introduction section formatting needs attention as there are some long spaces between words. Also, check the remaining form as well.
- The introduction section should also include how much time it will take for the respondents to complete the questionnaire.
- Q10 says: below is the list of ……. But there is no list provided there. It shows on the next page.
- Q 17 has statement 2 – but there is no statement.
- Q 28 – 30 should have an option of below 60%
- Q 31- 33 should have an option of below 50% and likewise for further questions on that page.
- Make sure to make questions are required –otherwise, people might skip some questions by mistake.
- Q38 needs a bit more clarity.
- Q39 has a spelling error in the first part.

- For the questions for different staff members of organisations, I think it's best to provide them in PDF format as an attachment to the email. And in the questionnaire just make a note to say that: please refer to page X-X of the PDF file sent through email and answer the following questions.
- The email message looks good, but I believe you need to add a line with something like
- ‘Your participation is voluntary, and you are free to withdraw at any time, without giving any reason, and without your legal rights being affected.” – just ask for advice from the ethics committee.

Participant 3

- Section 1: In the description of the study there seem to be some ‘weird’ formatting spaces – if you are unable to see them, try to open the survey on an anonymous tab. But the first page seems fine.
- Section 2: You forgot the number 2 after section. Missing the barriers on Question 8
- Please make sure that you set questions to be required or not (depending)
- On the barriers identified in the literature – maybe would be better to add the information on a tabular view (left side the definition, right side the reference)
- On readiness criteria you didn’t include the section number – consistency. Also, use caps on yes – Yes. You could also include the definitions of the readiness criteria on the page where you have the questions – the navigation to go to the definitions and to get back to the questions is not easy.
- In section 3, don’t use ‘tell me why’ (a bit informal). Would be better to use ‘Justify your answer’ or something similar. You could potentially merge all the Linkert scale questions in 1 ‘large section’
- In section 3 you were going from ‘Strongly Disagree to Strongly Agree’. But in section 4, you were going the opposite way, from ‘Strongly Agree to Strongly Disagree’
- John, you need to limit responses per person, currently people can submit as many responses as they want.
- It is a quite long questionnaire, how much time do you estimate this will take for people to complete?

Appendix 6.3 Letter to potential participants for engagement in the Delphi survey

Dear _____, I am writing to kindly request your participation in a Delphi study. You have been identified as an expert in the field of circular economy, sustainability and/or change and your views and contributions are significant to this pioneering phase of a conceptual model, to develop an expert consensus on SME change readiness.

This research aims to provide a comprehensive framework by combining the best practices of two concepts of Circular Economy and Lean in a structured/systematic manner to allow the adaptation of Circular Economy's principles within the manufacturing operations at the SME level. Delphi Study is a technique that seeks to obtain consensus on the opinions of experts (like yourself), termed panel members, through a series of questionnaires. As part of the process, the responses from each round are fed back in summarised form to the Delphi study participants who are then allowed to respond again to the emerging data. The Delphi is, therefore, an iterative multi-stage process designed to combine the opinion of specialists into group consensus. It is envisaged that it should take between 10-15 minutes to complete this questionnaire. This will then be deliberated along with the responses of other researchers from the same field of study. After verifying the framework, it will be empirically evaluated using the case study tool to validate it. Your expertise would be extremely beneficial to developing a credible sustainable operations management framework. I would like to convey my utmost gratitude for your contribution by participating in this Delphi study. I would be very grateful if you please respond by the 31st of May, thereafter I will follow up about your participation. Please access the questionnaire through the following link:

https://goo.gl/forms/CASQtMoIK3MRMTi32

Kind regards,

John Thorley PhD Candidate,
College of Science and Engineering
University of Derby

Appendix 6.4 Questionnaire for Review

Questionnaire for review This is the instrument that is to be reviewed. In practice, there will be 3 slightly different questionnaires, for the leader of the organisation, the senior team, and the staff, where questions will be framed slightly differently, but the sentiment remains. They will answer all questions on a Likert scale indicated below. There will be a clear definition of what circular economy is and examples of what it might mean.

Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
5 points	4 points	3 points	2 points	1 point

This part of the study needs to ascertain if the questions asked will determine readiness for each of the 24 categories that can be seen in the table at the end. The number in brackets between 1 and 10 indicates that the particular question also covers a particular barrier listed in the table at the end. The barriers make up the contextual factors. It is the organisations' beliefs about these perceived barriers we are measuring! For clarity, the readiness model aims to assess the readiness of organisational attitudes to the change rather than the capability of the organisation.

Questionnaire

Discrepancy

1. There is an impending need for our organisation to adopt a circular economy principles as we are behind expectations.
2. Currently our organisation has a gap between what it currently does and what it
could and should do in terms of circular economy activity?
3. There is a clear sense of urgency in terms of meeting sustainable goals and implementing circular economy.
4. We need to improve our performance in sustainability by implementing an organisational change for the circular economy.

5. The time we should be spending on change should not be on sustainability and circular economy but on something else. –

Appropriateness

1. Given the external pressures for sustainability in today's world, this kind of change
to adopt a circular economy is the right response for our organisation.
2. The change in our operations toward a circular economy will improve the performance of our organisation.
3. There is support from the supply and demand network to support new business models. (1)
4. Our customers and/or consumers have a real interest in the environment and are ready to positively change behaviour or business routine. (7)
5. When I think about these changes to our sustainable practices and circular economy, I realise it is appropriate for our organisation.

Personal Valence

1. This change to adopt a circular economy will benefit me.
2. With this change in my job based on circular activity, I will experience more self-fulfilment.
3. I will have better security in my job after this change to circular economy.
4. The change in my job assignments will increase my feelings of accomplishment.
5. When this change to circular economy is implemented, I don't believe there is anything for me to gain. –

Positive Emotions about change.

1. I feel elated that our company is now getting involved in more sustainable and more
specifically circular economy activities.
2. I am curious and enthused about adopting circular economy practices.
3. It makes me happy to know my organisation is heading toward a circular economy and more sustainable approach.
4. I am up for the challenge that a circular economy will present in my organisation.

5. This new change to a circular economy is exciting.

Change Self-Efficacy (confidence)

1. I have the skills that are needed to make this change to circular economy work. (4)
2. When I set my mind to it, I can learn everything that will be required when this change to a circular economy is adopted.
3. some tasks will be required when we change; I do not think I can do well. -
4. I am apprehensive about the tasks I will have to learn because of this change to circular economy. -
5. I do not anticipate any problems adjusting to the work I will have when this change to a circular economy is adopted.

Principle Support

1. There are not enough qualified personnel in environmental management to respond positively to change to a circular economy. (8) -
2. Our company culture is adaptable and will easily make the change to circular economy practices. (6)
3. Management has sent a clear signal this organisation is going to change to include a circular economy. (9)
4. This organization's most senior leader is committed to this change. (9)
5. We are spending a lot of time on this change to a circular economy when the senior managers don't even want it implemented. (9) –

Awareness and Mindfulness

1. There is a lack of awareness in the supply and demand networks of the supply chain to adopt new business models around circular economy. (1) -
2. I am completely aware of how our organisational collective behaviours must change if we are to adopt a circular economy.
3. Our customers and/or consumers have a lack of awareness of the need to change their behaviours and business routines. (7) -
4. I am fully aware of what behaviours I must change to satisfy the organisational shift to a circular economy.

5. I am mindful of the behaviour changes being asked of us and mindful of how some employees may struggle with the behavioural changes required.

Organisational Factors:

Collective Commitment

1. I have a good relationship with my line manager and I'm ready to follow their lead on a change transition to circular economy.

2. I am committed to seeing through this change transition to a circular economy.

3. As an organisation we are committed to making the necessary changes to adopt a circular economy.

4. I feel the organisation as a whole is ready to be involved with circular economy practices.

5. I am ready to follow our senior leaders on the organisation's journey to circular economy.

Collective Efficacy

1. This organisation has the methods to find the capital through Government funding and internal financial means necessary to successfully follow through and change to a circular economy. (2)

2. I am sure that our senior leaders will change their minds before we implement any aspects of the circular economy. (9) -

3. Our organisation has the technical know-how and ingenuity to develop new skills to adapt to circular economy practice. (4)

4. The leaders of this organisation will do whatever it takes to make the circular economy a success and continue to build on that success. (9)

5. Our management information systems will cope with any demands from a transition to a circular economy. (5)

6. Our company culture, (the way we do things) is supportive of a transition to circular economy. (6)

Collective Trust

1. My direct line manager will fully support my needs through this change to a circular economy. (9)

2. I’m not sure the senior management has my best interest at heart in terms of the change to circular economy. (9)

3. I know I will receive adequate training and support to carry out my duties in this transition to a circular economy. (10)

4. The senior management team will ensure all stakeholders are aware of the changes that a circular economy brings and be supportive. (9)

Organisational Valence

1. This change to a circular economy will be good for this organisation.

2. Engaging in circular economy activities will bring economic benefits to this organisation. (2)

3. A transition to a circular economy will mean more interesting work for employees.

Structural Factors.

Knowledge and Skills Alignment

1. I have the appropriate skills, knowledge, and ability for my revised role as we transition to a circular economy. (10)

2. I have the technical know-how or can at least obtain the technical resources and support from the organisation. (4)

Support climate

1. There are sound economic reasons to promote a transition to a circular economy. (2)

2. Our organisation will find the necessary capital to contribute and invest in circular economy business models and activities. (2)

3. There are financial incentives that make a circular economy and associated activity attractive. (2)

4. We have sufficient information to administer circular economy activities. (3)

5. There is little internal conflict in our company which in turn makes it adaptable to change to the circular economy. (6)

6. We can count on finding funding to assist with investment costs for the circular economy. (2)

7. Our management information systems are flexible enough to cope with circular economy activities. (5)

Facilitation

1. My new role and expectations are clearly defined.

2. There is a detailed implementation plan around the transition to a circular economy.

3. Our management information systems will facilitate this transition to a circular economy. (5)

4. There is clear expertise and strong leadership around the environmental issues and challenges we face. (8)

5. All new roles have been clearly defined and aligned to this new circular strategy.

	Readiness Factor	Maximum score	Actual score	Sample Average
1	Supply network constraints	10		
2	Capital, finance, and finance options	30		
3	General administration	5		
4	Lack of technical know-how	15		
5	Poor information systems	15		
6	Company culture	15		
7	Customer/consumer behaviour/routines	10		
8	Qualified personnel	10		
9	Leadership	40		
10	Awareness & Training	10		
11	Discrepancy	25		
12	Appropriateness	25		
13	Personal Valence	25		
14	Positive emotions about change	25		
15	Change self-efficacy	25		
16	Principle Support	25		
17	Awareness and Mindfulness	25		
18	Collective commitment	25		
19	Collective Efficacy	30		
20	Collective Trust	20		
21	Organisational Valence	15		
22	Knowledge and Skills Alignment	10		
23	Support climate	35		
24	Facilitation	25		

Table 4 shows the evaluation of the questionnaire for review.

Appendix 6.5 Letter for potential participation in the Delphi survey (Iteration 2)

I am writing to request your participation in the second iteration of a Delphi study. Delphi Study is a methodology that seeks to obtain consensus of expert opinion, anonymously, using participants such as yourself using a series of questionnaires. This is the second iteration for reviewing the conceptual model and supporting instrument (PDF) attached. As part of the process, the responses from this first round were evaluated and the questionnaire, conceptual model and instrument have been revised thus providing a second opportunity to respond again to the emerging data. The predicted time to complete this questionnaire is estimated at 5 minutes. The instrument is a set of three questionnaires to be conducted in a company by 1, the leader, 2, senior management, and 3 staff and a summary of the three questionnaires is attached to the email as a PDF. As an established expert, either within the industry or as an academic, your opinion and input to this study are of great value/significance at this particular stage of the research.

This research aims to provide a comprehensive model by combining the barriers to a circular economy with several change readiness models from the literature. This model and instrument will then be further developed adding credibility to this verification process. After verifying the model, it will be empirically tested by validating it in an industrial setting.

Your expertise would be tremendously beneficial to add credibility to this model and instrument. I would like to express my deepest gratitude for your contribution to this Delphi study. I would be most grateful if you please respond no later than the 25th of January. Please access the questionnaire through the link below.

https://forms.office.com/r/ZknnaAU06a

John Thorley
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University of Derby, UK.
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Appendix 6.6 Revised Questionnaire for Review

Questionnaire for review This is the instrument that is to be reviewed. In practice, there will be 3 slightly different questionnaires, for the leader of the organisation, the senior team, and the staff, where questions will be framed slightly differently, but the sentiment remains. They will answer all questions on a Likert scale indicated below. There will be a clear definition of what circular economy is and examples of what it might mean.

Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
5 points	4 points	3 points	2 points	1 point

This part of the study needs to ascertain if the questions asked will determine readiness for each of the 24 categories that can be seen in the table at the end. The number in brackets between 1 and 10 indicates that the particular question also covers a particular barrier listed in the table at the end. The barriers make up the contextual factors. It is the organisations' beliefs about these perceived barriers we are measuring! For clarity, the readiness model aims to assess the readiness of organisational attitudes to the change rather than the capability of the organisation.

Questionnaire

Discrepancy

1. There is an impending need for our organisation to adopt a circular economy principles as we are behind expectations.
2. Currently our organisation has a gap between what it currently does and what it
could and should do in terms of circular economy activity.
3. There is a clear sense of urgency in terms of meeting sustainable goals and implementing a circular economy.
4. We need to improve our performance in sustainability by implementing an organisational change for the circular economy.

5. The time we should be spending on change should not be on sustainability and circular economy but on something else. –

6. A strategic vision demonstrating medium to long-term benefits has been communicated.

Appropriateness

1. Given the external pressures for sustainability in today's world, this kind of change

to adopt a circular economy is the right response for our organisation.

2. The change in our operations toward a circular economy will improve the performance of our organisation.

3. There is support from the supply and demand network to support new business models. (1)

4. Our customers and/or consumers have a real interest in the environment and are ready to positively change behaviour or business routine. (7)

5. When I think about these changes to our sustainable practices and circular economy, I realise it is appropriate for our organisation.

6. There is sufficient planning in this transition to adopt circular practices.

7. There is a sound business case for this transition to circular practices.

Personal Valence

1. This change to adopt a circular economy will benefit me.

2. With this change in my job based on circular activity, I will experience more self-fulfilment.

3. I will have better security in my job after this change to circular economy.

4. The change in my job assignments will increase my feelings of accomplishment.

5. When this change to circular economy is implemented, I don't believe there is anything for me to gain. –

Positive Emotions about change.

1. I feel elated that our company is now getting involved in more sustainable and more

specifically circular economy activities.

2. I am curious and enthused about adopting circular economy practices.

3. It makes me happy to know my organisation is heading toward a circular economy and more sustainable approach.

4. I am up for the challenge that a circular economy will present in my organisation.

5. This new change to a circular economy is exciting.

Change Self-Efficacy (confidence)

1. I have the skills that are needed to make this change to circular economy work. (4)

2. When I set my mind to it, I can learn everything that will be required when this change to a circular economy is adopted.

3. some tasks will be required when we change; I do not think I can do well. -

4. I am apprehensive about the tasks I will have to learn because of this change to circular economy. -

5. I do not anticipate any problems adjusting to the work I will have when this change to a circular economy is adopted.

Principle Support

1. There are not enough qualified personnel in environmental management to respond positively to change to a circular economy. (8) -

2. Our company culture is adaptable and will easily make the change to circular economy practices. (6)

3. Management has sent a clear signal this organisation is going to change to include a circular economy. (9)

4. This organization’s most senior leader is committed to this change. (9)

5. We are spending a lot of time on this change to a circular economy when the senior managers don’t even want it implemented. (9) –

Awareness and Mindfulness

1. There is a lack of awareness in the supply and demand networks of the supply chain to adopt new business models around circular economy. (1) -

2. I am completely aware of how our organisational collective behaviours must change if we are to adopt a circular economy.

3. Our customers and/or consumers have a lack of awareness of the need to change their behaviours and business routines. (7) -

4. I am fully aware of what behaviours I must change to satisfy the organisational shift to a circular economy.

4. I am mindful of the behaviour changes being asked of us and mindful of how some employees may struggle with the behavioural changes required.

Organisational Factors:

Collective Commitment

1. I have a good relationship with my line manager and I'm ready to follow their lead on a change transition to circular economy.

2. I am committed to seeing through this change transition to a circular economy.

3. As an organisation we are committed to making the necessary changes to adopt a circular economy.

4. I feel the organisation as a whole is ready to be involved with circular economy practices.

5. I am ready to follow our senior leaders on the organisation's journey to circular economy.

6. There will be sufficient opportunity for co-creation and collaboration internally. (6)

7. There will be sufficient opportunity for co-creation and collaboration externally. (1)

Collective Efficacy

1. This organisation has the methods to find the capital through Government funding and internal financial means necessary to successfully follow through and change to a circular economy. (2)

2. I am sure that our senior leaders will change their minds before we implement any aspects of the circular economy. (9) -

3. Our organisation has the technical know-how and ingenuity to develop new skills to adapt to circular economy practice. (4)

4. The leaders of this organisation will do whatever it takes to make the circular economy a success and continue to build on that success. (9)

5. Our management information systems will cope with any demands from a transition to a circular economy. (5)

6. Our company culture, (the way we do things) is supportive of a transition to circular economy. (6)

Collective Trust

1. My direct line manager will fully support my needs through this change to a circular economy. (9)

2. I'm not sure the senior management has my best interest at heart in terms of the change to circular economy. (9)

3. I know I will receive adequate training and support to carry out my duties in this transition to a circular economy. (10)

4. The senior management team will ensure all stakeholders are aware of the changes that a circular economy brings and be supportive. (9)

Organisational Valence

1. This change to a circular economy will be good for this organisation.

2. Engaging in circular economy activities will bring economic benefits to this organisation. (2)

2. A transition to a circular economy will mean more interesting work for employees.

Structural Factors.

Knowledge and Skills Alignment

1. I have the appropriate skills, knowledge, and ability for my revised role as we transition to a circular economy. (10)

2. I have the technical know-how or can at least obtain the technical resources and support from the organisation. (4)

3. I believe others in the organisation have the appropriate knowledge and skills to make the changes necessary to adopt circular practices.

Support climate

1. There are sound economic reasons to promote a transition to a circular economy. (2)

2. Our organisation will find the necessary capital to contribute and invest in circular economy business models and activities. (2)

3. There are financial incentives that make a circular economy and associated activity attractive. (2)

4. We have sufficient information to administer circular economy activities. (3)

5. There is little internal conflict in our company which in turn makes it adaptable to change to the circular economy. (6)

6. We can count on finding funding to assist with investment costs for the circular economy. (2)

7. Our management information systems are flexible enough to cope with circular economy activities. (5)

Facilitation

1. My new role and expectations are clearly defined.

2. There is a detailed implementation plan around the transition to a circular economy.

3. Our management information systems will facilitate this transition to a circular economy. (5)

4. There is clear expertise and strong leadership around the environmental issues and challenges we face. (8)

5. All new roles have been clearly defined and aligned to this new circular strategy.

6. We will be given the time and space necessary to adopt new practices. (10)

	Readiness Factor	Maximum score	Actual score	Sample Average
1	Supply network constraints	15		
2	Capital, finance, and finance options	30		
3	General administration	5		
4	Lack of technical know-how	15		
5	Poor information systems	15		
6	Company culture	20		
7	Customer/consumer behaviour/routines	10		
8	Qualified personnel	10		
9	Leadership	40		
10	Awareness & Training	15		
11	Discrepancy	30		
12	Appropriateness	35		
13	Personal Valence	25		
14	Positive emotions about change	25		
15	Change self-efficacy	25		
16	Principle Support	25		
17	Awareness and Mindfulness	25		
18	Collective commitment	35		
19	Collective Efficacy	30		
20	Collective Trust	20		
21	Organisational Valence	15		
22	Knowledge and Skills Alignment	15		
23	Support climate	35		
24	Facilitation	30		

6.7 Revised Questionnaire after Validation

Discrepancy

1. There is an impending need for our organisation to adopt circular economy principles.
2. We need to improve our performance in sustainability by implementing an organisational change for the circular economy.

Appropriateness

1. The change in our operations toward a circular economy will improve the performance of our organisation.
2. When I think about these changes to our sustainable practices and circular economy, I realise it is appropriate for our organisation.

Personal Valence

1. This change to adopt a circular economy will benefit me.
2. With this change in my job based on circular activity, I will experience more self-fulfilment.

Positive Emotions about change.

1. I feel elated that our company is now getting involved in more sustainable and more specifically circular economy activities.
2. I am curious and enthused about adopting circular economy practices and this new direction is exciting.

Change Self-Efficacy (confidence)

1. I have the skills that are needed to make this change to circular economy work.
2. When I set my mind to it, I can learn everything that will be required when this change to a circular economy is adopted.

Principal Support

1. Management has sent a clear signal this organisation is going to change to include a circular economy.
2. This organisation's most senior leader is committed to this change to a circular economy

Organisational Valence Factors:

Collective Commitment

1. As an organisation we are committed to making the necessary changes to adopt a circular economy.

Collective Efficacy

1. I believe this organisation has the collective ability to make a full transition to a circular economy in terms of our strategy

Collective Trust

1. I have full trust in my direct line manager will fully support my needs through this change to a circular economy.

Structural Factors.

Knowledge and Skills Alignment

1. I have the appropriate skills, knowledge, and ability for my revised role as we transition to a circular economy.

Facilitation

1. All new roles have been clearly defined and aligned to this new circular strategy.

Supply Network Constraints

1. There is support from the supply and demand network to support new business models.
2. Our customers and/or consumers have a real interest in the environment and are ready to positively change behaviour or business routine.

Lack of Capital and Finance

1. We can count on finding funding to assist with investment costs for the circular economy
2. Engaging in circular economy activities will bring economic benefits to this

organisation.

Lack of Technical Knowhow

1. Our organisation has the technical know-how and ingenuity to develop new skills to adapt to circular economy practice.
2. I have the technical know-how or can at least obtain the technical resources and support from the organisation.

Information Systems / Admin

1. Our management information systems will facilitate this transition to a circular economy
2. Our management information systems are flexible enough to cope with circular economy activities.

Company Culture

1. There is little internal conflict in our company which in turn makes it adaptable to change to the circular economy
2. Our company culture is adaptable and will easily make the change to circular economy practices.

Qualified Personnel

1. There is clear expertise and strong leadership around the environmental issues and challenges we face.
2. There are not enough qualified personnel in environmental management to respond positively to change to a circular economy.

Leadership

1. The senior management team will ensure all stakeholders are aware of the changes that a circular economy brings and be supportive.
2. The leaders of this organisation will do whatever it takes to make the circular economy a success and continue to build on that success.

Awareness and Training

1. I know I will receive adequate training and support to carry out my duties in this transition to a circular economy.
2. I am fully aware of what behaviours I must change to satisfy the organisational shift to a circular economy.

Appendix 7.1 Diagnostic Feedback report to the participating company (Futaba)

FEEDBACK	Maturity Index
Discrepancy - a belief that there is need for a change. That there is a difference between the current state (what is happening now) and the future state (what must be happening in the future). **If your maturity index is red or amber, there is a lack of belief about the need for change to a circular operation. This is likely to lead to apathy and resistance or at least poor performance if it is not addressed.**	3.5
Appropriateness - the change is an appropriate response to organisational or external issues. In this case, is the perceived plan for adopting a circular economy and new ways of working the right response to the challenge? **If your maturity index is red or amber, there is a lack of belief about the style of the approach to the issue. If individuals consider this is the wrong approach, it is likely to lead to resistance from some or at least poor performance if it is not addressed.**	3.3
Personal Valence - an individual's belief that change has intrinsic and extrinsic benefits including the perceived benefits of a change for an individual. An individual has a sense that they will be also moving to a more personally favourable position. It has a motivational factor if an individual believes the change is good also for them. **If your maturity index is red or amber individuals feel there is nothing in it for them and will therefore be less likely to engage wholeheartedly with the proposed changes. Even worse, If individuals feel a sense of loss, it is likely to lead to resistance or at least poor performance if it is not addressed.**	3.5
Positive emotions about change - the emotions that are present in response to change, such as joy, happiness, excitement, curiosity, enthusiasm, and pride. There is a genuine positive emotion attached to the change and the way they have perceived it being managed. **If your maturity index is red or amber there is a lack of positive emotions, which are a key driver of motivation. Without a positive feeling of emotion for the change, team members are unlikely to fully embrace the change let alone champion the cause. Understanding the emotions of the team/employees is key to knowing whether they will engage, conform, become an advocate, or even champion the change effort.**	2.0
Change self-efficacy - Confidence in your ability to affect change. An individual has a belief in their abilities to step up to the required change and develop the skills and competence to do so. **If your maturity index is red or amber, there is a lack of belief in many individuals in terms of their perceived capability to do what is being asked of them. We all have a belief about our capability. This firmly held belief will be a huge indicator of whether we believe we can step up with the skills and competencies required for any particular change. We are more likely to demonstrate behaviours aligned to the change challenges if we believe we are capable of success.**	3.0
Principal Support – A belief of provisional support from a range of leaders, moreover senior leadership, direct line management, formal, informal and one's peers. An individual believes they will be assisted and helped where necessary to achieve objectives associated with the change. **If your maturity index is red or amber, Individuals don't believe they will get direct support from their line management in times of change. If they believe that they will not receive the level of support they need to make the changes necessary it is likely to generate apathy and discontentment towards the change.**	3.0

Awareness and Mindfulness - being attentive to, aware of, and mindful of how a change is unfolding in the present, awareness of their routine behaviours and how they need to change. An individual is aware of their actions and the consequences of such actions or omissions and mindful of developing new ways of doing things. **If your maturity index is red or amber Individuals within the organisation at different levels lack awareness and are not mindful about the changes they must make in their actions and behaviour to support the transition to circular practice.**	1.5
Collective commitment – shared workforce belief and resolve to pursue courses of action that will lead to successful change implementation. Commitment based on 'want to' motives reflects the highest level of commitment to implement organizational change. It is these I want to motives, that the instrument questions are based. A belief that the organisation as a whole is committed to the change. **If your maturity index is red or amber, there is a lack of belief within the organisation about the collective commitment to want to step up and make the transition. The individual members believe that there is no collective commitment within the organisation, which is often perceived to be more of an indicator of success or failure.**	3.5
Collective Efficacy - a shared belief in their conjoint capabilities to organize and execute the courses of action required to implement change successfully. All members or the majority of members believe the organisation as a whole can implement the change successfully. This is a belief about what the organisation can achieve together. **If your maturity index is red or amber, there is a lack of belief in their conjoint capabilities to organise and execute the courses of action required to implement change successfully. The majority of members don't believe in the organisational capabilities to achieve success in the change to a circular economy.**	3.2
Collective Trust - shared belief that leaders will act in the best interest of the organisation's stakeholders. Individuals share the belief that the organisation is in safe hands and that the leaders and managers will do the right things on behalf of employees. **If your maturity index is red or amber, team members do not wholly trust the management and leadership to carry this change through and don't believe they have their best interests at heart. They don't trust the management and leader to do the right things for them and the company**	4.0
Knowledge and Skills alignment – the degree to which the employees' knowledge, skills and abilities align with the change. This is the attitude towards the degree of change that is anticipated for individuals and their ability to develop. **If your maturity index is red or amber, team members don't feel that their current knowledge and skills align with the change requirements. They may feel inadequate to contribute to the scale of the change that is being proposed.**	3.3
Support climate - sufficient tangible (e.g., funding, reward, and incentive systems) and an encouraging intangible environment (i.e., culture and climate) to support implementation. **If your maturity index is red or amber, team members don't feel there are sufficient tangible funding opportunities or reward and incentive systems in place. Further, they feel there is no encouraging intangible environment, and no climate for change to support implementation.**	3.3
Facilitation - a set of clearly articulated goals and objectives that are supported by a detailed implementation plan defining roles and systems to measure progress. A sense of confidence and belief in the plan and pathway to deliver the change. **If your maturity index is red or amber, team members have little faith in any plans or the general approach to the change. There is a lack of communicated roles, goals joined thinking and systems to measure progress**	3.0

Supply network constraints in this context are the beliefs and attitudes you and your employees have towards customers and suppliers' or consumers' behaviour. It is based on their individual and collective attitude whether they believe customers and suppliers have a willingness to participate in strategies about circular economy. Are suppliers and customers prepared to collaborate and share the risk? So, from a supply perspective, an absence of "green" suppliers for specific inputs and /or these inputs are insufficiently developed in the supply chain. From a demand or customer perspective is the need to convince customers to buy a green product or to use a green service, the need to provide accurate figures and additional evidence of benefits related to green goods and services, and those green products and services are of sound quality. **If your maturity index is red or amber, there is a belief that having available suppliers that are open to and supplying circular options or opportunities are few and far between. Moreover, their attitude to green thinking and circular economy is less than favourable. They believe the effort to convince customers and consumers to change is futile and not worth the effort as it is bound to fail.**	2.5
Capital and finance options refer to perceived lack of capital, lack of initial capital, lack of financial opportunities or alternatives to private funds and traditional bank funding. It can also include the indirect (time and human resources) costs related to extra R&D effort needed for the development or improvement of a new green good or service and investors' understanding of the commercial potential of the circular economy, especially for new products. Non-conducive legal systems and misaligned incentives. **Amber or red indicates the attitude and belief that there is no funding, appetite for investment, history of lack of investment, little chance of securing any type of external funding and no incentive to invest.**	3.0
General administration is the perception of complex systems and long procedures that businesses face to obtain certifications and labels, as well as to meet standards and legal obligations. Additionally, the different legal frameworks across countries add a layer of complexity to identifying the origin of inputs. **Amber of red indicates there is a perception of complex and long-drawn-out procedures to reach the new standard or required level of compliance. Keeping up to date with legal requirements is perceived as difficult to maintain almost overwhelming for your organisation.**	2.5
Lack of technical know-how is the perception that there is a gap in employee skills and a lack of knowledgeable people in matters related to circular economy business practices. In most cases, it is closely connected to SMEs' lack of resources and time to acquire skills training. Lack of knowledge of circular technologies. **Amber or red here indicates there is a perceived lack of knowledge and technical know-how surrounding the transition to circular economy and circular thinking. It could be a lack of understanding about the concept of circular economy and how to apply the theory in the real world, your context!**	3.5
Poor information systems - Inadequate information management systems, and real-time data. A lack of information about the benefits of the circular economy and new business models, due to the unfamiliarity of the term circular economy. The non-existent exchange of information among companies. **Amber or red indicates your information systems are perceived to lack real-time data to support activity associated with the circular economy. A perceived lack of information or not sharing information amongst and between other companies**	2.0
Company culture - Attitudes and beliefs of the workforce towards a circular economy and potential cost/benefit analysis. Beliefs around capability, lack of awareness. A reluctance to change, and therefore an unwillingness to invest time in looking for green solutions. Company culture is the organisation's collective mindset, ways of working, problem-solving, innovating, and introducing effective change. **Amber or red indicates there is a perception that the organisation is too rigid to change easily and that any changes attempted would be thwarted with resistance and apathy.**	3.0

Government Policy and Incentives - Organisational attitudes and beliefs towards perceived Government policy, incentives, and legislation. How supportive helpful and accessible are these perceived to be. **Amber or red indicates there is a perception that Government support is non-existent or is not helping or incentivising changes towards circular economy and circular activity.**	3.0
Qualified Personnel - Organisational attitudes and beliefs towards having qualified personnel in the field of environmental management, understanding legislation, opportunities and how to apply circular thinking in the context of a strategy. **Amber or red indicates a lack of belief that the organisation has qualified personnel in the field of environmental legislation and environmental management to steer the company through a circular journey.**	2.5
Leadership - Poor or insufficient leadership. Perceived lack of commitment from leaders and lack of strategy and communication. Company leadership must go beyond pure everyday management if a circular business model is to be more effective and efficient in the long run. Leadership on capacity development, skills building, and leadership training are a requirement. **Amber or red indicates the perception of poor or insufficient leadership. It is the perception that there is a lack of commitment from top leadership, poor communication, no belief they are serious about the change and little evidence of any strategy.**	3.2
Awareness and training - Adequate promotion and support of R& D, education, and training to increase general awareness and create the required skill base. **Amber or red indicates there is an inadequate promotion of the strategy to embrace a circular economy. There is a lack of awareness and, a perceived lack of training opportunities. There is a lack of engagement with the workforce to upskill and promote behaviour change.**	3.0

Maturity Index	Strategic Insights
3.5	How can you change, improve, or increase the message to the organisation? How can you influence others that there is a need to adopt circular practices? How can you best present an organisational vision of the future? What is your competition doing?
3.3	Is there anything you must understand better from others to re-align your approach? How can you convince others that this approach is for the best? People seldom resist change for no reason and often just want to have a voice! Listening and reasoning may enable an improved approach. What intervention could be put into place to facilitate input into the approach?
3.5	People are your greatest asset. What can you do to communicate the high value you hold for them? Is there any incentive to offer team members? How can you re-assure them their future is a positive one! How will the wider employees benefit from this transition to a circular economy? What motivates members of the organisation? What do they value? Can you give me more responsibilit Can you provide training and development? Mutual goal setting? Flexible hours?

2.0	Being mindful of individual emotions towards the changes will be a key indicator of the likely success of the plan. How can you Marshall more positive emotions within your team or teams towards the change strategy? Sending an anonymous survey might enable employees and staff to vent any emotion enabling appropriate responses from leaders. These new insights may enable new leadership approaches and strategies.
3.0	How can individuals be empowered, supported, coached, and developed to improve their knowledge, competence, and skills in line with the perceived changes? How could you identify the skills and competencies that are perceived to be lacking amongst the team members and staff? Consider sending an anonymous survey to each department asking for feedback on the perceived lack of skills and know-how.
3.0	How can you ensure a culture of support and empowerment throughout the organisation? How can you develop your line managers and supervisors? Great leaders produce more great leaders. What steps are you taking to create more leaders in different areas of the business? How can you further develop the leaders you already have?
1.5	How can you develop individuals to think laterally and creatively to find solutions toward circularity in the areas in which they work? How can training assist individuals in core activities and meeting expectations? What habits are no longer serving the company well? How can you raise more awareness of individual and organisational habits, and the need to find better ones! Consider building elements of training into the organisational structure for different roles/areas of the business
3.5	How do the different departments work together? How could you challenge them or design them to work more collaboratively? How could you create the conditions for better collaboration across departments? How could you encourage key individuals to change to increase commitment to the transition to a circular economy? Consider whether targets and department goals could be more aligned to prevent a silo mentality
3.2	How can you effectively communicate, the desire and need to change as well as outline the plan for upsk where necessary? What specific conjoint capabilities do they believe are not present? What skill sets? What knowledge? What management skills? What changes might you need to make within the leadership team? How might members of the leadership team need to champion this change more?

4.0	Trust is one of the most important values for great leaders to develop. How can you create highly trusting relationships between all team members, management, and leaders? How can you build more trust between management and team members? How compelling is the vision for the future? Do the management team completely buy into this vision? What actions need to be demonstrated to represent a highly trusting culture?
3.3	What new knowledge might be required for team members? How can this new knowledge be developed within the team? What upskilling might be necessary based on the perceived changes? Consider short courses, in-house training, and the development of key staff members. Which team members are both willing and able to step up?
3.3	How aware are you about the nature of support, empowerment, development, coaching and goal setting within your organisation? What can you do to create a more supportive hierarchy to develop more team members to become higher performing? How do you reward high performance? Great leaders create more leaders within their teams at all levels. How can you develop more leaders for higher performance?
3.0	The strategic plan to make this change transition must be robust, and clear, with responsibilities and accountabilities communicated to all. How are goals set within the organisation? How is performance measured towards these goals? What changes can you make to the overall plan to enable, enhance, and motivate team members? What barriers might exist to effective communication? Are there any tensions, conflicts, or confusion am team members?
2.5	How could you influence both suppliers and customers or consumers to explore different ways of working? One of the key challenges for circular economy adoption is leadership up and down the supply chain. How could you demonstrate leadership not only in your organisation but within the supply chain as well? Somebody has to be first! What opportunities might there be for mutually beneficial projects/rese investment?
3.0	What are competitors doing? What low-hanging fruit exists that does not require a huge investment in money or time? What marginal gains are possible? What options do you have to learn more about funding opportunities? How could you explore opportunities to adopt circular economic thinking with little investment? Who can help with financial support and what are the barriers to exploring these opportunities?

2.5	What real barriers exist to changing processes and procedures? How could a new system or system upgrade enhance capability in this area? How would current information systems need to change to enable circular activity? How could you pilot a scheme to better understand how easy or hard circular activity could be? How could you go further than complying with legislation, but take administration to the next level?
3.5	How can you identify the perceived lack of knowledge? Maybe a specifically designed survey for different departments. How can you build an expert team around technical challenges within your business to explore circular possibilities? What development do you think your staff require? What technical knowledge is missing in the business? How could you find out more about best practices in your industry/sector or area of specialism?
2.0	How do information systems support your business? How flexible are they? What upgrades or changes could be made? What information might be missing in real time that would be necessary to support circular activity? How much circular activity could be achieved without any significant changes to your information systems? What workarounds would be necessary to enable the transition to more circular activity?
3.0	How could you create a sense of urgency around this change? In what ways could you assess an employee's willingness to engage in circular activity? In what ways could you empower willing employees to develop additional learning around the concept of circular economy and what that means to them in their current role and the broader organisation? How could you develop a coalition of willing actors to engage in a circular strategy?
3.0	How much up-to-date knowledge has your organisation obtained about Government incentives for circular activity? Which key staff are currently engaged in this kind of research or enquiry? Could you identify third-party actors to do this on your behalf? Join networking groups and clubs associated with the transition to a circular economy. Develop key members of staff to further their knowledge at such events.
2.5	Who is the best and most likely employee to be developed in this area to help create a future with circularity in mind? Does the organisation need to and could justify a new or merged role? Could you employ a part-time professional to support this area of the business? Could you develop a team of key individuals as part of your transition and succession planning?
3.2	How committed are you to embarking on and staying the distance on a journey to circularity? How could you redefine, refine, and communicate your strategy to the top team and the remainder of the organisation? How can you empower others to step up and take decisive action aligned with the strategy? How can you develop circular leaders within your organisation? Leadership goes beyond your organisation. How can you step out to influence both suppliers and customers on the desire and necessity of going circular?

3.0	In what ways could you further raise awareness of what circular activity is and how it impacts the business and what benefits could be gleaned from such activity? How could you double the efforts to promote a circular economy in your organisation? In what ways could you provide training and development within your organisation In what ways could you inspire behaviour change in light of changes to be more circular? How could you incentivise employees to be more engaged with circular activity and circular thinking?

Appendix 7.2 Short version questionnaire presented to Futaba

A Sustainable Business Using Circular Economy (Leader) *Short Version*

The circular economy is a strategy for businesses to ensure it can be completely sustainable for the future. This means that no waste goes unrecovered and that every waste material has value and input into another process. It means rethinking everything that we do, such as using energy from sustainable sources, refusing to use virgin materials, choosing recycled materials, taking back products and re-manufacturing, refurbishing etc. It also means re-designing products that are easier to maintain, repair and disassemble for end-of-life reuse. Working with customers and suppliers on these issues is key to success. This questionnaire is **anonymous** and designed to find out if your organisation is ready for the journey to a circular economy. Please answer the questions by first reading the statement and then responding on a sliding scale between (1) Marginally agree (2) partially agree (3) Somewhat agree (4) Agree (5) Strongly agree.

Leaders' short version readiness for change Diagnostic (for illustration)

1. There is an impending need for our organisation to adopt circular economy principles as we need to future-proof.

1 2 3 4 5

2. Changing to a circular economy will present a stronger sense of purpose.

1 2 3 4 5

3. I feel elated that our company is now getting involved in more sustainable and more specifically circular economy activities.

1 2 3 4 5

4. We have enough qualified personnel in environmental management to respond positively to change to a circular economy.

1 2 3 4 5

5. Players in the supply and demand networks of the supply chain are aware of the need to adopt new practices around circular economy.

1 2 3 4 5

6. Given the external pressures for sustainability in today's world, this kind of change to adopt a circular economy is the right response for our organisation.

1 2 3 4 5

7. All of the organisation’s employees have the appropriate skills, knowledge and ability or capability to step up for their revised role as we transition to a circular economy.

1 2 3 4 5

8. I have the skills to lead this organisation in this field of sustainability and the skills that are needed to make this change to circular economy work.

1 2 3 4 5

9. This organisation can find the capital through Government funding and/or financial means internally necessary to successfully follow through and change to a circular economy.

1 2 3 4 5

10. I am sure that our senior leaders know I will not change my mind on the implementation of the circular economy.

1 2 3 4 5

11. There are sound economic reasons to promote a transition to a circular economy.

1 2 3 4
5

Section 2

12. We have sufficient information to administer circular economy activities.

1 2 3 4 5

13. I am clear about the strategy I am moving this organisation in terms of circular economy.

1 2 3 4 5

14. Our customers and/or consumers have a real interest in the environment and are ready to positively change behaviour or business routine with our support.

1 2 3 4 5

15. I have a good relationship with my team, and I know they are ready to follow my lead on a change transition to a circular economy.

1 2 3 4 5

16. When my organisation has committed to change in the past, they see things through, and this change transition to a circular economy is no different.

1 2 3 4 5

17. My senior team members will fully support all initiatives associated with a change to a circular economy.

1 2 3 4 5

18. My senior management team will ensure all stakeholders are aware of the changes that a circular economy brings and be supportive as I'm passionate about the circular economy and the way I communicate it to my organisation.

1 2 3 4 5

19. Our management information systems are flexible enough to cope with circular economy activities.

1 2 3 4 5

20. This organisation has the technical know-how and resources to adopt a circular economy.

1 2 3 4 5

21. Our company culture, (the way we do things) is supportive of a transition to circular economy.

1 2 3 4 5

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