Development and Validation of an Instrument to Measure the Service Innovation Capability Maturity of SMEs

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Abstract

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By Tadhg Blommerde

Small and medium-sized enterprises in the service sector must continuously innovate and adapt to remain competitive and ensure their survival. Key to this is their service innovation capability, a dynamic capability underpinning the repeated generation of new services and improvement of existing ones. However, despite the significance of this capability within the literature, there are serious gaps in how it is understood, and no measure exists of its effectiveness or maturity. As a result, practitioners are unaware of their service innovation capability performance or where resources should be directed for its improvement.

Informed by a positivistic research philosophy, this study addressed this gap by constructing and validating a formative measure of service innovation capability maturity for SMEs. As the maturity score for this capability is caused by its three subdimensions; User Involvement, Strategising, and Networking capabilities; an index construction procedure was synthesised and applied to its development. Using a cross-sectional online survey methodology, the responses of 284 service organisations located in the Republic of Ireland were used to test the instrument. Collected data were utilised to subject the index to rigorous testing that confirmed the acceptability of goodness-of-fit statistics, variance explained, the validity of individual indicators, the absence of excessive multicollinearity, and the validity of its structural model.

The novel and original measure developed in this study is the first of its kind and makes several major contributions to theory and practice. Specifically, the study's findings provide empirical support for the three subdimensions as predictors of service innovation capability performance, its synthesis and execution of a best practice index construction procedure offer a valuable template to researchers with similar objectives, and the managers of SMEs are provided with a tool to quantitatively understand their capability maturity and learn where their effort or attention ought to be directed to achieve improvements.

Declaration

No element of the work described in this Thesis or the Thesis itself, except where otherwise acknowledged, has been previously submitted for any degree at this or any other institution. The work described in this Thesis has been performed entirely by the author.

Signature ___________________________________ Date ___________

Dedication

Dedicated to Bobby Jameson

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List of Acronyms

Analysis of Moment Structures	AMOS
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Business-to-Consumer	B2C
Capability Maturity Model	CMM
Capability Maturity Model Integration	CMMI
Chief Executive Officer	CEO
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Comparative Fit Index	CFI
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New Service Development	NSD
New Service Development Maturity Model	NSDMM
Partial Least Squares Structural Equation Modelling	PLS-SEM
Research and Development	R&D
Resource Based View	RBV
Resource Dependence Theory	RDT
Research in Innovation, Knowledge, and Organisational Networks	RIKON
Root Mean Square Error Correlation	RMS_{theta}
Root Mean Square Error of Approximation	RMSEA
Service Innovation Capability Maturity Index	SICMI
Service Innovation Capability Maturity Model	SICMM
Service Innovation Capability	SIC
Service Innovation Performance	SIP

Shapiro-Wilk	S-W
Small and Medium-Sized Enterprises	SMEs
Standardised Root Mean Square Residual	SRMR
Statistical Package for the Social Sciences	SPSS
Structural Equation Modelling	SEM
Unweighted Least Squares Discrepancy	d_ULS
Valuable, Rare, Inimitable, and Non-substitutable	VRIN
Variance Inflation Factor	VIF

Chapter 1: Introduction

The services sector is fundamental to the prosperity of all nations (OECD, 2008). Indeed, the transition of a country's economy from agricultural, through manufacturing, and ultimately to services, is considered a feature of its development (Shepherd and Pasadilla, 2012). Presently, in developed economies, services are estimated to account for between two-thirds and three-quarters of all economic activity (Maroto-Sánchez, 2012; Kristen, 2015). Figures from the European Union report that this sector represents 75% of employment (Kemekliene *et al.*, 2007) and 73.9% of gross domestic product (GDP) (Eurostat, 2017). Even from this high base, the sector is predicted to grow still further with estimates that services will account for 80% of total employment by 2020 (Kemekliene *et al.*, 2007).

Consequently, service innovations, new or significantly improved services, are regarded by Ojasalo (2009) as a strategic imperative for most organisations, while Perks and Riihela (2004) go further arguing that they are critical to their very survival. Unsurprisingly, recognition of the importance of service innovation by researchers, managers, and policy makers is evident from the proliferation of literature on this topic (Giannopoulou *et al.*, 2011; Cheng *et al.*, 2012; Gryszkiewicz *et al.*, 2013; Stryja *et al.*, 2013; Witell *et al.*, 2016).

However, while acknowledging the value of singular or discrete service innovations, increased competition and rapid changes in customer demands necessitate their repeated generation (Kindström *et al.*, 2013). As a result, the attention of practitioners and researchers has progressively become directed towards a deeper factor, the firm-level capability underlying their continuous introduction (Siguaw *et al.*, 2006; Pöppelbuß *et al.*, 2011). This is commonly referred to as service innovation capability (SIC) (Lillis *et al.*, 2015; Nada and Ali, 2015). The link between this capability and service innovation performance (Plattfaut *et al.*, 2015), effectively responding to changing customer demands (Pöppelbuß *et al.*, 2011), and improved market (Grawe *et al.*, 2009) and organisational performance (Omar *et al.*, 2016), mean that its mastery is an issue of considerable concern to small and medium-sized enterprises (SMEs) (Çakar and Ertürk, 2010).

SMEs are economically important organisations (Hill, 2001), that, due to vulnerabilities resulting from their size (Narula, 2004), face intense pressure to continuously innovate and adapt to remain profitable, grow, increase their market share, or achieve superior performance to that of competitors (Stryja *et al.*, 2013; Smith-Eckhardt, 2015). Indeed, sustaining or improving their SIC is a key priority (Çakar and Ertürk, 2010) as it allows them to strategically practice service innovation and utilise their limited resources to maximum capacity (Pöppelbuß *et al.*, 2011; Prajogo and McDermott, 2014).

As studies related to SIC have grown in both number and prominence (See O'Cass and Sok, 2013; Lillis *et al*., 2015; Tang *et al*., 2015), it is reasonable to assume that there is an abundance of psychometrically sound apparatus and practical tools that can quantify the effectiveness or maturity of SIC and support its strategic management. Nevertheless, this is not the case and, to the best of the author's knowledge, no study has developed a measure of SIC that can be beneficially applied by practitioners. A major ramification of this failing is that SMEs are unaware of their SIC performance, which dimensions their capability is suffering on, or where resources should be directed for its improvement (Hipp and Grupp, 2005; Mohammed and Romeri, 2007; Jin *et al*., 2014).

For Zitkiene *et al.* (2015), this deficiency can be attributed to the discipline's corpus, which has been unsuccessful in its attempts to definitively conceptualise SIC. While it is accepted that SIC has multiple conceptually distinguishable facets (MacKenzie *et al.*, 2011) and must be represented as multidimensional construct (Agarwal and Selen, 2009; Hogan *et al.*, 2011; Zitkiene *et al.*, 2015), there is little harmony amongst the studies that attempt this. Most studies are predominantly theoretical and advance inconsistent and divergent dimensions that often overlook any empirical substantiation of their conceptualisation (Zhou and Wei, 2010; Plattfaut *et al.*, 2012; Nada and Ali, 2015). Of the few empirical studies of SIC, several defy the prevailing view that it should be represented as a multidimensional construct (Wang and Ahmed, 2004; Tuominen and Anttila, 2006; Ngo and O'Cass, 2009; Hogan *et al.*, 2011) and utilise unidimensional measures (Grawe *et al.*, 2009; Daugherty *et al.*, 2011; Thambusamy and Palvia, 2011; Tang *et al.*, 2015). This approach has too narrow a focus to adequately tap the domain of SIC, impedes the diagnostic potential of these measures, and negates their value to practitioners by concealing aspects of the capability key to improving its performance (Bollen and Lennox, 1991; Diamantopoulos and Winklhofer, 2001; Helm, 2005; Cadogan *et al.*, 2008; MacKenzie *et al.*, 2011).

A key reason for these deficiencies is the discipline's exclusive utilisation of classical test theory (CTT), rather than the formative approach (Blommerde and Lynch, 2017). These terms describe representations of the relationship between a latent construct and indicators of its dimensions that fundamentally differ in their assumptions (Diamantopoulos and Winklhofer, 2001; Jarvis *et al.*, 2003; MacKenzie *et al.*, 2011). CTT utilises a reflective measurement model that assumes a latent variable causes scores on its indicators i.e. indicators reflect the latent variable (Bollen, 1989). Simply put, with measures of this type, a construct is assessed by its outcomes. Conversely, formative measurement models assume the opposite causality, where indicators cause the score for the latent variable (Bollen and Diamantopoulos, 2015).

The representation of the relationship between SIC and its indicators has had important implications for research, where two of the major shortcomings of the reflective approach can be overcome by using a formative measurement model.

First, reflective constructs, measured using scales (Johnson *et al.*, 2012), assume unidimensionality; can contain only interchangeable items that correlate with one another; and allow any combination of these items to be included or excluded, without impacting the conceptual meaning of the measure (Jarvis *et al.*, 2003). This approach is unsuitable when representing a complex multifaceted phenomenon like SIC as a latent construct, as it is likely that there will be trade-offs between indicators of these facets (Cadogan *et al.*, 2008; Molina-Castillo *et al.*, 2013). Inevitably, indicators of conceptually necessary dimensions will be eliminated during scale purification when they do not display internal consistency with others (Diamantopoulos and Winklhofer, 2001; Rossiter, 2002; Diamantopoulos *et al.*, 2008) and result in an incomplete picture of SIC. On the other hand, with formative models, measured using an index, indicators may correlate positively, negatively, or not at all, meaning that important aspects of a phenomenon will not be eliminated when these trade-offs occur (Podsakoff *et al.*, 2003a; Coltman *et al.*, 2008).

Second, formatively representing a construct of a phenomenon, designates its indicators as its causes or as levers for controlling its performance. This means that the model will be of immediate practical relevance, as the indicators can be made sense of by managers operationally (Cadogan *et al.*, 2008).

Ultimately, formatively representing SIC has the potential to capture multiple aspects of this phenomenon, provide comprehensive theoretical insights into it, and provides the foundation for a useful diagnostic tool to assist managers of SMEs in assessing the capability's performance and detecting specific points of strength and weakness.

A further shortcoming of employing scales to support strategic capability management, is the level of detail or granularity that they offer. Likert-type scales are the class typically used for organisational research (Hinkin, 1995) and pose either a positive or negative statement to which respondents score the extent of their agreement or disagreement (Croasmun and Ostrom, 2011). Moultrie *et al.* (2007: 337) are critical of their application to improvement programmes for SMEs, asserting that they provide "little insight into what might constitute good practices", and instead favour measures of capability maturity.

Measures of this type are based on capability maturity models (CMMs), rigorously constructed tools that are used to support the measurement and management of organisational capabilities (Röglinger *et al.*, 2012; Wendler, 2012), and provide descriptions of an examined capability at several stages of development. CMMs assume capability improvement occurs in distinct stages and capture the effectiveness or maturity of the focal capability at a moment in time by comparing it against defined best practices (Becker *et al.*, 2009; Curley *et al.*, 2012). This representation of a capability's evolution on a performance continuum, allows for the rapid identification of areas of strength and weakness and for targeted improvement initiatives to be implemented which address those of poor performance (Essmann and Du Preez, 2009). While the benefits of maturity models in guiding performance management have led to this framework being utilised in a variety of domains (Ibbs *et al.*, 2004; Gibson *et al.*, 2006; Wendler, 2012), no scholar has yet taken the initiative to apply this apparatus to service innovation capability.

Another major weakness in service innovation capability literature is that it devotes inadequate systematic effort to methodological issues in the development of measures (Tuominen and Anttila, 2006; Kohler *et al.*, 2013). Indeed, as illustrated in Table 1, current measures of SIC all violate an established sequence of best practice steps prescribed for the development and validation of legitimate measures of constructs (Churchill, 1979; Hinkin *et al.*, 1997; Diamantopoulos and Winklhofer, 2001; MacKenzie *et al.*, 2011; DeVellis, 2017).

Phase	Step		Designer of Measure							
			(Wang and Ahmed, 2004)	(Tuominen and Anttila, 2006)	(Ngo and O'Cass, 2009)	(Thambusamy and Palvia, 2011)	(Hogan *et al.*, 2011)	(Daugherty *et al.*, 2011; Grawe *et al.*, 2009)	(Tang, 2015)	(Tang *et al.*, 2015)
Theoretical Foundation	Select an appropriate theoretical foundation	Select a theoretical basis to assist with specifying the relationships among variables.	×	✓	✓	✓	✓	✓	✓	✓
Conceptualisation	Unambiguously define the construct	Clearly and concisely define the construct.	✓	×	✓	✓	✓	✓	✓	✓
	Specify the conceptual domain of the construct	Specify the property to which the construct refers and the entity to which the property applies.	×	×	×	×	×	×	×	×
	Specify the conceptual theme	Describe the necessary and sufficient attributes or characteristics something must possess to be an example of the construct. Consider the stability of the construct over time.	×	×	×	×	×	×	×	×
	Specify construct dimensionality	Determine whether the construct is unidimensional or multidimensional and how the dimensions relate to each other and the construct.	✓	✓	✓	×	✓	×	×	×
Development of Measurement Items	Generate items to represent the construct	Generate and precisely write a set of items that fully represent the construct's conceptual domain.	✓	✓	✓	✓	✓	✓	✓	✓
	Assess the content validity of items	Evaluate the extent to which the items represent the construct's content domain.	×	✓	✓	×	✓	×	×	×
Model Specification	Formally specify the measurement model	Specify the empirical relationships between indicators and the focal construct.	✓	×	×	×	×	✓	×	×
Testing the Measure	Collect data to test the measure	Obtain data from a sample representative of the focal population to identify potential problems with the measure.	×	×	×	✓	×	×	×	×
Data Collection	Collect Data	Obtain data from a representative sample, sufficiently large to examine the psychometric properties of the measure.	✓	✓	✓	✓	✓	✓	✓	✓
Measure Evaluation and Refinement	Measure purification and refinement	Decide whether the measure requires refinement or purification through the elimination of items by evaluating the model's goodness of fit and the validity of indicators.	✓	×	×	×	✓	×	×	×
Validation	Assess measure validity	Assess the validity of the measure at the construct-level.	✓	✓	✓	✓	✓	✓	✓	✓
Norm Development	Develop norms for the measure	Develop norms to aid in the interpretation of scores on the measure.	×	×	×	×	×	×	×	×
Formative Approach			×	×	×	×	×	×	×	×
Maturity			×	×	×	×	×	×	×	×

Table 1: Procedural Steps Adhered to in the Development of SIC Measures.

One procedural step that is consistently ignored is clarification of the conceptual theme. Its neglect has resulted in confusion surrounding the distinctness of SIC from other constructs and the utilisation of deficient indicators (Podsakoff *et al.*, 2016). Furthermore, while it is usual for measures to identify the property to which a construct refers (Schwab, 1980; Davis, 1989; MacKenzie *et al.*, 2011), no SIC measure in Table 1 articulates that it examines the intensity, performance, effectiveness, maturity, or any other attribute of this capability.

The deficiencies in the development of SIC measures are not exclusive to their early phases. Specifically, all measures overlook the final step, where a frame of reference and standards should be provided in order to support the interpretation of meaning from scores (Urbina, 2014). Consequently, organisations that use these measures would be confused regarding the significance of their results and whether or what management actions are required (Spector, 1992).

To combat the foregoing deficiencies of CTT, remedy the significant research gap created by them, and overcome the laxness with which existing measures have been developed, this research diverges from the present literature by meticulously constructing and empirically validating a formative measure of service innovation capability maturity. This index is the first of its kind and, through its development, will provide researchers with a concrete conceptualisation of the phenomenon, based on empirically verified drivers, and enable SMEs to diagnose their SIC performance, informing decisions for its improvement or optimisation that maximise their scarce resources.

1.2 Objectives of the Study

The objective of this research is:

To develop and validate a formative measure of service innovation capability maturity.

Underlying this objective are the following sub-objectives:

A. *To define and conceptualise the service innovation capability construct;*

B. *To develop a framework to support the assessment of service innovation capability maturity and inform improvement initiatives*; and

C. *To construct and empirically validate an index that quantitatively measures service innovation capability maturity in small and medium-sized enterprises.*

1.2.1 Method

The development and validation of this study's focal service innovation capability maturity index is accomplished through its close adherence to a best practice procedure consisting of nine phases and 16 steps (See §2.3.3). The objective of early activities is to build a solid conceptual understanding of SIC maturity from which a measure can be prepared and empirically tested through an online survey questionnaire in later stages. The research design can be classified as descriptive.

1.3 Definition and Clarification of Terminology

Given the number and complexity of terms and concepts in this thesis, the following sections present their use and meaning.

1.3.1 Capability

The term 'capability' is used to describe how an organisation deploy their resources through a repeatable series of actions to achieve some intended outcome (Winter, 2000; Helfat and Peteraf, 2003; Giannopoulou *et al.*, 2011; Vicente *et al.*, 2013). Capabilities evolve over time, are embedded in processes or routines, are repeatable and reliable, and difficult to imitate or acquire (Teece *et al.*, 1997; Teece, 2009; Felin *et al.*, 2012; Storey and Hughes, 2013).

1.3.2 Service Innovation Capability

Service innovation capability describes the ability of an organisation to innovate their services, that is, to develop new services or make significant improvements to existing services (Kohler *et al.*, 2013; Nada and Ali, 2015). As it is an organisational capability, it is repeatable, embedded in processes and routines, and does not refer to proclivities or behavioural characteristics (Westerduin, 2012; Plattfaut *et al.*, 2013). When effectively managed, this capability allows organisations to adapt to their environment or respond to changes in customer demand through the repeated and continuous creation of service innovations (Giannopoulou *et al.*, 2011).

1.3.3 Maturity

Maturity is an attribute, characteristic, or property of an examined object that refers to its degree of sophistication or the effectiveness of its performance compared to predefined criteria, usually best practice (Wendler, 2012; Hynds *et al.*, 2014). Within the study of business administration, the term was originally used to describe software development performance (Paulk *et al.*, 1993) but has spread to numerous other disciplines since (Fraser *et al.*, 2002; Rapaccini *et al.*, 2013). As organisational capabilities can be performed effectively or ineffectively (Ekionea *et al.*, 2011), their maturity is represented along a continuum (Dadfar *et al.*, 2013). A low level of maturity describes poor and inconsistent performance, while high maturity, best practice which is effective, predictable, and consistent (Rasula *et al.*, 2008).

1.3.4 Index

While multi-item measures of constructs with reflective indicators are referred to as scales (Churchill, 1979), those for constructs with formative indicators are referred to as indexes (Diamantopoulos and Winklhofer, 2001). In a scale, items (i.e. observed variables) are regarded as effects of an underlying construct (i.e. latent variable) of which they are reflective (Edwards and Bagozzi, 2000). Conversely, with an index, the items are considered to be causes of the latent construct (Bollen and Diamantopoulos, 2015). The primary difference between these two classes of measure is how the score for the measured latent variable is calculated (Diamantopoulos and Siguaw, 2006). For scales, it is the shared variance amongst items (MacKenzie *et al.*, 2005). This means that high covariation between all items is required as they are reflective of a common cause (Jarvis *et al.*, 2003). The score for a latent variable measured using an index is determined by its total variance (Coltman *et al.*, 2008). Each of the items in measures of this type are essential and each makes a separate and distinct contribution to its score (Covin and Wales, 2012).

1.4 Location of Research within Current Literature

This study is positioned within the discipline of business administration, spanning the fields of innovation management and service development. It is specifically located in the domain of performance measurement and management and concerns the construction and validation of a measure to support the strategic management of service innovation capability. In order to achieve its research objectives, the study drew from several literature streams: Service Innovation Capability, Dynamic Capabilities, Capability Maturity Model, and guidance advanced by methodologists to support the construction and validation of legitimate measures of constructs.

Understanding the phenomenon of service innovation capability necessitates an appropriate theoretical paradigm pertaining to organisational capabilities, which for this study is the Dynamic Capabilities View (Teece *et al.*, 1997; Helfat *et al.*, 2007). This paradigm is used to explain variance in organisational performance over time and can provide helpful insights into intangible capabilities that are embedded in processes and routines (Mort and Weerawardena, 2006). However, this theory has been constrained due to its dichotomous view of these capabilities, where they are normally represented as either effective or absent from an organisation (Helfat and Peteraf, 2003). This despite the contention that allowing for "varying degrees of dynamic capability across firms… [is] more compatible with real-world situations than a 'have it or not' approach" and permits changes in their performance over time to be observed along a continuum between low and high (Barreto, 2010: 270).

SMEs must consistently and persistently innovate their services to adapt to changes in customer demand and continue operating successfully (Çakar and Ertürk, 2010; Janssen *et al.*, 2012). This is achieved through their service innovation capability, a firm-level dynamic capability that underlies the repeated introduction of new and significantly improved services (Plattfaut *et al.*, 2013; Nada and Ali, 2015). The basic premise of this research is that the performance or effectiveness, referred to as maturity (Wendler, 2012), of this organisational capability exists along a continuum i.e. from low to high (Ekionea *et al.*, 2011). Though SIC is a complex dynamic capability that is difficult to observe directly, the study argues that its maturity can be measured and controlled through dimensions that are designated as its causes (Barreto, 2010).

While the effectiveness or maturity of specific dynamic capabilities is an area in which insufficient research has been undertaken to date, it is suggested that their performance can be diagnosed by representing them formatively with ordinary capabilities as their indicators (Cepeda and Vera, 2007; Barreto, 2010). Simply put, the maturity of dynamic service innovation capability can be assessed by examining the maturity of its dimensions or causes, ordinary level capabilities. However, the majority of SIC studies are conceptual and have proposed divergent dimensions that are never substantiated (Zhou and Wei, 2010; Nada and Ali, 2015; Zitkiene *et al.*, 2015). The limited empirical research on this topic, where SIC is regarded as a multidimensional construct (Wang and Ahmed, 2004; Hogan *et al.*, 2011), exclusively represents it as a reflective construct (Tuominen and Anttila, 2006; Ngo and O'Cass, 2009), meaning that indicators of its dimensions are its effects (Diamantopoulos *et al.*, 2008). As a result, they contribute nothing to the management of SIC nor the identification of its drivers.

Although scant attention has been devoted to empirically substantiating the causes or drivers of service innovation capability in SMEs, conceptual literature that proposes antecedents or enablers of service innovations proved beneficial. These studies are predominantly located in the service management literature and list ‘service innovation capabilities’(Den Hertog *et al.*, 2010; Janssen *et al.*, 2015), factors that ‘give rise’ to service innovations (Gryszkiewicz *et al.*, 2013). By constructing a valid formative measure of service innovation capability maturity, it is possible to empirically validate its subdimensions or drivers (MacKenzie *et al.*, 2011).

The literature reviewed yields several critical insights into researching the maturity of service innovation capability in SMEs. There is a paucity of research that examines the maturity of this capability’s performance or of the performance of any dynamic capability and, due to this limited attention, neither the service innovation nor capability maturity modelling literatures are likely to develop an understanding of this phenomenon that can assist managers of SMEs. Thus, blending literatures should provide a better understanding and greater knowledge regarding the characteristics of SIC and its subdimensions as they increase in effectiveness, than any one single perspective. Therefore, this research will augment the current literature.

The contribution of this study enhances substantive knowledge in several theoretical streams: Innovation Management, Service Innovation Capability, Dynamic Capabilities (Specifically with regard to the measurement of dynamic capabilities and their dimensions), Capability Maturity Model, and literature regarding the development of measures of constructs with formative indicators. It is anticipated that the results will address the “significant gap [which] exists in our knowledge of the measurement of service firm innovation capability”, recognised by Hogan *et al.* (2011: 1264), and heretofore unremedied.

1.5 The Structure of the Thesis

This thesis is comprised of nine chapters, the first of which is the present introductory chapter. The purpose of this chapter is to introduce the wider research context from which this study’s objectives emerged. It outlines these research objectives, the chosen methodology, and clarifies foundational terminology.

In Chapter 2, an overview of the study’s philosophy and methodology is presented. It describes the foundation of the selected research approach and justifies its appropriateness. Importantly, it summarises a best practice procedure, comprised of nine phases and 16 steps, through which a measure of service innovation capability maturity can be constructed and empirically validated. All subsequent chapters are built around the logical and incremental structure of this procedure and are intentionally ordered so as to align with it. Table 2 presents an overview of the thesis and illustrates how the chapters and procedure are integrated and where various phases and steps in the procedure are located throughout the thesis.

Chapter	Phase	Step
1. Introduction		
2. Philosophical and Methodological Approach		
3. Theoretical Foundation	1. Theoretical Foundation	1. Select an Appropriate Theoretical Foundation
4. Conceptualisation of Service Innovation Capability Maturity	2. Conceptualisation	2. Unambiguously Define SIC
		3. Specify the Conceptual Domain of the Construct
		4. Specify the Conceptual Theme
		5. Identify the Dimensions of SIC
		6. Confirm the Suitability of Dimensions as Formative Indicators of SIC
		7. Specify the Conceptual Theme of the Dimensions
5. Measurement	3. Development of Measurement Items	8. Generate Items to Represent the Construct
		9. Assess the Content Validity of the Items
	4. Measurement Model Specification	10. Formally Specify the Measurement Model
6. Data Collection	5. Testing the Index	11. Pretest
		12. Pilot
	6. Data Collection	13. Collect Data
7. Data Analysis	7. Index Evaluation and Refinement	14. Purify and Refine the Index
	8. Validation	15. Assess Index Validity
	9. Norm Development	16. Develop Norms for the Index
8. Discussion		
9. Conclusion		

Table 2: Structure of the Thesis.

Chapter 3 evaluates numerous theoretical perspectives and their suitability for achieving the objectives of the study. A large portion of this chapter is concerned with justifying the application of the dynamic capabilities view to the study of service innovation capability.

Chapter 4 fully explores the study's core concepts, explicitly, the maturity of service innovation capability. It begins with a review of the service innovation literature and continues by summarising literature on the subject of capability maturity. Thereafter, the chapter describes the development of a conceptual service innovation capability maturity model.

The fifth, sixth, and seventh chapters together present a detailed account of preparing the study's focal service innovation capability maturity index for empirical testing, the implementation of this measure, and report the analyses of data collected and the findings obtained. This is followed by an analytical discussion of these findings in Chapter 8.

Finally, Chapter 9 contains the conclusions and implications of this study, resulting from both theoretical and empirical analyses. This chapter concludes with possible directions for future research that can build upon this research project and further enhance the study of service innovation capability.

Chapter 2: Philosophical and Methodological Approach

2.1 Introduction

For any research project, many philosophical foundations are possible (Crotty, 1998). These potential philosophical stances make assumptions about the social world and how it is to be investigated (Burrell and Morgan, 1979; Holden and Lynch, 2004). While these assumptions are often implicit and unexamined (Ackroyd and Fleetwood, 2000), consideration of them can guide a researcher's choice of research design and bolster confidence that the most appropriate method has been chosen to achieve the research objectives (Gioia and Pitre, 1990; Cunliffe, 2004). Therefore, this chapter outlines the philosophical assumptions and methodological approach adopted for the current study.

The chapter begins by overviewing the major schools of business philosophy and detailing this study's philosophical approach. Next, a description is provided of the methods employed to achieve the objectives of the research, an explanation is given of the two primary classes of construct, and the rigorous methodological process required to develop a valid measure of a construct with formative indicators is summarised.

2.2 This Study's Philosophical and Methodological Approach

According to Burrell and Morgan (1979), when determining the philosophical perspective of a study, core assumptions must be made by a researcher regarding the nature of society and the nature of science. Of these two dimensions, the sociological one has two extreme views, labelled 'regulatory' and 'radical change'. The regulatory view assumes that society is unified and cohesive and evolves rationally. The radical change view assumes that society is in constant conflict as humans struggle to free themselves from the dominion of societal structures (Burrell and Morgan, 1979). These contrasting views underlie diametrically opposed schools of thought, where the regulatory view is the basis of modernism, while the radical change perspective is the foundation of post-modernism.

For the second dimension, concerned with the nature of science, two antithetical views are recognised regarding approaches to research, labelled ‘objective’ and ‘subjective’. These views are differentiated by conflicting assumptions on the four factors that underlie them, ontology, epistemology, human nature, and methodology. Each assumption subsequent to that for ontology is consequential and logically follows that for the previous factor (Hallebone and Priest, 2009). This sequential interdependence means that the choice for one will, in turn, effect the choice for others.

Burrell and Morgan (1979: 23) contend that the consolidation of the aforementioned dimensions results in “four distinct sociological paradigms which can be utilised for the analysis of a range of social theories”. The authors label these paradigms, ‘radical humanist’, ‘radical structuralist’, ‘interpretive’, and ‘functionalist’, as illustrated in Figure 1. These paradigms represent four standpoints with regard to the social world that are based upon distinct meta-theoretical assumptions about the nature of society and the nature of science, and are valuable to researchers when positioning their work within social theory (Burrell and Morgan, 1979). While a full discussion on the contemporary research methodologies should consider all four paradigms, the ambit of this study’s philosophical debate will be restricted to what Burrell and Morgan (1979) have described as the interpretive and functionalist paradigms.

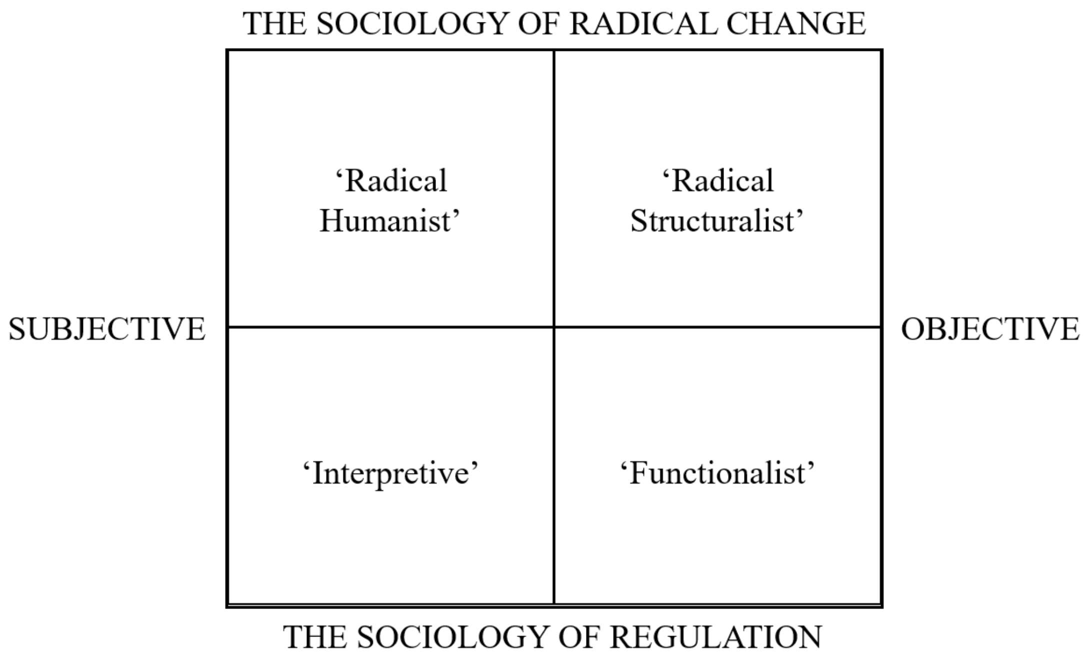

Figure 1: Four Paradigms for the Analysis of Social Theory.

Source: Burrell and Morgan (1979:22)

Consideration of only the interpretive and functionalist paradigms is a justifiable line of reasoning. It is consistent with the majority of other research and supported by Morgan and Smircich (1980) who argue that, with regard to research methods, the other paradigms concern only ideological debates that are of little consequence or overlook application by researchers.

As illustrated in Figure 1, the functionalist paradigm approaches academic sociology and organisational studies from a perspective that is established deeply in the sociology of regulation while adhering to an objectivist view of the subject matter. While its antithetical paradigm, the interpretive standpoint, has a similar perspective regarding the nature of society, specifically the regulatory view, it assumes a subjective view regarding the nature of science.

While Burrell and Morgan (1979), use the terms objectivist and subjectivist, alternative labels for paradigms based these polarised views on the nature of science have been employed by others. These are summarised in Table 3. For instance, Hughes and Sharrock (1997) use the terms positivism and interpretative alternative and Easterby-Smith *et al.* (2002) utilise positivism and phenomenology.

Objectivist	Subjectivist
Quantitative	Qualitative
Positivist	Phenomenological
Scientific	Humanistic
Experimentalist	Interpretivist
Traditionalist	
Functionalist	

Table 3: Alternative Labels for Philosophical Paradigms.

Source: Holden and Lynch (2004: 399)

The objectivist view of social science research is an extension of approaches rooted in the natural sciences, while subjectivism emerged in response to criticisms of the former viewpoint (Burrell and Morgan, 1979). It opposes the reductionism of objectivism and attempts to address perceived defects with its key assumptions (Giddings and Grant, 2007). As a result, the fundamental distinctions between these contrasting views are most easily observed through an examination of their differing assumptions on the four factors that underlie them, illustrated in Figure 2.

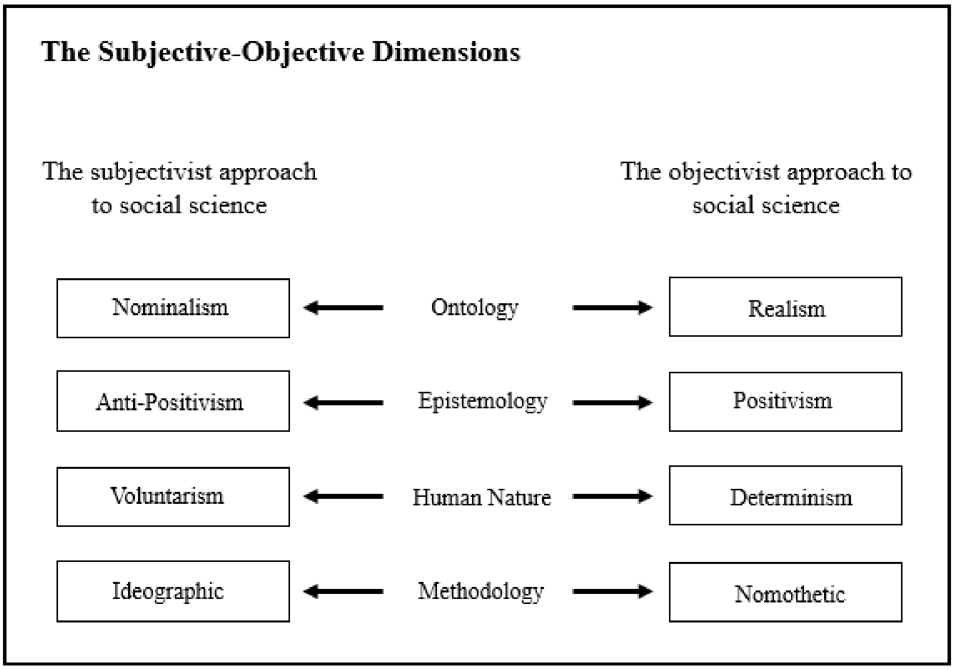

Figure 2: A Scheme for Analysing Assumptions About the Nature of Social Science.

Source: Burrell and Morgan (1979: 3)

The assumptions for each of these factors are mutually exclusive, meaning that only one can be adopted by a researcher due to their inherent contradictions with the opposing view (Lincoln and Guba, 1985). However, it is rare that researchers will subscribe to *all* aspects of these extreme views and many adopt more moderate positions that "attempt to incorporate insights from others" (Morgan and Smircich, 1980: 493). While there is vigorous debate between proponents of the two schools of philosophy (Mkansi and Acheampong, 2012; Kerman, 2017), there is no single correct paradigm (Connell and Nord, 1996), and the argument has been made that exclusively utilising only one may impede social science research by preventing researchers from engaging with each other (Gill and Johnson, 2002). For Morgan and Smircich (1980), regarding these extreme philosophical views as dichotomous due to their differences is an oversimplification, and the authors suggest that they can be more appropriately represented on a continuum, as illustrated in Figure 3. This study takes its lead from the schema offered by these authors and adopts an objectivist position, though not an extreme one.

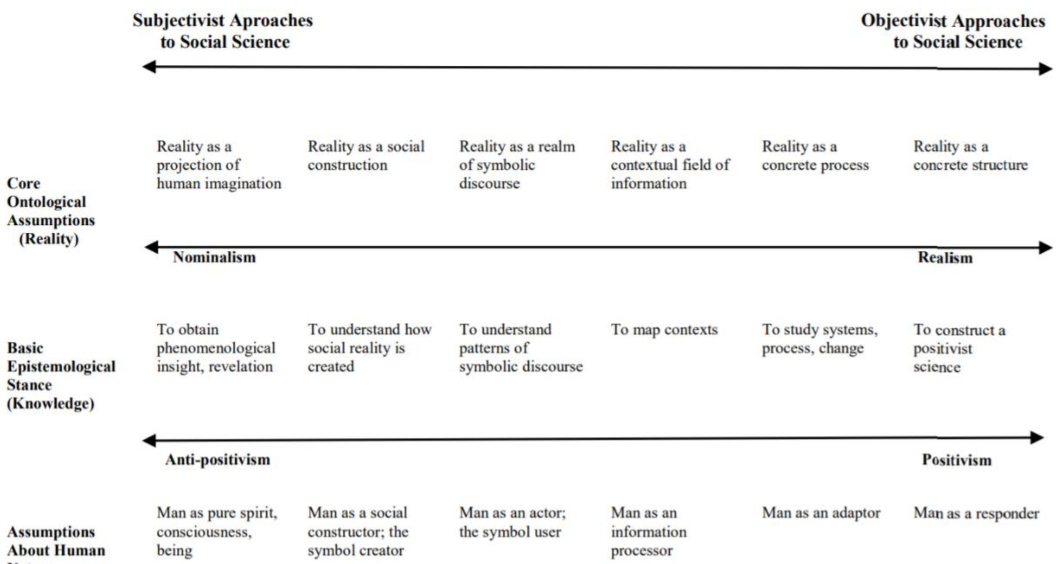

Figure 3: Basic Assumptions Characterising the Subjectivist-Objectivist Debate Within Social Science.

Adapted from Morgan and Smircich (1980)

Ontological assumptions relate to form and nature of reality (Easterby-Smith *et al.*, 2002) and whether things have an existence or are the product of humans' subjective minds (Bentz and Shapiro, 1998). There are two extreme views, nominalism and realism (Dunne *et al.*, 2005). The former contends that there is no real structure in the world, where the latter considers the world as existing independently of humans (Hallebone and Priest, 2009). In essence, the debate is whether the material world is a social construction built from the actions and perceptions of actors, or reality is external to these actors (Bryman, 2004). Where a realist would consider the world as existing externally to a person, the nominalist assumes that the world is made up of names, concepts, and labels which are shaped by the individuals in it (Burrell and Morgan, 1979).

Ontologically, this study adopts a realist position, though not an extreme one. Reality is viewed as external (Easterby-Smith *et al.*, 2002; Brown, 2006) and the aim of science is to gain a knowledge of that external world (Gordon, 1991). In Morgan and Smircich's (1980) typology (Figure 3), the stance of this research is in the second 'Realism' category as it implies that, though reality is tangible, humans have an input into forming its concreteness.

Epistemological assumptions pertain to the nature of knowledge and how it can be obtained (Bryman, 2004). Hughes and Sharrock (1997: 5) present it in the form of a question asking, "how is it possible, if it is, for us to gain knowledge of the world?", while Hallebone and Priest (2009: 27) relate it to how a view of reality can be "generated, represented, understood, and used". Epistemological suppositions are concerned with whether knowledge can be acquired, or if it must be experienced first. It raises questions as to whether knowledge is even real and can be expressed in a tangible form, or whether it is soft and subjective and based only on human experiences. Central to this debate is whether similar principles and procedures to those used in the natural sciences, can be applied to social science (Dunne *et al.*, 2005). The polarised and extreme epistemological positions are labelled positivist and anti-positivist (Burrell and Morgan, 1979).

Positivism, or empiricism, often requires the testing of theories about the hypothesised relationships between elements (Easterby-Smith *et al.*, 2002). It understands the existence of an external world with properties which can and should be objectively measured (Remenyi *et al.*, 1998). Anti-positivism, sometimes referred to as phenomenology (Easterby-Smith *et al.*, 2008) or interpretivism (Bryman, 2004), emphasises the interpretation of subjective meanings from social actors in order to understand their experience in a context-specific setting (Creswell, 1998). Table 4 outlines the implications of these diametrically opposed epistemological assumptions.

	Positivism	**Anti-Positivism**
The Observer	Must be independent	Is part of what is being observed
Human Interests	Should be irrelevant	Are the main drivers of science
Explanations	Must demonstrate causality	Aim to increase general understanding of situation
Research Progresses Through	Hypotheses and deductions	Gathering rich data from which ideas are induced
Concepts	Need to be defined so that they can be measured	Should incorporate stakeholder perspectives
Unit of Analysis	Should be reduced to simplest forms	May include the complexity of whole situations
Generalisation Through	Statistical probability	Theoretical abstraction
Sampling Requires	Large numbers selected randomly	Small numbers of cases chosen for specific reasons

Table 4: The Contrasting Implications of Positivism and Anti-Positivism.

Adapted from Easterby-Smith et al. (2002)

The stance adopted for epistemology in this study is a positivistic one (Crossan, 2003; Hallebone and Priest, 2009), though not extreme. Knowledge is not regarded as absolute and “can be accumulated, tested, and either retained or discarded” (Holden and Lynch, 2004: 407). Accordingly, with scientific advancement, there are improvements to knowledge that are achieved through the falsification or confirmation of theories using both quantitative and qualitative approaches.

Assumptions regarding human nature concern the relationship between human beings and their environment (Burrell and Morgan, 1979). The extreme views are voluntarism, which considers man as having free will and acting autonomously, and determinism, which holds that man is conditioned by the environment and external influences (Dunne *et al.*, 2005).

The author takes a deterministic view of human nature, though, again, it is not an extreme view, but closer to an intermediate approach (Morgan and Smircich, 1980). This assumption perceives that both society and organisations are pre-constructed and re-constructed, but appear fixed when measured at a single point in time (Hudson and Ozanne, 1988). Therefore, the study's methodology involves the measurement of variables at a single point.

The final assumption, methodology, refers to the researcher's tool kit and incorporates all means that social scientists have available to them for the investigation of phenomena (O'Gorman and MacIntosh, 2014). The two polarised positions are labelled by Burrell and Morgan (1979) as ideographic and nomothetic. While the former position concerns first-hand knowledge and proximity to research subjects, the latter emphasises research that is based "upon systematic protocol and technique" (Burrell and Morgan, 1979: 6).

Based on the foregoing and the objectives of this research project, this study's methodological approach is nomothetic, though not extreme (Bentz and Shapiro, 1998). Consequently, it is appropriate for both descriptive and causal research designs and allows for some subjectivity (Falconer and Mackay, 1999; Lincoln and Guba, 2000). Rather than being classified as a pluralist methodology though (Mingers and Brocklesby, 1997; Lawrenz and Huffman, 2006), the study's methodology is predominantly objective, deductive, uses quantitative data and hypthetico-deductive reasoning to test the relationships between objects, is structured, emphasises systematic procedures and techniques, and lends itself to surveys (Bentz and Shapiro, 1998; Crotty, 1998; Falconer and Mackay, 1999; Gill and Johnson, 2002). The rationale for adopting this methodological approach is illustrated in Figure 4.

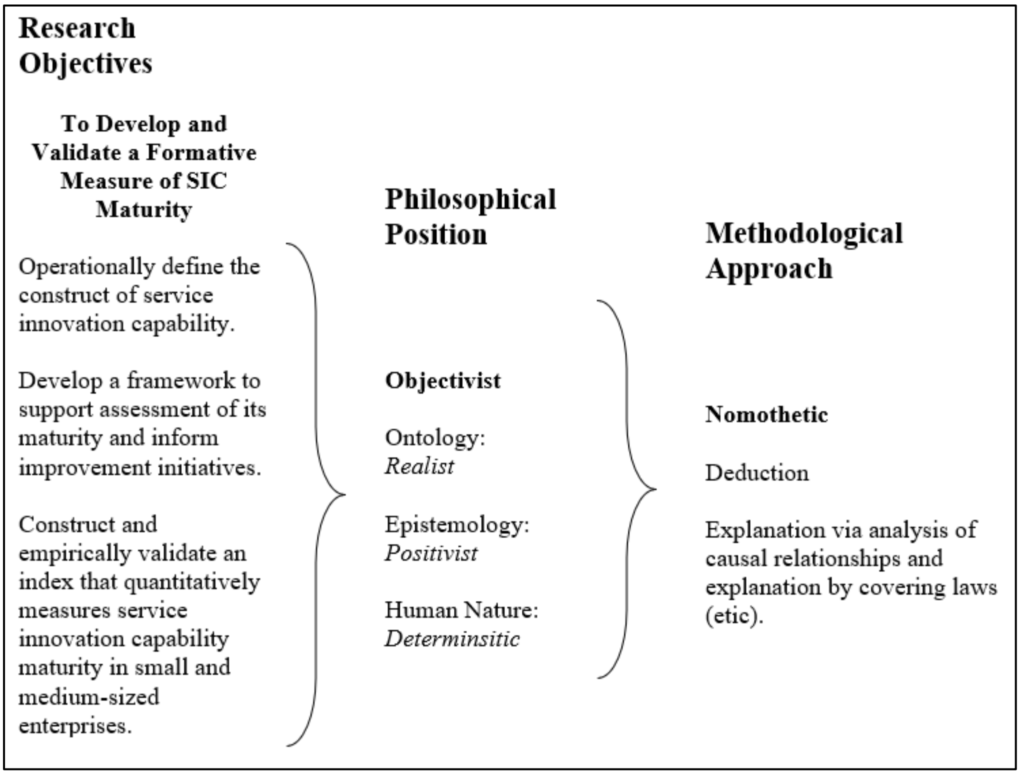

Figure 4: Rationale for a Nomothetic Methodology.

2.2.1 Research Design

Once a study's research method has been chosen, its research design can be developed (Bryman, 2004: 27). This describes a researcher's plan for obtaining data that allows them to answer a study's research questions (Oppenheim, 2000; Saunders *et al.*, 2003; Creswell *et al.*, 2004; Hallebone and Priest, 2009). It is recommended that this plan specify three major items, the type of data to be collected, the tools and procedures for data collection, and the type of analysis that will be performed (Edmondson and McManus, 2007).

As the objectives of the research require the development and testing of an instrument to measure the variability of service innovation capability maturity and the maturity of its subdimensions in SMEs (Saunders *et al.*, 2003), quantitative data were required (Malhotra, 2002; MacKenzie *et al.*, 2011; Nghia and Duyen, 2019).

Domegan and Fleming (2003) note that there are three major methods that can be used to collect quantitative data. They are panels, observation, and surveys (Mooi and Sarstedt, 2011). Each has a different purpose; data are collected in distinct ways;

sampling varies; and intervention by the researcher may or may not be required, depending on which is chosen. Observation was dismissed as it would not allow for the data required to address the study's research objectives to be collected. Panel research, which is longitudinal, was considered inappropriate as the research objectives necessitate data that are collected at a single point in time. Consequently, the survey method was the option selected for this study. A survey is defined as a research design where "data are collected predominantly by questionnaire or by interview on more than one case" (Bryman and Bell, 2007: 56).

Surveys are the most prevalent tool for quantitative research, require little contact with respondents, and allow for large numbers to be reached for minimal cost (Saunders *et al.*, 2003; O'Gorman and MacIntosh, 2014). In contrast with the semi-structured surveys typical of qualitative research, quantitative studies use highly structured instruments that fit responses into categories, assigned with numbers (Patton, 1990). They can have either a cross-sectional or longitudinal design (Creswell, 2003; Spector, 2019). The latter design is used to examine the changes in variables over time and involves collecting data from one sample at multiple points in time (Dooley, 2001; Saunders *et al.*, 2003). The former is the most commonly used descriptive research design (Malhotra and Grover, 1998). It can obtain a snapshot of the relationship between variables or compare factors across different organisations "at a single point in time" and does not involve any intervention as data are collected from a representative sample on only one occasion (Bryman, 2004: 41).

Cross-sectional survey research is the approach adopted for this study as it is appropriate for achieving the research objectives, can be undertaken with the study's time and resource constraints, and is consistent with the study's positivist philosophical assumptions. Indeed, the 'snapshot' of the focal phenomenon, service innovation capability maturity, that this approach can provide is fundamental to achieving the objectives of this research (Hollebeek and Rather, 2019).

2.2.2 Survey Administration Method

Surveys can be implemented through various modes that include face-to-face, telephone, postal, or online (Malhotra, 2002; Mooi and Sarstedt, 2011). Each of these options are considered in turn.

While there are advantages, such as high response rates, to collecting data through face-to-face interviews using a structured set of questions, it presents potential for interviewer bias (Duffy *et al.*, 2005). Additionally, the consequence of travelling large distances and the required research activities at all organisations sampled, are that it would be very resource intensive and require considerable time and expense (Oppenheim, 2000; Boiral *et al.*, 2019). This mode was judged to be unfeasible.

For telephone surveys, data are collected through phone interviews that are less resource intensive, but still present the potential for researchers to influence responses (Oppenheim, 2000; Redmiles *et al.*, 2017). This method was discounted for several reasons: (1) it is exclusively suited to short surveys with very simple questions (Remenyi *et al.*, 1998; Malhotra, 2002) and (2) the presence of gatekeepers and electronic voicemail systems can restrict access to appropriate informants (Braunsberger *et al.*, 2007; Blumberg *et al.*, 2008).

With postal surveys, respondents are sent questionnaires which are self-completed and then returned (Sekaran and Bougie, 2010). This minimises researcher bias, allows for extensive informant reach, and can be undertaken for a relatively low cost (Hair *et al.*, 2009). However, the major disadvantages of this approach are the low rate of response, slow collection speed, and non-response bias (Diamantopoulos and Schlegelmilch, 1996; Malhotra, 2002; Tajvidi and Karami, 2015). Ultimately, it was concluded that the disadvantages of this approach, outweighed its advantages.

Online surveys provide similar advantages to postal surveys (Evans and Mathur, 2018). Instead of being sent using the postal service, an invitation to participate in a survey is sent electronically and the respondent is linked to a webpage with an online, self-administered questionnaire (Ilieva *et al.*, 2002; Lewis and Hess, 2017). This approach was deemed to be suitable as most workers presently have access to the internet and an online survey, transmitted via email, would suit their working style (Wright, 2005; Lefever *et al.*, 2007). While the response rate can be low, and a large list of email addresses is required, this method is by far the most cost effective option available to researchers (Sheehan, 2002). It allows for the swift collection of data from substantial numbers of respondents, provides researchers with the means to reach suitable respondents in the study's sampling frame, reduces researcher bias, minimises or eliminates the problem of missing values, and is convenient to both the researcher and respondents (Dillman, 2000; Malhotra, 2002; Dolnicar *et al.*, 2009; Evans and Mathur, 2018).

For these reasons, the utilisation of an online survey was judged the most efficient and effective way to gather data from a sizeable number of relevant business persons and was selected for use in the present study (Remenyi *et al.*, 1998; Bryman and Bell, 2007). Favourably, the online survey format is well understood by this cohort, allows them to complete the survey at a time that is convenient to them, and fits in with their daily usage of email and the internet (Evans and Mathur, 2005; 2018). Moreover, employing a cross-sectional online survey results in the collection of timely data that can be easily tested for validity and reduces the data entry errors prevalent with traditional methods (Saunders *et al.*, 2003; Hair *et al.*, 2009).

However, while this approach does have many advantages, its reliance on self-reported data does present some potential problems with bias (Podsakoff and Organ, 1986). These include: (1) common method bias (CMB): where a single respondent is the source of all data; (2) consistency motif: describing the tendency of respondents to answer questions in a manner that makes them appear consistent and rational; and (3) social desirability: whereby perceived socially desirable responses are over-reported and perceived undesirable responses, under-reported (Podsakoff and Organ, 1986; Podsakoff *et al.*, 2003a; MacKenzie and Podsakoff, 2012).

MacKenzie and Podsakoff (2012: 549) are of the view that the negative impact of these biases can be diminished through the effective design of questionnaires and suggest that self-reported data are more likely to be accurate by "guaranteeing anonymity". Accordingly, for this study, it was asserted in the invitation sent to participants and reiterated on the questionnaire's cover page, that all responses would treated confidentially. To eliminate socially desirable responses to the greatest extent possible, all questions were carefully designed and attention given to their phrasing (Brannick and Roche, 1997). Respondents were informed that there were no correct or incorrect answers, providing them an assurance that a range of responses were possible to items contained in the questionnaire (Podsakoff *et al.*, 2003a).

By adhering to the above guidelines for preventing biases and integrating these measures into the design of the questionnaire, it was anticipated that bias would not negatively affect results (MacKenzie and Podsakoff, 2012).

2.3 Instrumentation

As there is no quantitative measure for a construct of service innovation capability maturity, a new instrument is developed in this study. The term 'construct' is used to describe a "phenomenon of theoretical interest" (Edwards and Bagozzi, 2000: 158) and is an abstraction that is quite literally 'constructed' by researchers attempting to describe real phenomena (Howell *et al.*, 2007b). They are used as an element of scientific discourse and become a verbal surrogate for the phenomenon in question (Petter *et al.*, 2007). A latent construct is a specific type of construct, used when phenomena of theoretical interest cannot be observed directly, and must be measured using observable items called manifest variables or indicators (Diamantopoulos *et al.*, 2008). Consequently, the score obtained for a latent construct is some function of the scores achieved for the multiple manifest variables that are used to represent its characteristics (Borsboom *et al.*, 2003; Cohen *et al.*, 2003).

2.3.1 Two Primary Classes of Construct

2.3.1.1 Constructs with Reflective Indicators

With reflective measurement models, it is assumed that a latent construct causes its measures or indicators, or in other words, that causality or meaning flows from the construct to its indicators (Bollen, 1989; Edwards and Bagozzi, 2000; Borsboom et al., 2003). The indicators are understood to be manifestations of the construct and variation in the construct is 'reflected' by corresponding changes in *all* indicators simultaneously (Rossiter, 2002; Coltman *et al.*, 2008). More simply, the indicators can be understood as dependent variables and the latent construct as an explanatory variable that produces measured effects (Diamantopoulos *et al.*, 2008; Covin and Wales, 2012). Figure 5 illustrates a reflective measurement model.

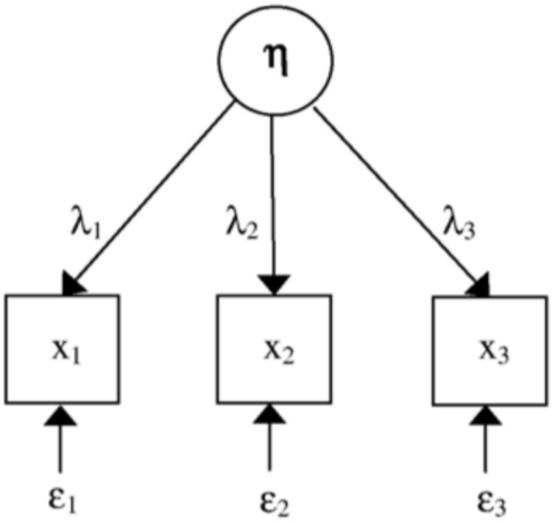

Figure 5: Path Diagram of a Reflective Measurement Model.

Source: Diamantopoulos *et al.* (2008: 1205)

Measurement models of this type are thematic, and all measures are assumed to be equally valid and interchangeable since they all reflect a single underlying latent construct (MacKenzie *et al.*, 2005). Indeed, as long as the measures deployed sample the underlying domain of the construct, the set used may be altered or any measure may be excluded without any negative impact to the construct's empirical meaning (Churchill, 1979; Jarvis *et al.*, 2003). Because all measures reflect the same underlying construct and are conceptually interchangeable, all are expected to share identical antecedents and consequences.

Constructs with reflective indicators are empirically defined by common or shared variance among measurement items (MacKenzie *et al.*, 2005). For this reason, high covariation or correlations between indicators are desired, as all reflect a common cause. Consequently, it is appropriate to use tests for internal consistency, such as Cronbach's Alpha coefficient or average variance extracted (AVE), for evaluating measurement models of this type (Bollen and Lennox, 1991; Covin and Wales, 2012).

Constructs are predominantly represented as having reflective indicators in psychological and management sciences (Bollen, 1989; Coltman *et al.*, 2008), where the use of scales for measurement has become convention (Law and Wong, 1999; Johnson *et al.*, 2012).

2.3.1.2 Constructs with Formative Indicators

When the presumed direction of causality flows from the measures to the construct, the measurement model is classified as causal-formative or formative (Bollen and Lennox, 1991; Bollen, 2011; Bollen and Diamantopoulos, 2015). With measurement models of this type, the construct is measured by its causes (Diamantopoulos and Winklhofer, 2001; Coltman et al., 2008). Therefore, any variation in the construct does not cause corresponding changes in the measures (Rossiter, 2002), but the reverse occurs, and variation in the measures cause variation in the construct (Edwards and Bagozzi, 2000). A formative measurement model is illustrated in Figure 6.

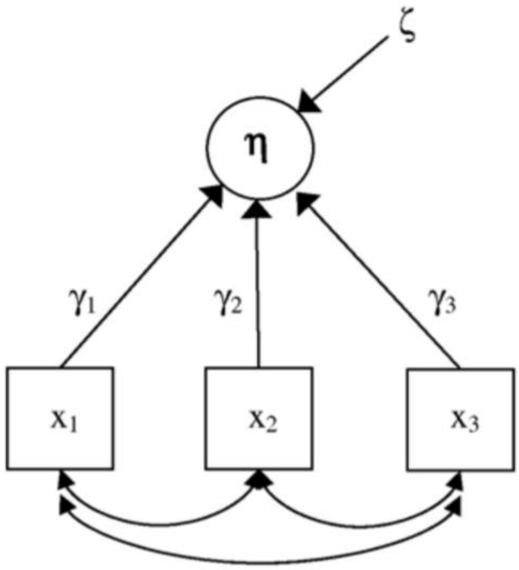

Figure 6: Path Diagram of a Formative Measurement Model.

Source: Diamantopoulos *et al.* (2008: 1205)

Formative indicators are not interchangeable, and each represents a separate, distinct, and essential aspect of a construct's conceptual domain and jointly determine its empirical meaning (Jarvis *et al.*, 2003; Covin and Wales, 2012). Indeed, constructs of this type are empirically defined by the total variance of their indicators which can only capture this meaning as a group (MacKenzie *et al.*, 2005). Consequently, the objective of researchers using this class of construct is to include indicators that cover *all* of the construct's defining aspects (MacKenzie *et al.*, 2011). Any changes or omissions to the construct's indicators can have a negative impact by altering the empirical meaning of the latent variable they are used to measure (Bollen and Lennox, 1991; Bollen and Diamantopoulos, 2015).

As the indicators are unique and not interchangeable, they are not expected to have the same antecedents and consequences (Jarvis *et al.*, 2003). Correlation or covariation between these measures is not assumed or required and may be positive, negative, or absent (Diamantopoulos *et al.*, 2008). Therefore, tests for internal consistency reliability (i.e. Cronbach's Alpha) are unsuitable for evaluating the adequacy of formative measures and this must be assessed using alternative methods (Bollen and Lennox, 1991; Coltman *et al.*, 2008; MacKenzie *et al.*, 2011).

Unlike indicators in reflective measurement models, formative indicators do not have measurement error terms (Diamantopoulos, 2006). Error variance is represented only by the disturbance term (ζ), related to the prediction of the latent construct, which captures the variance or impact of all remaining causes not explained by the formative indicators (Diamantopoulos, 1999).

The formative treatment of indicators and use of indexes for measurement occurs only infrequently in the social sciences in comparison to the use of scales (Jarvis et al., 2003; Diamantopoulos et al., 2008).

2.3.1.3 Class of Construct Used for the Study

The decision regarding whether a scale or index should be utilised for the measurement of a construct should be theoretically driven and based on the researcher's objectives for the instrument (Edwards and Bagozzi, 2000; Diamantopoulos and Winklhofer, 2001; Diamantopoulos and Siguaw, 2006; Coltman *et al.*, 2008; MacKenzie *et al.*, 2011). Constructs are not inherently reflective or formative and there are both benefits and limitations to both classes of measurement model (Ellwart and Konradt, 2011). To support researchers seeking to confirm the suitability of a study's representation of the relationship between a latent construct and its indicators, methodologists have proposed several criteria. These examine the direction of causality, interchangeability of indicators, covariance between indicators, and whether their antecedents or consequences are shared (Jarvis *et al.*, 2003; MacKenzie *et al.*, 2005).

To address deficiencies with existing SIC measures and provide support to practitioners, this study develops a measure of a SIC construct with formative indicators. The purpose of representing the construct in this way is twofold. First, developing a formative index allows all conceptually necessary indicators of SIC to be included in the measure (Diamantopoulos and Winklhofer, 2001). This is because the index construction procedure (MacKenzie *et al.*, 2011) differs from that for scale development (Churchill, 1979) and, while indicators of conceptually necessary aspects of SIC could be eliminated during scale purification for failing to display internal consistency with others (Rossiter, 2002; DeVellis, 2017), this would not occur with the former approach (Diamantopoulos *et al.*, 2008; Molina-Castillo *et al.*, 2013). Formative indicators of SIC could correlate positively, negatively, or not at all, and as a result, items representing conceptually necessary aspects of this phenomenon would not be eliminated for empirical reasons, resulting in a complete picture of SIC and comprehensive theoretical insights into this phenomenon (Podsakoff *et al.*, 2003a; Coltman *et al.*, 2008). Second, by representing SIC as a formative construct, one that is measured by its causes, its indicators can be regarded as levers for controlling the performance of this capability (Mahr *et al.*, 2014; Allais *et al.*, 2017). As a result, representing the construct in this way provides the foundation for a useful diagnostic that is of immediate practical relevance as the indicators can be made sense of by managers operationally to enhance their organisation's performance (Cadogan *et al.*, 2008; Bollen and Diamantopoulos, 2015).

Since a formative measurement model has been chosen to represent SIC and its indicators, an index construction procedure is used to develop a measure of this construct (Diamantopoulos and Siguaw, 2006; MacKenzie et al., 2011).

2.3.2 Structural Equation Modelling

The analysis of this study's formative measure of service innovation capability maturity will be undertaken using structural equation modelling (SEM) (Diamantopoulos and Winklhofer, 2001; Martínez-López *et al.*, 2013). SEM is recognised internationally by management researchers as the discipline's most sophisticated and powerful analysis tool (Hair *et al.*, 2016; Richter *et al.*, 2016). This versatile multivariate data analysis method is also referred to as latent variable analysis (Oh *et al.*, 2004) and can test hypothesised relationships between observed and unobserved variables (Shook *et al.*, 2004; Schreiber *et al.*, 2006; Lei and Wu, 2007) through a combination of factor analysis and multiple regression (Anderson and Gerbing, 1988; Westland, 2010; Henseler, 2017).

SEM techniques are divided into two families, component-based SEM (e.g. Partial Least Squares or PLS-SEM) and covariance-based SEM (CB-SEM) (Henseler *et al.*, 2009). The focus of the former technique is to maximise explained variance for all outcome variables through a series of regressions (Reinartz *et al.*, 2009). It is regarded as an exploratory technique and primarily employed for predictive purposes (Hair *et al.*, 2013). Several features of this approach make it attractive to researchers employing formatively measured constructs (Cenfetelli and Bassellier, 2009). It can be used when distributions are skewed, when sample sizes are small, and does not require the scale of measurement to be set or other conditions to be fulfilled to ensure all model parameters are identified (Fornell and Bookstein, 1982; Hwang *et al.*, 2010; Diamantopoulos, 2011; MacKenzie *et al.*, 2011). However, with PLS-SEM it is assumed that formative indicators fully explain the focal construct, meaning that construct level error terms cannot be calculated (Diamantopoulos, 2011), and the approach lacks "a global scalar function" for overall models (Henseler and Sarstedt, 2013: 566), resulting in significant confusion regarding the assessment of model fit (Hair *et al.*, 2011; Henseler *et al.*, 2016). The most popular PLS-SEM software, SmartPLS (SmartPLS, 2019b), facilitates only the assessment of standardised root mean square residual (SRMR); the exact fit criteria, unweighted least squares discrepancy (d_ULS) and geodesic discrepancy (d_G); normed fit index (NFI); chi-square (χ^2); and root mean square error correlation (RMS_{theta}) (SmartPLS, 2019a).

CB-SEM techniques estimate path coefficients and loadings by "minimising the difference between observed and predicted variance-covariance matrices" (Hsu *et al.*, 2006: 357). This approach is generally used for model validation, or confirming theoretically assumed relationships (Tenenhaus, 2008), and provides diagnostics, such as modification indices, that are not available in PLS software (Diamantopoulos, 2011). It outperforms component-based SEM with regard to parameter consistency and accuracy, but requires approximately normally distributed data and large sample sizes (Reinartz *et al.*, 2009). As the analyses facilitated by this technique enable the estimation of all required values for the construction of new indexes, including, recommended goodness-of-fit statistics (χ^2, comparative fit index [CFI], root mean square error of approximation [RMSEA], and SRMR) (MacKenzie *et al.*, 2011), the R^2 statistic, and those for path coefficients between measured constructs (Law *et al.*, 1998; Schermelleh-Engel *et al.*, 2003), it was selected for use in the validation of the study's focal measure. Indeed, Diamantopoulos (2011: 354) suggests that "researchers would be well-advised to adopt… [CB-SEM] procedures for measure *development* purposes (i.e., when a new formative measure is being constructed for a given construct)".

When utilising SEM, two conceptually distinct models must be specified that consider different aspects of the relationships among variables (Anderson and Gerbing, 1982; Weston and Gore Jr, 2006). The first is the measurement model which depicts the relationship between latent constructs and their indicators, observed or manifest variables (Diamantopoulos *et al.*, 2008). The second is the structural model, which specifies their hypothesised relationships with other unobserved or latent constructs (Shah and Goldstein, 2006; Ullman, 2006).

Convention when drawing SEM diagrams dictates that measured variables, otherwise referred to as observed or manifest variables, should be represented using squares or rectangles (Byrne, 2013). Latent constructs or unobserved variables are depicted graphically with large circles or ovals (Schreiber *et al.*, 2006). Unique factors such as measurement error or disturbance, are represented by small circles or ovals that point to a variable. The relationships between variables are represented using lines with arrows on one or both ends. A line with one arrow is used to represent a hypothesised direct relationship between two variables (either latent or observed), where the variable to which the arrow points is the dependent variable (Ullman, 2006). This is referred to as a path. A line with arrows at both ends represents covariance, or a relationship hypothesised between variables without a direction of effect being defined (Weston and Gore Jr, 2006).

Two important terms that are associated with SEM variables are *exogenous*, referring to source variables similar to independent variables, and *endogenous*, that are result variables and similar to dependent or outcome variables (Lei and Wu, 2007). It is possible for a single variable to be both (Schreiber *et al.*, 2006).

Figure 7 depicts a basic SEM diagram where Factors 1 and 2 are reflectively measured with the items labelled y1-6. D1 and D2 represent the disturbance or construct-level error term, while e1-6 is the measurement error associated with each measurement item.

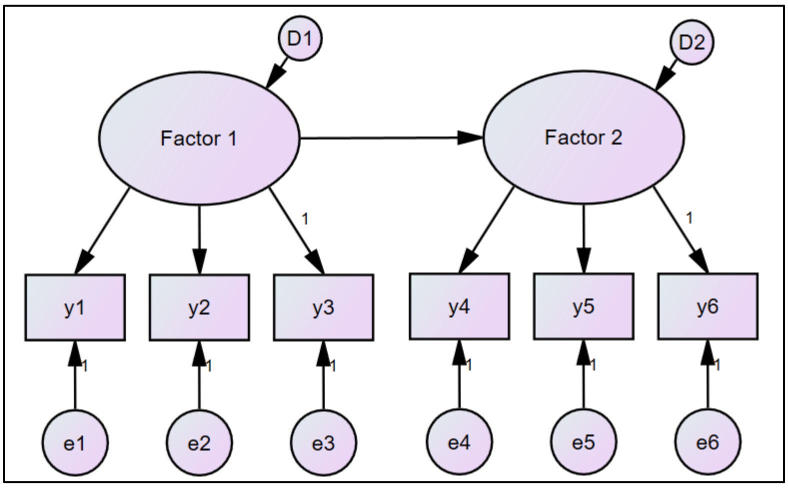

Figure 7: Basic SEM Diagram.

2.3.3 Overview of Best Practice Procedure for Index Construction

To support the construction of an index to measure service innovation capability maturity, an incremental sequence of best practice steps was synthesised (See Figure 8). These were largely based on guidelines proposed by MacKenzie *et al.* (2011), but included key recommendations proposed by other methodologists (Churchill, 1979; Gerbing and Anderson, 1988; Hinkin *et al.*, 1997; Diamantopoulos and Winklhofer, 2001; Rossiter, 2002; DeVellis, 2017). Importantly, the procedure incorporates all recommended activities for two-step SEM analysis (Anderson and Gerbing, 1988). An overview of this procedure now follows.

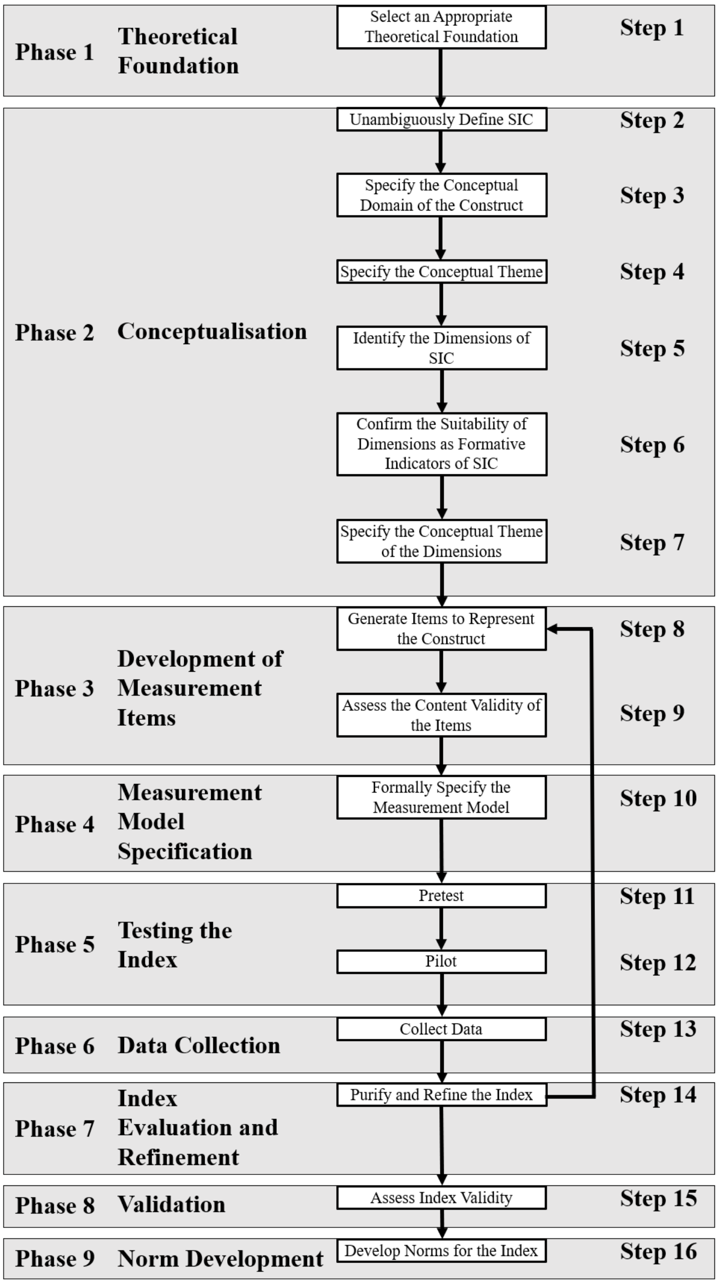

Figure 8: Best Practice Steps for Index Construction.

Adapted from MacKenzie *et al.* (2011)

<u>Phase 1 – Theoretical Foundation</u>

The selection of an appropriate theoretical perspective by researchers is fundamental to the quality of new measures (Ramirez-Portilla, 2015). The objective of this phase is to select a suitable paradigm to guide the research, assist with specifying the relationships among variables, and with the interpretation of results (Kembro *et al.*, 2014).

Step 1: Select an Appropriate Theoretical Foundation: The first step in developing an index to measure a phenomenon, is to evaluate the many possible theoretical options and select a suitable foundation for the research (Williams and Ecker, 2011). This decision is critical as it will provide a set of assumptions to the researcher that will have implications for every subsequent decision (Ramirez-Portilla, 2015).

<u>Phase 2 – Conceptualisation</u>

The aim of the second phase is to define the construct's conceptual domain (Lewis *et al.*, 2005; DeVellis, 2017). This eliminates ambiguity by specifying what the construct intends to measure and its differences from other constructs (MacKenzie, 2003; Wong *et al.*, 2008). For this study of service innovation capability, a clear description of SIC and its characteristics at various stages of maturity is required, in addition to those of its dimensions.

Step 2: Unambiguously Define SIC: Following an examination of how the focal construct has been defined or conceptualised in prior research, a clear and concise definition is written (Clark and Watson, 1995). This step must be completed using only language that is not overly technical or that can be subject to multiple interpretations (MacKenzie et al., 2011). Furthermore, it is recommended to avoid tautology in the definition and make certain that it positively describes the construct, rather than exclusively through explanations of what it is not, or its antecedents or consequences (Howell et al., 2007b).

Step 3: Specify the Conceptual Domain of the Construct: The conceptual domain of a construct refers to the property or attribute represented by the construct and the entity or object to which it applies (Diamantopoulos and Winklhofer, 2001). As both can refer to many things, researchers are strongly urged to provide clarity (MacKenzie *et al.*, 2011).

Step 4: Specify the Conceptual Theme: The conceptual theme describes the fundamental attributes or characteristics of a construct which are necessary and sufficient for an entity to possess in order to represent an archetype of that construct (MacKenzie et al., 2011). To fulfil this step, common and unique characteristics of SIC must be established (Podsakoff *et al.*, 2016).

Step 5: Identify the Dimensions of SIC: For this step, consideration is given to whether SIC has multiple conceptually distinguishable facets, or dimensions, and how these relate to each other and the focal construct (MacKenzie *et al.*, 2011).

Step 6: Confirm the Suitability of Dimensions as Formative Indicators of SIC: The objective of this step is to confirm that any identified dimensions can be accurately represented by formative indicators. To verify that an appropriate 'relational form' has been employed (Wong et al., 2008), the dimensions must be examined against criteria for both of the primary classes of relational direction (Jarvis et al., 2003). Additionally, the structure of this relationship must be clarified, and details provided of the manner in which the combination of indicators of dimensions give meaning to the construct (Edwards and Bagozzi, 2000; Polites et al., 2012).

Step 7: Specify the Conceptual Theme of the Dimensions: The conceptual theme of an examined object refers to its fundamental attributes or characteristics (MacKenzie *et al.*, 2011). This step in the development of the study's index, requires the development of descriptions of each of the dimensions at each level of maturity to illustrate their evolutionary path from ad hoc and immature execution to that which is more disciplined and mature (Maier *et al.*, 2012).

Phase 3 – Development of Measurement Items

The purpose of this phase is to generate a content valid set of indicators that cover the entire scope of the construct's conceptual meaning (Diamantopoulos and Winklhofer, 2001).

Step 8: Generate Items to Represent the Construct: A set of quasi-interval items is produced that capture all aspects of the construct essential to its conceptual meaning

(Diamantopoulos and Winklhofer, 2001). They must be written so as to be clear and comprehensible to respondents (Nederhof, 1985; Haynes et al., 1995; Podsakoff et al., 2003a; MacKenzie et al., 2011; DeVellis, 2017).

Step 9: Assess the Content Validity of the Items: To establish the content validity of measurement items, an assessment is required to confirm that they measure what was intended and fully capture the conceptual domain of the construct (Anderson and Gerbing, 1991; Schriesheim et al., 1993; Hinkin and Tracey, 1999; Schriesheim et al., 1999; Lewis et al., 2005).

Phase 4 – Measurement Model Specification

The objective of this phase is to specify the expected relationships between the indicators and the focal construct (MacCallum and Browne, 1993).

Step 10: Formally Specify the Measurement Model: For this step, the expected relationships between all observed and latent variables are specified (Diamantopoulos and Winklhofer, 2001; MacKenzie et al., 2011). With formative measurement models, this is complicated by the requirement for certain conditions to be met in order to obtain estimates for all model parameters (Heise, 1972; Edwards, 2011).

Phase 5 – Testing the Index

Prior to the study's main survey, feedback is obtained from a review panel (Rossiter, 2002) in order to locate any weaknesses or ambiguities in the questionnaire and apply corrections (Cannell *et al.*, 1989). The questionnaire is then tested under realistic conditions (Bryman, 2004).

Step 11: Pretest: To confirm the adequacy of the questionnaire, feedback is obtained from expert academics and practitioners representative of the target population (Anderson and Gerbing, 1991), allowing any issues to be identified and resolved (Easterby-Smith *et al.*, 2002).

Step 12: Pilot: In order to test a measure and identify possible problems, a pilot study is recommended using a sample representative of the target population (Straub, 1989;

Litwin, 2003; Saunders et al., 2003). This allows any issues to be corrected prior to a large-scale study (Anderson and Gerbing, 1991).

Phase 6 – Data Collection

For this phase, a sufficiently large sample of data are collected to evaluate the psychometric qualities of the measure (Hinkin et al., 1997; Diamantopoulos and Winklhofer, 2001).

Step 13: Collect Data: During this step, a large sample of data are collected. Details are provided of the composition of the questionnaire, administration of the survey, of response rates, activities undertaken to prepare data for analysis, and a profile of respondents is reported.

Phase 7 – Index Evaluation and Refinement

Once quantitative data have been obtained, a newly developed measure must be evaluated, and decisions made regarding its purification through the omission of items (Hinkin *et al.*, 1997; Diamantopoulos and Winklhofer, 2001).

Step 14: Purify and Refine the Index: To determine whether items should be omitted from a newly developed index, an evaluation is required of the goodness of fit of the measurement model (Steiger, 1990; Hu and Bentler, 1999), the predictive power of the indicators (Williams et al., 2003; Diamantopoulos et al., 2008), and confirmation that all indicators make a unique and significant contribution to the construct (Bollen, 1989; Diamantopoulos et al., 2008).

Phase 8 – Validation

The purpose of this phase is to confirm that the focal construct is accurately represented by its underlying indicators, or that index items behave as anticipated if they were valid indicators of SIC (MacKenzie et al., 2011).

Step 15: Assess Index Validity: The validity of the index at the construct level is ascertained through examinations of known groups validity (Cronbach and Meehl, 1955), nomological validity (Diamantopoulos and Winklhofer, 2001; Giovanis, 2013; Park et al., 2017), and discriminant validity (Andreev et al., 2009; Witemeyer, 2013).

Phase 9 – Norm Development

For the final phase, normative values for the index are calculated and reported to provide a frame of reference and aid users in the interpretation of their scores (Spector, 1992; Urbina, 2014).

Step 16: Develop Norms for the Index: To assist users of the index with comprehension of their maturity scores, values for means, standard deviation, and the overall distribution of sample scores are reported.

2.4 Chapter Conclusion

This chapter has provided a philosophical and methodological overview of the current study. It detailed the rationale for the selection of an objectivist, positivist philosophy and the resultant nomothetic methodology, employing a cross-sectional online survey. These choices originated with the research objectives and were favoured for their suitability for satisfactorily achieving them (Bryman and Bell, 2007).

Following this, the two primary classes of construct were summarised and the psychometric and conceptual differences between them were outlined (Bollen and Lennox, 1991; Helm, 2005; Diamantopoulos and Siguaw, 2006). As the study aims to construct and validate a novel formative measure of service innovation capability maturity, a best practice procedure synthesised to support this activity was synopsised (Churchill, 1979; Gerbing and Anderson, 1988; Hinkin *et al.*, 1997; Diamantopoulos and Winklhofer, 2001; Rossiter, 2002; MacKenzie *et al.*, 2011; DeVellis, 2017).

Chapter 3: Theoretical Foundation

3.1 Introduction

This chapter relates to the first phase in the index construction procedure, Theoretical Foundation. Its location in the context of the thesis and in relation to other phases in the procedure is illustrated in Table 5. The purpose of the chapter is to elaborate on the selection of this study's underlying theoretical approach and justify its suitability.

Chapter	Phase	Step
3. Theoretical Foundation	**1. Theoretical Foundation**	**1. Select an Appropriate Theoretical Foundation**
4. Conceptualisation of Service Innovation Capability Maturity	2. Conceptualisation	2. Unambiguously Define SIC
		3. Specify the Conceptual Domain of the Construct
		4. Specify the Conceptual Theme
		5. Identify the Dimensions of SIC
		6. Confirm the Suitability of Dimensions as Formative Indicators of SIC
		7. Specify the Conceptual Theme of the Dimensions
5. Measurement	3. Development of Measurement Items	8. Generate Items to Represent the Construct
		9. Assess the Content Validity of the Items
	4. Measurement Model Specification	10. Formally Specify the Measurement Model
6. Data Collection	5. Testing the Index	11. Pretest
		12. Pilot
	6. Data Collection	13. Collect Data
7. Data Analysis	7. Index Evaluation and Refinement	14. Purify and Refine the Index
	8. Validation	15. Assess Index Validity
	9. Norm Development	16. Develop Norms for the Index

Table 5: Location of Current Index Construction Phase in Thesis.

3.2 Phase 1 - Theoretical Foundation

The choice of theoretical perspective is fundamental to good quality research and measure development and has implications for every decision made during the process (Ramirez-Portilla, 2015). For Kembro *et al.* (2014: 609) it enhances "description, explanation, and predictions of complex phenomena". In essence, it provides a set of assumptions that specify the relationships between variables, direct observations, and assist with interpreting results (Ramirez-Portilla, 2015). However, because social science research is so heterogeneous in nature, there are a range of theoretical approaches available to study a given phenomenon (Williams and Ecker, 2011). Accordingly, the purpose of the initial phase in the index construction procedure is to review a sample of the theoretical paradigms that could be used to gain insights into the maturation of service innovation capability and its dimensions.

3.2.1 Step 1: Select an Appropriate Theoretical Foundation

The purpose of this step is to explore the numerous theoretical perspectives that could be applied to this study and select an appropriate option.

For instance, this study could adopt Resource Dependence Theory (RDT) to explain service innovation capability as this theory's general approach attempts to explain behaviour and change in organisations (Kembro *et al.*, 2014). It describes performance and the activities of organisational systems as the result of varying relationships of dependency between actors seeking critical resources and those who control them (Pfeffer and Salancik, 1978; Pfeffer and Salancik, 2003). Favourably, RDT accounts for both resource use and an organisation's external environment (Reitz, 1979; Williams and Ecker, 2011). However, it does have several shortcomings, it is described as an 'essay theory' and implies no causal propositions; power, or its equivalent, dependency, are the primary mechanisms used to explain behaviour; it overlooks internal resources as a source of competitive advantage; and has little prescriptive power in contrast with theories that have emerged from strategic management (Nienhüser, 2008; Fraczkiewicz-Wronka and Szymaniec, 2012). As the purpose of this study is to understand internal capabilities that enable organisations to generate service innovations, it is consequently deemed to be unsuitable.

Next, the functional approach has been formerly used in the study of innovation capability, meaning that there is a precedent (Panda and Ramanathan, 1997). It portrays innovation capability as occurring through complex interactions within and between the functional departments of an organisation (Chatha and Jajja, 2015). Its central contention is that each characteristic linked to innovation success, referred to as a capability, represents a separate function of the organisation, including research and development (R&D), strategic planning, marketing, and manufacturing (Yam *et al.*, 2004). It is described as easy to understand in contrast with other approaches and allows for multiple informants when collecting survey data (Yam *et al.*, 2011). However, this approach has many weaknesses. It is used infrequently and has been applied only in a few studies, primarily within developing economies; learning capability is not assigned to an organisational function and considered separately; and the overlap between functional departments is not sufficiently accounted for (Guan and Ma, 2003; Yam *et al.*, 2004). While acknowledging that this perspective has provided a foundation for earlier studies, in this case it is considered to be too simplistic to explain service innovation capability through its dimensions which are understood to be diffused throughout an organisation, rather than present only in a single organisational function.

Evolutionism is a branch of evolutionary theory which emerged from economics and is used to explain change over time; or why a phenomenon behaves as it does at a certain moment in time, using dynamic analysis (Nelson and Winter, 1982; Dosi and Nelson, 1994). Although there are a range of heterogeneous theories considered ‘evolutionary’, their core concepts are predominantly derived from Darwinian selection models and they are linked by three central threads (Iwai, 2000). Specifically, these theories describe processes through which organisations identify activities that generate diversity or distinguish them from others, selective mechanisms that choose those that produce the best results, and consequently the transmission of their desirable characteristics (Eparvier, 2005). Rather than perceiving innovation as an isolated and separate act, this perspective views it as a complex process of organisational learning throughout all functional areas which are subject to production decisions and changes in the organisation’s environment (Martínez-Román *et al.*, 2011). Advantageously to the objectives of this study, it accounts for the external environment, organisational characteristics of innovation, and includes non-technological innovations (Sher and Yang, 2005; Martínez-Román *et al.*, 2011). However, evolutionism also presents several serious deficiencies. Its focus lies predominantly on industry or market level changes and it is intrinsically difficult to measure empirically. Consequently, this theoretical perspective is unable to contribute to an organisational level assessment of SME service innovation capability maturity and can provide no useful managerial guidelines for its enhancement (Iwai, 2000). As it cannot be utilised to achieve the objectives of this study, it is excluded from selection.

The resource-based view (RBV) is a theoretical lens used to understand the heterogeneity in firm performance by considering the competitive advantages organisations create as rooted in their resources (Barney, 1991; Barney and Arikan, 2001; Menor and Roth, 2008). It depicts firms as bundles of resources, including all tangible and intangible assets, processes, information, and knowledge which can be used to improve their efficiency and effectiveness (Barney and Clark, 2007). By considering resources as the origin of competitive advantage, the RBV brings a systematic approach to firm-level analysis (Lawson and Samson, 2001; Wang and Ahmed, 2007; Sigalas, 2015). Resources are said to be heterogeneously dispersed and imperfectly mobile, but must be valuable, rare, inimitable, and non-substitutable, often referred to as 'VRIN' criteria (Barney, 2001; Wang and Ahmed, 2007; Ambrosini *et al.*, 2009; Den Hertog *et al.*, 2010).

Opportunely, the RBV has been used previously in the study of innovation, considering the creation of new resources and resource combinations (Mathews, 2002), mobilisation of resources to solve problems (Nielsen, 2012), or the management of resources to efficiently organise innovation processes (Mothe and Thi, 2010). However, in recent years the resource-based view has been in decline (Helfat and Peteraf, 2003; Kaufman, 2015). From the theory it is unclear how, in dynamic markets, firms can achieve sustainable competitive advantage over time through certain resource attributes or configurations (Achtenhagen and Naldi, 2004; Sirmon *et al.*, 2007). As a result, the RBV is characterised as static, overlooking the evolution of firms and market dynamism, and ultimately providing an insufficient explanation for performance (Wang and Ahmed, 2007; Kindström *et al.*, 2013). For these reasons, it is excluded from consideration for this study and attention is instead given to its successor, the dynamic capabilities view, which claims to address these weaknesses.

The dynamic capabilities view (DCV) provides a solid foundation and has prior scholarly acceptance as a theoretical basis for the study of service innovation capability (Pöppelbuß *et al.*, 2011; Sajib and Agarwal, 2012; Stryja *et al.*, 2013; Nada and Ali, 2015). It depicts an organisation as a bundle of capabilities which allow them to achieve their objectives by managing and deploying resources through repeatable patterns (Teece, 2009). These capabilities belong to two classes. Operational capabilities are used to perform routine tasks and are modified by higher-order dynamic capabilities to respond to evolving customer demands or changes in the market (Zollo and Winter, 2002; Helfat *et al.*, 2007). Importantly, the DCV perfectly complements the study of service innovation capability, enabling the examination of activities that are embedded in organisational processes and routines and diffused throughout an organisation (Janssen *et al.*, 2012).

Although this study could have adopted several theoretical perspectives, the DCV was deemed the most appropriate lens to provide unique insights into the complex phenomenon that is service innovation capability. The application of this theory extends and enhances dynamic capabilities too, addressing the paucity of measurement in this area by determining the maturity of a specific dynamic capability. The remainder of the chapter is structured as follows. The subsequent sections will elaborate on the concepts of resources and capabilities and examine dynamic capabilities theory in more detail. Following this, the application of dynamic capabilities theory to this study will be discussed.

3.2.1.1 Resources and Capabilities

This section clarifies the terms ‘resources’ and ‘capabilities’, both of which are fundamental to comprehension of this work.

To Lai (2004), resources are assets owned or controlled by a firm. Mathews (2002) describes firm resources as the means with which inputs are transformed into outputs. Helfat and Peteraf (2003: 999) consider a resource to be “an asset or input to production (tangible or intangible) that an organisation owns, controls, or has access to on a semi-permanent basis". Kostopoulos *et al.* (2002) likewise understand resources as tangible or intangible assets that are semi-permanently tied to a firm. Grawe *et al.* (2009) consider them tangible or intangible assets, processes, skills, or knowledge that a firm can use to implement strategies that improve their efficiencies or effectiveness, while Menor and Roth (2008: 269) similarly describe them as "all tangible and intangible assets, including organisational and operational processes, information, [and] knowledge, that enable the firm to formulate and implement strategies".

Some authors (Peteraf, 1993; Barney and Arikan, 2001) have defined resources so broadly that they serve as an umbrella term which includes capabilities, processes, organisational attributes, and knowledge (Pöppelbuß *et al.*, 2011). This contrasts directly with research by Giannopoulou *et al.* (2011) and others (Ethiraj *et al.*, 2005) who disagree, arguing that resources are distinct from these other terms. However, while there remains some divide among authors as to whether resources and capabilities are distinct, there is agreement that resources can be either tangible or intangible as long they are semi-permanently tied to a firm (Ethiraj *et al.*, 2005; Helfat *et al.*, 2007; Vicente *et al.*, 2013). Consequently, they can be physical, reputational, legal, human, informational, organisational, financial, intellectual, technological, or relational (Mahoney and Pandian, 1992; Bakar and Ahmad, 2010; Daugherty *et al.*, 2011).

While acknowledging the importance of assets and resources, Day (1994) and Hogan *et al.* (2011) agree that they can only be a source of competitive advantage if they are combined, developed, or transformed through capabilities and create value for customers. Similarly, Menguc *et al.* (2014: 314) describe capabilities as "the ability to deploy resources or transfer input into desirable output" and affirm that they drive performance. This corresponds with the view of Helfat and Peteraf (2003: 999) who maintain that a capability is "the ability of an organisation to perform a coordinated set of tasks, utilising organisational resources, for the purpose of achieving a particular end result".

Hooley *et al.* (1998), Winter (2000), Giannopoulou *et al.* (2011), Storey and Hughes (2013), and Snyder (2013) all agree with this notion of ability and coordination, and view capabilities as high-level routines or processes, essentially repeatable series of actions, which deploy an organisation's resources to produce outputs of a particular type, or in other words, how activities are accomplished using resources (Kelliher and Reinl, 2009). Likewise, Vicente *et al.* (2013: 241) understand capabilities as "complex coordinated patterns of skills and knowledge… embedded as organisational routines and practices", but they contend that capabilities enable firms to make the best possible use of their scarce resources.

Because they are 'close to the action' it is difficult to separate capabilities from other activities (Giannopoulou *et al.*, 2011), with Felin and Foss (2009) observing that there is a tendency to pack so much into the definition of routines and capabilities that they effectively become the organisation itself. Nevertheless, despite some divergence in the scholarly understanding of capabilities, consensus is that they repeatedly deploy resources to achieve desired or intended outcomes; are embedded in an organisation's routines or processes, but are distinct from them; evolve over time; and are difficult to imitate or acquire (Lai, 2004; Ethiraj *et al.*, 2005; Loasby, 2006; Börjesson and Elmquist, 2011; Daugherty *et al.*, 2011; Felin *et al.*, 2012). Accordingly, the talents or abilities of individuals or singular successes do not mean that a capability is present as they exclusively relate to repeatable and reliable practices over time (Storey and Hughes, 2013).

Markedly, within capabilities, it is understood that there are different classes or categories, which include operational, or substantive capabilities, and dynamic capabilities, which are elaborated on in the following section (Helfat *et al.*, 2007; Barreto, 2010).

3.2.1.2 Dynamic Capabilities

The origins of the dynamic capabilities view (DCV) can be traced back to the early 1990s when researchers in strategic management began addressing the failings of the RBV (Teece and Pisano, 1994; Teece *et al.*, 1997). Their motivation arose as a result of rapid changes in technology and markets, where stable configurations of resources could not guarantee long-term or sustainable competitive advantage, and presented the requirement for an updated theory which could account for these external changes (Pöppelbuß *et al.*, 2011; Janssen *et al.*, 2012). Agreeing with this narrative, Wang and Ahmed (2007: 32) too ascribe the emergence of the DCV to the objective of enhancing the RBV and adequately encapsulating the "evolutionary nature of resources and capabilities".

Since its introduction, the DCV has evolved in a stream parallel to the RBV through the cross fertilisation of ideas and combinations of the two theories (Helfat and Peteraf, 2003; Lin and Wu, 2014). In many ways it is most appropriately thought of as an addition, rather than a total departure from the RBV, that explains an organisation's economic performance through their resources and capabilities and their capacity to reconfigure both (Janssen, 2011). While resources are thought to be important in static markets where there is little change, capabilities are regarded as necessary for performance in dynamic markets with a higher velocity of change (Eriksson, 2014). However, some authors (Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Ambrosini *et al.*, 2009) argue that dynamic capabilities make a contribution to competitive advantage even in markets that fluctuate with a modest velocity. Teece and Pisano (1994) and Winter (2003) clarify that use of the locution 'dynamic' is with specific reference to the shifting character of the environment.

As a consequence of being built on the RBV, the DCV is likewise considered a theoretical exploration of variance in firm performance over time (Mort and Weerawardena, 2006). However, in contrast to the formers' exclusive focus on combinations of a firm's internal resources, the DCV attributes competitive advantage to the ability to renew and reconfigure ordinary, or operational capabilities to respond to unpredictable environmental changes (Eisenhardt and Martin, 2000; Wang and Ahmed, 2007; Pavlou and El Sawy, 2011). Dynamic capabilities manifest themselves in patterns of an organisation's behaviour which can be invoked on a repeated basis (Teece, 2007; Janssen *et al.*, 2012). The DCV's emphases on change and strategic management mean that it is a useful addition to the strategic analysis toolkit (Teece *et al.*, 1997; Winter, 2003).

Inherent within this theory is the assumption of a hierarchy of organisational capabilities, of which dynamic capabilities constitute the highest level (Collis, 1994; Sune and Gibb, 2015). The prevailing view of scholars is that there are two strata (Teece *et al.*, 1997; Helfat and Peteraf, 2003; Winter, 2003; Cepeda and Vera, 2007; Breznik and Hisrich, 2014), where dynamic capabilities affect output by influencing an organisation's operational capabilities. This lower class of capabilities are also known as ordinary capabilities (Drnevich and Kriauciunas, 2011), 'zero order' capabilities (Winter, 2003), or substantive capabilities (Zahra *et al.*, 2006) and 'make a living' for an organisation by executing the routine business activities that underlie their daily operations (Gebauer, 2011; Pavlou and El Sawy, 2011; Felin *et al.*, 2012).

Other academics contend that there are additional levels to this hierarchy that ought to be discriminated (Eisenhardt and Martin, 2000; Agarwal and Selen, 2009). From the perspective of Wang and Ahmed (2007) there are four, with dynamic capabilities (DCs) positioned at the top. The 'zero order' encompasses resources that are required to deliver static competitive advantage when the VRIN criteria are met. Above these are 'first-order', routine competencies that restructure the resource base to deliver value through the production of a product or service. Higher still, are 'second-order', 'core capabilities', which are bundles of resources and capabilities that are of strategic importance to a 'certain point' but can become stagnant due to market changes. At the highest level, the authors propose the presence of dynamic capabilities, or 'third-order' capabilities, that allow an organisation to respond to their environment by renewing and reconfiguring capabilities lower in the hierarchy (Wang and Ahmed, 2007). Despite the merits of this more granular depiction of DCs, this study follows the more generally accepted two-level view that solely discerns 'zero-order' operational capabilities and 'first-order' dynamic capabilities (Helfat *et al.*, 2007; Teece, 2009).

Dynamic capabilities are defined periodically. Teece *et al.* (1997: 516) delineate the term as a "firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments". Zollo and Winter (2002: 340) describe them as "a learned or stable pattern of collective activity through which the organisation systematically generates and modifies its operating routines in pursuit of improved effectiveness". Weerawardena and Mavondo (2011) explain dynamic capabilities as those which allow organisations to sense opportunities and threats and respond to them by recombining or reconfiguring tangible or intangible assets. Kurtmollaiev (2014: 5) specify them as "the organisational capacity to purposefully create and manipulate its resource base" and as a source of competitive advantage.

Wang and Ahmed (2007: 35) explain dynamic capabilities as "a firm's behavioural orientation constantly to integrate, reconfigure, renew, and recreate its resources and capabilities… in response to the changing environment". Eriksson (2014: 2) understands them as an organisation's capacity "to purposefully create, extend, or modify its resource and capability bases to address changes in its environment". Unanimously, these definitions accentuate the role of dynamic capabilities as repeated patterns of behaviour that can be invoked when necessary to alter lower-order capabilities (Sirmon *et al.*, 2007).

There is some debate surrounding what constitutes a dynamic capability (Maritan and Peteraf, 2007). For some they are processes and behavioural patterns (Zollo and Winter, 2002), while for others they are strategic higher-order change capabilities (Prieto *et al.*, 2009). Kindström *et al.* (2013) understand them as routines in managerial or organisational processes that gain, release, integrate, and reconfigure resources; and Wang and Ahmed (2007) clarify further explaining that dynamic capabilities are not processes or routines, but are embedded within them. The implication of which is that it cannot be accurately stated that a process *is* a dynamic capability, but that it must instead be said that "this process or these processes contain or constitute a dynamic capability" (Janssen *et al.*, 2012: 4). Here the term 'processes' is used in its most general sense, referring to their primary function of "changing the firm's resource base" (Breznik and Hisrich, 2014: 371).

Additionally, there is an ongoing debate about the causal relationship between dynamic capabilities and firm performance, with Janssen (2011) suggesting that DCs are directed towards long-term survival, rather than performance at a specific moment in time. Some authors perceive dynamic capabilities as a direct source of competitive advantage (Teece *et al.*, 1997), some as a source of improved effectiveness (Zollo and

Winter, 2002), while it is suggested by others that they do not necessarily lead to improved performance at all (Eisenhardt and Martin, 2000).

In early work on dynamic capabilities (Teece *et al.*, 1997), it was thought that they directly resulted in competitive advantage. However, as the theoretical perspective evolved and matured, the prevailing view of scholars has become that the organisation-enhancing properties of dynamic capabilities are mediated partially or wholly through their influence on operational capabilities and better matching them to the environment (Zahra *et al.*, 2006; Pavlou and El Sawy, 2011; Eriksson, 2014; Lin and Wu, 2014). As illustrated in Figure 9, dynamic capabilities affect an organisation's ability to achieve competitive advantage through the alteration of one or a combination of lower-order capabilities and resources (Eisenhardt and Martin, 2000; Arend and Bromiley, 2009). Specifically, they build, integrate, and reconfigure operational capabilities, improving processes, but contributing only indirectly to the output of an organisation (Janssen, 2011; Plattfaut *et al.*, 2012). This view is supported by Helfat and Peteraf (2003) who argue that the function of dynamic capabilities is to adapt ordinary value creating capabilities and by Zahra *et al.* (2006) who separate DCs from their effects, concluding that it is ultimately 'zero order' capabilities that create value for an organisation.

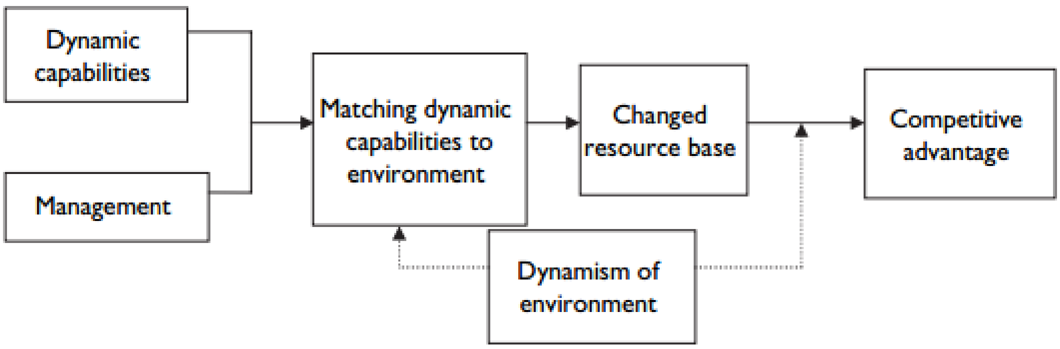

Figure 9: Dynamic Capabilities and Competitive Advantage.

Source: Arend and Bromiley (2009:79)

In the early stages of dynamic capabilities research, numerous authors (Camuffo and Volpato, 1996; Pisano, 2000; Figueiredo, 2003; Meyer and Lieb-Dóczy, 2003; Salvato, 2003; Verona, 2003; Brady and Davies, 2004; Keil, 2004; Roy and Roy,

2004) proposed sets of capabilities which tended to be derived from singular, anecdotal case studies and resulted in the specification of highly specific firm, or industry capabilities (Wang and Ahmed, 2007). These included acquisition capabilities and drug development capabilities which had no relationship to each other and were too dependent on their context to be of value in the development of general theories (Zollo and Winter, 2002; Capaldo *et al.*, 2003). Eisenhardt and Martin (2000) were among the first to address this shortcoming, pointing out the existence of 'idiosyncrasies' in the details of dynamic capabilities, but 'commonalities' in their key features that ensured their wide applicability (Den Hertog *et al.*, 2010). In order to balance these characteristics, it was decided that the common features or attributes of dynamic capabilities manifested themselves as a 'best practice'. This could be arrived at through different routes, referred to as 'equifinality', and accounted for firm-specific characteristics which had evolved through organisational learning processes over time (Eisenhardt and Martin, 2000; Peteraf *et al.*, 2013).

While there are common elements evident in dynamic capabilities, the suggestion is not that they are precisely identical in all organisations due to dissimilar paths to their achievement being taken from unique opening positions (Eisenhardt and Martin, 2000). Indeed, their composition and application can differ significantly between firms and settings and intensify their idiosyncratic characteristics (Ambrosini *et al.*, 2009; Jantunen *et al.*, 2012).

Based on the assumption of these common features, it can be can be reasoned that it is possible to develop a framework which identifies distinctive, general dynamic capabilities (Janssen, 2011). As a result, many scholars have attempted to deconstruct dynamic capabilities into their component parts. Wang and Ahmed (2007) delineate these elements as adaptive, absorptive, and innovative capabilities. A framework developed by Teece (2007) consists of abilities to sense market changes, seize opportunities, and reconfigure the organisation. Ambrosini *et al.* (2009) list incremental and renewal capabilities for leveraging the resource base and regenerative capabilities that adapt an organisation's portfolio. However, these types of common capabilities still remain quite vague and do little to further the measurement or management of specific dynamic capabilities (Macher and Mowery, 2009; Pavlou and El Sawy, 2011).

Throughout the literature there is agreement that firms can exhibit varying levels of dynamic capability possession (Helfat and Peteraf, 2003; Wang and Ahmed, 2007; Jiao *et al.*, 2010; Aramand and Valliere, 2012; Killen and Hunt, 2013; Krzakiewicz and Cyfert, 2014), or in other words that there are both more effective and less effective ways to execute dynamic capabilities. However, despite the importance of understanding the evolution or development of dynamic capabilities, the debate has predominantly focused on their nature and effects (Easterby-Smith *et al.*, 2009; Fallon-Byrne, 2013). This is in conflict with Helfat and Peteraf's (2003) standpoint, which argues that merely taking a dichotomous view of the possession of these capabilities does little to further the theory or its explanation of heterogeneity between firms. Instead, they suggest the value of research which determines the maturity of dynamic capabilities, or the effectiveness of their performance (Helfat and Peteraf, 2003).

Eisenhardt and Martin (2000) agree that there are 'best practices' for particular dynamic capabilities, but do little to elaborate on their evolution or increasing excellence. Janssen *et al.* (2012: 6) are of the view that when "successful ways are widely applied, the use of that 'best practice' can give dynamic capabilities a more homogeneous character than usually assumed" and suggest that common characteristics of DCs can be relevant across a range of industries. The implication of this argument is that it permits the development of frameworks for the purposes of both capability comparison and enhancement (Eisenhardt and Martin, 2000; Den Hertog *et al.*, 2010).

It is important to remember that at its basic level the DCV is a tool for strategic management and that the insights it provides are only of value if they can be used to enhance the performance of organisations (Vivas López, 2005). Salunke *et al.* (2011) assert that unlike its predecessor the resource-based view, the DCV assigns a prominent role to a firm's strategic management of capabilities critical to the value generation process. Ultimately, when dynamic capabilities are effectively managed, resources and capabilities will be configured in a manner best aligned to the current market situation, allowing firms to adapt, survive, and prosper (Bjork *et al.*, 2010; Kindström *et al.*, 2013). Nevertheless, the difficulty of managing dynamic capabilities is exacerbated because, although they possess common elements or attributes, they have different starting points and different development trajectories (Teece, 2012).

Obstacles to the practical management of dynamic capabilities can be traced back as far as the origins of this theory, where in its early stages, examinations were primarily undertaken by economics and industrial organisation researchers who directed their attention mainly toward conceptual details (Kuuluvainen, 2012). It was only later when it was picked up by other disciplines that the actual processes and interactions where dynamic capabilities were located became identified (Eriksson, 2014). Helfat *et al.* (2007) emphasise both the importance and difficulty of management in this area, designating managers as responsible for 'asset orchestration', developing and deploying processes that have an internal fit and constitute a dynamic capability, while discarding those that do not create value. This is often referred to as 'resource and capability management' (Degravel, 2011).

Ethiraj *et al.* (2005) further address the importance of dynamic capability management, attributing their presence to targeted firm investments in their structure and systems. Breznik and Hisrich (2014) are of the view that one of management's key roles is to develop dynamic capabilities, maintaining that even firms with similar characteristics may deploy different dynamic capabilities based on the decisions of managers. Eisenhardt and Martin (2000: 1107) add that DCs are "built through managerial choices in identifying, developing, and integrating routines and processes to undertake specific functionally oriented behaviours". Notably, the optimal approach to building a dynamic capability varies for each firm and in order for effective capability management to occur, firms must take into consideration whether the net positive benefits are greater than the costs of their development or maintenance (Janssen *et al.*, 2012).

3.2.1.2.1 Overcoming Criticisms of the DCV

Despite the merits of the dynamic capabilities view, it is not without perceived flaws (Wang and Ahmed, 2007; Schilke *et al.*, 2018). The DCV is not a perfect theory and, in relative terms, is a somewhat new discipline where research (Wang and Ahmed, 2007; Peteraf *et al.*, 2013; Zitkiene *et al.*, 2015; Girod and Whittington, 2017) and debate (Peteraf and Tsoukas, 2017; Pisano, 2019) are still ongoing. Its notable critics (Priem and Butler, 2001; Arend and Bromiley, 2009), express inadequacies concerning the degree of vagueness around the theory, descriptions of how resources and capabilities are developed, and the lack of empirical research (Kraatz and Zajac, 2001). Other objections to the theory are that it is tautological, endlessly recursive, and non-operational (Eisenhardt and Martin, 2000). Resultantly, requests have been made for the concrete identification of precise dynamic capabilities, specifications as to why they are important, and the provision of insights into their management (Sune and Gibb, 2015).

While each of the above criticisms of the dynamic capabilities view possesses some merit, suggestions have been made subsequent to their advancement that assert they have now been satisfactorily addressed (Schilke *et al.*, 2018) or detail how they can be overcome (Kurtmollaiev, 2014).

For instance, efforts have been made to defeat the criticism of dynamic capabilities as vague (Winter, 2003; Menguc and Auh, 2006). Indeed, Eisenhardt and Martin (2000: 1107) strongly argue that dynamic capabilities are not vague, but rather “consist of identifiable and specific routines”. Barreto (2010) suggests that this objection can be surmounted by specifying the relationship between a construct representing a dynamic capability and its dimensions. He suggests the use of an aggregate or formative construct where each dimension is a facet of the dynamic capability and cannot represent it in isolation (Barreto, 2010). This eliminates the ambiguity around specific dynamic capabilities (Pavlou and El Sawy, 2011) and is advice that is adhered to for this study.

The challenge of being ‘endlessly recursive’ conjectures that if a capability, or dynamic capability, can potentially be superseded by another of greater value (Collis, 1994), an ‘infinite regress problem’ arises, making it impossible to “identify the ultimate source of competitive advantage” (Cepeda and Vera, 2007: 426). However, this issue is easily resolved by imposing limitations on the number of ‘higher-orders’ in a piece research and examining, for instance, only a specific dynamic capability and its dimensions (Katzy and Crowston, 2008; Kurtmollaiev, 2014).

Much has been written about the troublesome operationalisation of the DCV and the scarcity of valid empirical studies (Williamson, 1999; Eisenhardt and Martin, 2000; Hoopes *et al.*, 2003; Wang and Ahmed, 2007; Janssen, 2011; Sune and Gibb, 2015). While, in the past, little empirical evidence was generated through quantitative measurement, and the DCV was essentially a theoretical contribution (Newbert, 2007; Arend and Bromiley, 2009; Giannopoulou *et al.*, 2011; Janssen, 2015), Schilke *et al.* (2018: 422) argue that “this is no longer the case as most of the research on dynamic capabilities is now empirical”.

The dynamic capabilities view has often been criticised for being tautological (Williamson, 1999; Wang *et al.*, 2004; Barreto, 2010; Wang *et al.*, 2015). This is because an examination of past research in this area reveals the dominance of one particular approach. It involves the identification of firms with unique skills and above average results and attributes their performance, post hoc, to these skills which are designated ‘dynamic capabilities’ (Zahra *et al.*, 2006; Wang and Ahmed, 2007). However, this rationale cannot be used in the development of a solid theoretical argument (Pavlou and El Sawy, 2011). To avoid this flawed reasoning, it is advised to decouple the hypothesised presence of a dynamic capability and firm performance (Teng, 2016), instead examining its role in developing or modifying operational routines (Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Kurtmollaiev, 2015).

3.2.1.3 Extending the DCV to Service Innovation Capability

The systematic approach that the DCV affords is particularly well-suited to this firm-level study of service innovation capability and its performance (Lawson and Samson, 2001; Helfat et al., 2007). It provides helpful insights, specifically as service innovation capability is not tangible and interwoven with capabilities embedded in an organisation's processes and routines (Crossan and Apaydin, 2010; Den Hertog *et al.*, 2010; Fallon-Byrne, 2013; Janssen *et al.*, 2013).

The DCV is frequently used in studies of SIC and it is often argued that service innovation capability *is* a dynamic capability (Fischer *et al.*, 2010; Giannopoulou *et al.*, 2011; Gebauer *et al.*, 2012; Plattfaut *et al.*, 2012; Kindström *et al.*, 2013; Plattfaut *et al.*, 2013; Stryja *et al.*, 2013; Malsbender *et al.*, 2014; Nada and Ali, 2015). SIC describes an organisation's ability to adapt and change in the pursuit of market opportunities, an explanation which bears a high degree of similarity to the definition of dynamic capabilities, and implies that their purposes are almost synonymous (Den Hertog *et al.*, 2010; Essmann and Du Preez, 2009; Breznik and Hisrich, 2014).

Additionally, both classes of capability share several features. Both are the result of learning processes (Lawson and Samson, 2001); are continuously developed, or evolve over time (Breznik and Hisrich, 2014); are concerned with responding to market changes (Eisenhardt and Martin, 2000); maintain the key role of management in their development and implementation (Zahra *et al.*, 2006); focus on organisational change (Helfat *et al.*, 2007); and are frequently represented as a function or combination of multiple ordinary level capabilities (Fuchs *et al.*, 2000; Agarwal and Selen, 2009; Breznik and Hisrich, 2014).

Pöppelbuß *et al.* (2011), adhere to this viewpoint and regard SIC as a dynamic capability that enables firms to sense and seize opportunities through the transformation of operational capabilities. Similarly, Menor and Roth (2008) conceptualise SIC as a second-order dynamic construct with four dimensions, while Zitkiene *et al.* (2015) possess an almost identical understanding, but differ in the number of dimensions they suggest. Building upon these enquiries, this study recognises service innovation capability as a dynamic capability and its dimensions as operational capabilities (Zollo and Winter, 2002).

Dynamic capabilities are abstract phenomena and are often represented as constructs composed of distinct, separate, but interrelated subdimensions (Desouza, 2006; Giannopoulou *et al.*, 2011; Stryja *et al.*, 2013). According to Zahra *et al.* (2006: 927), “dynamic capabilities are affected by and operate on substantive capabilities”. In other words, they govern how lower-order capabilities will be modified or extended but are also underpinned by them (Agarwal and Selen, 2009). Kislov *et al.* (2014: 169) supports this viewpoint, explaining that higher-order dynamic capabilities are “often combinations of simpler foundational capabilities”. The multidimensional nature of dynamic capabilities has been highlighted many times in the literature (Rubalcaba *et al.*, 2012; Kindström and Kowalkowski, 2014), where they have been disaggregated to better understand their underlying mechanisms (Ridder, 2013).

Building upon this approach, this study investigates dynamic service innovation capability (DSIC) as a higher-order, multidimensional construct (Fuchs *et al.*, 2000; Agarwal and Selen, 2009; Kohler *et al.*, 2013; Kindström and Kowalkowski, 2014). This technique allows DSIC to be disentangled and for its subdimensions, ordinary level capabilities, to be specified (Zahra *et al.*, 2006; Feldmann *et al.*, 2013).

It should be noted at this point, that only the effect of the subdimensions on DSIC is examined in this study. While there is a bidirectional relationship between DCs and their dimensions, where a DC is both formed or caused by its dimensions and reconfigures them to align with market conditions (Barreto, 2010), this is outside the scope of this research. Indeed, this study is concerned only with discovering and describing which capabilities are causes or predictors of the focal phenomenon. Consequently, for the purposes of clarity, the extent to which DSIC influences its subdimensions is intentionally omitted. This is recognised as an opportunity for future research in §9.7.

While there are studies that consider mechanisms related to the evolution of dynamic capabilities (Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Zahra *et al.*, 2006), little has been done to identify their behavioural characteristics at various levels of advancement (Helfat and Peteraf, 2003). Accordingly, remedying this void is considered one of the primary contributions this inquiry makes to the DCV. Building upon Eisenhardt and Martin’s (2000) assumption of ‘commonalites’ between the dynamic capabilities possessed by organisations, it is hypothesised that there are also similarities in their evolution, specifically in the form of distinct development plateaus

(Arend and Bromiley, 2009; Vyas *et al.*, 2014). This does not negate the notion of idiosyncrasies in their details (Wang and Ahmed, 2007), but rather contends that their key features at various levels of maturation possess commonalities also (Eisenhardt and Martin, 2000; Klievink and Janssen, 2009).

The application of the DCV for this study provides several advantages. The theoretical perspective has the scope to provide new understanding of SIC and its maturity (Helfat *et al.*, 2007; Camisón and Monfort-Mir, 2012; Thornton *et al.*, 2014), can facilitate the development of a holistic model (Den Hertog *et al.*, 2010), highlights the criticality of strategic capability management (Teece and Pisano, 1994; Cetindamar *et al.*, 2009), and provides a mechanism for operationalising SIC in practice (Camisón and Monfort-Mir, 2012).

3.3 Chapter Conclusion

This chapter provided an overview of the central theoretical perspective and its appropriateness to this firm-level study of service innovation capability. It is summarised in Table 6. Extant research on dynamic capabilities was explored and they were defined as hierarchical competencies embedded in organisational processes and routines which can reconfigure operational capabilities to allow organisations to adapt to changes in their environment (Helfat *et al.*, 2007; Teece, 2009; Fallon-Byrne, 2013). They are critical to preventing organisations from continuing to engage in outdated practices by aligning the value that they produce with the conditions of their dynamic market (Teece *et al.*, 1997; Sirmon *et al.*, 2007). Harnessing the potential of DCs is a significant issue for managers and requires them to develop processes and routines that constitute dynamic capabilities (Arend and Bromiley, 2009; Janssen, 2011).

What are dynamic capabilities?	**The ability of an organisation to reconfigure their capability base and adapt to market changes.**
Why are they important?	They prevent the practices of an organisation from becoming obsolete and can lead to (sustainable) competitive advantage.
Empirical evidence for their existence and importance	Insufficient evidence due to studies that are anecdotic, tautological, sector specific, or use poor proxies.
How should they be managed?	Through a focus on the management of routines, processes, or groups thereof which constitute a dynamic capability.
Research gap	There is insufficient quantitative evidence, ambiguity regarding their relationship with performance, and limited application in the services context.

Table 6: Summary of Literature on Dynamic Capabilities.

The selection of the DCV as this study’s theoretical foundation utilises the perspective for an original approach to the measurement and management of dynamic service innovation capability. In the next chapter, the literature in this area is examined with the purpose of conceptualising service innovation capability maturity.

Chapter 4: Conceptualisation of Service Innovation Capability Maturity

4.1 Introduction

As illustrated in Table 7, within the index construction procedure, this chapter relates to the second phase, Conceptualisation.

Chapter	Phase	Step
3. Theoretical Foundation	1. Theoretical Foundation	1. Select an Appropriate Theoretical Foundation
4. Conceptualisation of Service Innovation Capability Maturity	**2. Conceptualisation**	**2. Unambiguously Define SIC**
		3. Specify the Conceptual Domain of the Construct
		4. Specify the Conceptual Theme
		5. Identify the Dimensions of SIC
		6. Confirm the Suitability of Dimensions as Formative Indicators of SIC
		7. Specify the Conceptual Theme of the Dimensions
5. Measurement	3. Development of Measurement Items	8. Generate Items to Represent the Construct
		9. Assess the Content Validity of the Items
	4. Measurement Model Specification	10. Formally Specify the Measurement Model
6. Data Collection	5. Testing the Index	11. Pretest
		12. Pilot
	6. Data Collection	13. Collect Data
7. Data Analysis	7. Index Evaluation and Refinement	14. Purify and Refine the Index
	8. Validation	15. Assess Index Validity
	9. Norm Development	16. Develop Norms for the Index

Table 7: Location of Current Index Construction Phase in Thesis.

This chapter describes key terminology and concepts and details the steps through which a service innovation capability maturity model was derived. It takes the following format. First, the terms services, service innovation, and service innovation capability are explained and defined in turn. Next, the fundamentals of capability maturity models, their purposes, underpinning concepts, history, structure, and common criticisms are summarised. Following this, five levels of maturity are synthesised and the characteristics of SIC at each of them is detailed. SIC is then dimensionalised and represented as a multidimensional construct caused by four interrelated subdimensions, the characteristics of which are described at all levels of maturity. The chapter concludes by asserting the requirement to empirically test this conceptual maturity model.

4.2 Phase 2 – Conceptualisation

The objective of this phase is to clearly conceptualise SIC maturity (Lewis *et al.*, 2005). This is achieved through its six constituent steps which together describe a formation of a novel and original model of service innovation capability maturity.

4.2.1 Step 2: Unambiguously Define SIC

First, in order to attain a comprehensive understanding of service innovation capability, it is necessary to examine the term and its elements, services and service innovation. In the following subsections, these key concepts are detailed for the purpose of clarifying them to the reader and providing some context for this study.

4.2.1.1 Services

Since the 1970s, the importance of the services sector has increased compared to manufacturing and it now accounts for the dominant share of the world economy (Randhawa and Scerri, 2015). Indeed, there is consensus among academics that services account for approximately 70% of employment and GDP in developed economies (Salter and Tether, 2006; Chen *et al.*, 2007; Ostrom *et al.*, 2010; Crevani and Palm, 2011; McDermott and Prajogo, 2012; Yen *et al.*, 2012; Cuadrado-Roura, 2016). However, despite their importance, services are problematic to characterise or define because of their immaterial or ‘fuzzy’ nature (Gallouj and Weinstein, 1997; Gallouj and Savona, 2009), a difficulty that is further compounded by the fact that their attributes tend to exist along a continuum (Shostack, 1984). As a result, scholars are reluctant to define services and instead stress their heterogeneity and nuanced differences with goods (Poel, 2013). This has meant that a single, comprehensive, and unified understanding of services does not presently exist (Stephen L. Vargo and Robert F. Lusch, 2004; Johansson and Smith, 2015).

The services sector is very broad and encompasses a huge variety of activities from an array of industries, including consumer services, business services, and public sector services (Randhawa and Scerri, 2015). Because a service can refer to many things they are often distinguished, usually from products, on the basis of their characteristics of being non-material or intangible, heterogeneous, co-produced with clients, and non-stockable or perishable (Gallouj and Weinstein, 1997; Gallouj and Djellal, 2010; Ojasalo, 2012). These criteria are commonly referred to as the IHIP framework, an acronym for intangible, heterogeneous, inseparable, and perishable (Fisk *et al.*, 1993; Zhou, 2010; Hurnonen, 2012; Edvardsson and Tronvoll, 2013).

Intangibility describes services as immaterial offerings or physical operations that affect the state of a person or good (Miles, 2005; Moeller, 2010). Heterogeneity concerns the difficulty of standardising services and incorporates their numerous contexts, outcomes, performance, and level of customer participation (Lovelock and Gummesson, 2004; Kuester *et al.*, 2013). Inseparability describes the simultaneous production and consumption of a service, for example in the context of education, visiting a physician, or during consultancy, where the presence or participation of the service user is required (Berry, 1980; Morrar, 2014). Perishability refers to the inability to stockpile or inventory a service as they are provided through unique processes (Biege *et al.*, 2013).

These characteristics, while observed frequently, are often present in varying degrees. However, all have been described as inaccurate at some point (Stephen L Vargo and Robert F Lusch, 2004). Intangibility has been criticised due to the number of tangible objects involved with the delivery of services (Stephen L. Vargo and Robert F. Lusch, 2004). Heterogeneity is attacked as there are elements of services that both increase or impede the possibility for standardisation (Lovelock and Gummesson, 2004). The attribute of inseparability has been denounced as the observation of some services, including cleaning, logistics, or laundry, illustrate that many can be performed in the absence of the customer (Jack *et al.*, 2015). Finally, the perishability characteristic has been condemned by academics who believe that services can be stored in systems, buildings, knowledge, or people (Moeller, 2010).

Edvardsson and Olsson (1996) propose three components through which they believe services can be understood. The first of these is the service concept, which describes their structure and content (Goldstein *et al.*, 2002). Next, the service system refers to the structure of the organisation and specifies the roles played by people, technology, equipment, and physical facilities (Alter, 2008). Finally, the service process component describes the activities required to produce and deliver the service and the roles of the provider and client (Edvardsson and Olsson, 1996; Edvardsson, 1997).

In the study of services, the NACE[1] framework is often used to classify activities (PRO INNO Europe, 2009; Eurostat, 2016). It categorises services into groups, including transport, government, education, health care, social and personal services, retail and wholesale, hotels and restaurants, telecommunications, and financial services (Oke, 2007). However, this industrial division has been described as vague and difficult to use for analysis and is criticised for failing to account for differences between individual firms with its broad categories (Hortelano and Gongález-Moreno, 2007; Miles, 2008). This has led to the suggestion that perhaps services are best thought of as a composite of many subsectors with varying, unique characteristics (Pires *et al.*, 2008) and that any research conducted with a specific set of service companies will be difficult to generalise to the sector as a whole (Santos-Vijande *et al.*, 2013).

Notwithstanding the merits of service classifications, they do little to enhance collective understanding of services. Lovelock and Gummesson (2004) assert that no single definition is capable of encompassing the full diversity of services or the complex attributes that describe them. For example, the services sector is so heterogeneous that Szczygielski (2011: 6) states "a plausible definition of services,

[1] Nomenclature statistique des activités économiques dans la Communauté européenne / Statistical classification of economic activities in the European Community.

might be, everything that isn't agriculture". The sector is understood as one that is highly fragmented and incorporates anything from 'pure' services, to mixtures of goods and services, constituting both high and low technology activities that range anywhere from housecleaning to information and communications technology (ICT) support (Den Hertog, 2000; Prajogo, 2006; Eichengreen and Gupta, 2011). Similarly, Maskus (2008) illustrates the breadth of economic and social activities represented by services which vary in terms of their labour intensity, capital intensity, and level of customer orientation.

An additional complication to delineating this sector is that it is becoming increasingly blurred as the way that companies do business evolves (Sheehan, 2006). Specifically, organisations that traditionally would have been thought of as manufacturers are increasingly adding a service component to their products to instead become 'solution' providers (Lightfoot and Gebauer, 2011). This increasing 'servitisation' is fast becoming a widely-used strategy to create value and respond to the needs of customers and is otherwise known as bundling, or product-service integration (Kindstrom and Kowalkowski, 2009).

At a rudimentary level, service industries or firms can be understood as those with the main function of providing a service (Miles, 2008). Contrasting them with goods, Janssen (2011) perceives services as providing a full experience or a solution, while Gallouj and Savona (2009: 154) regard them as not having a physical output and define them as "a process, a sequence of operations, a formula, a protocol, a problem solution". In a widely used definition by Stephen L. Vargo and Robert F. Lusch (2004: 2) they are described as "the application of specialised competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself". Gadrey *et al.* (1995) understand a service as the provision of a function or solution, not principally involving a good. Likewise, Miller and Foust (2003: 37) describe services as "value creating processes or events", while PRO INNO Europe (2011) suggest that a service can be as simple as an act that creates value.

In the context of this study, services are defined as *the organisation of value creating solutions* (Gadrey *et al.*, 1995; Hsieh *et al.*, 2013).

4.2.1.2 Service Innovation

Due to the enormous growth of the services sector, interest and the number of publications relating to service innovation have increased in parallel (Sundbo, 1997; Kallio, 2015; Witell *et al.*, 2016; Li *et al.*, 2017; Gallouj and Djellal, 2018). Service innovation is considered to be a major driver of sustainable SME growth and competitive advantage (McDermott and Prajogo, 2012; Gryszkiewicz *et al.*, 2013; Randhawa and Scerri, 2015). New or improved services enhance profitability, attract new customers, increase loyalty, allow an organisation to access new markets or create new opportunities, improve their image, and provide a platform for future offerings (Storey and Easingwood, 1999; Menor *et al.*, 2002; Kindström *et al.*, 2013).

Nevertheless, services were initially regarded by researchers as ‘non-innovative’ (Pavitt, 1984) and any ‘innovations’ were “reduced to the adoption and use of technologies” (Morrar, 2014: 6). Because they were thought of only as consumers of innovations and, owing to the fact that early innovation research centred on manufacturing industries and treated innovation as a technological subject, services were excluded from innovation studies and surveys (Tether, 2004; Gallouj and Savona, 2009; Crevani and Palm, 2011). However, this view of services has disappeared entirely in recent decades.

Currently, service innovation is thought of as an ambiguous and vague concept, a collection of numerous divergent approaches, perspectives, and contexts (Drejer, 2004b). Existing literature is fragmented, with numerous inconsistent classifications by type, patterns, competences, process stages, and types of outputs (Avlonitis *et al.*, 2001; Snyder *et al.*, 2016); disagreement as to whether the term describes ongoing organisational activities or an outcome (Nijssen *et al.*, 2006; Droege *et al.*, 2009); interpretations that vary significantly in their breadth (Toivonen and Tuominen, 2009; Burger *et al.*, 2011); and no widely shared definition (Santos-Vijande *et al.*, 2016; Witell *et al.*, 2016). Collectively, these factors hinder its integrated study, obfuscate theoretical understanding, and provide little in the way of direction to organisations seeking to effectively innovate their services (Drejer, 2004a; Giannopoulou *et al.*, 2011; Gryszkiewicz *et al.*, 2013).

One of primary focuses of service innovation studies are the differences with innovation in manufacturing (Drejer, 2004a; Prajogo and McDermott, 2014). Manufacturing innovation is generally orientated towards products and technology, relies more heavily on professional capabilities and technical expertise, and requires greater expenditure on research and development activities (Ettlie and Rosenthal, 2012). This is in contrast with service innovations which require less expenditure on R&D, use less formal development processes, create outputs that are more easily copied and cannot be protected by patents, and are more reliant on human capital capabilities such as person-to-person skills or customer interface and communication competences (Lopes and Godinho, 2005; Miles, 2008; Ettlie and Rosenthal, 2011; Baines and Lightfoot, 2013).

Approaches used in the study of service innovation are categorised based on these differences as either assimilation, demarcation, or synthesis (Coombs and Miles, 2000; de Vries, 2006). The assimilation approach is an early perspective which emphasises the role of technology and regards manufacturing and service innovations as similar, even going as far as applying manufacturing models to service innovation (Droege *et al.*, 2009; Crossan and Apaydin, 2010). The demarcation approach is entirely service-orientated and argues that services are distinct and require their own models and theories (Sundbo, 1997; Nijssen *et al.*, 2006). This approach is concerned with ‘pure’ services, emphasises the idiosyncrasies of service activities, and excludes technology (Toivonen and Tuominen, 2009). Lastly, the synthesis approach, used in the majority of recent studies, integrates both manufacturing and service innovations by accounting for both technological and non-technological forms of innovation (Gallouj and Weinstein, 1997). It combines the two respective streams of innovation research in anticipation that important elements of each will be illuminated which formerly may have been neglected by their independent study (Drejer, 2004a; Droege *et al.*, 2009).

A typical approach used to classify service innovations is by their ‘innovation trajectory’, or pattern, which is understood to be common to organisations that engage in analogous activities or are active in similar sectors. This viewpoint was introduced by Pavitt (1984), who used the source of the innovation and the appropriability mechanism as differentiating factors. Four trajectories or patterns were identified:

supplier dominated, scale-intensive, specialised suppliers, and science-based (Pavitt, 1984). Later Miozzo and Soete (2001) updated Pavitt's taxonomy and included more diverse patterns, adding the categories of supplier-dominated, scale intensive physical information networks, and science-based and specialised suppliers (Miozzo and Soete, 2001; Miles, 2008).

The contribution to this discourse by Gadrey *et al.* (1995) was the addition of a typology describing five distinct categories of service innovations. These included product innovation, process innovation, organisational innovation, market innovation, and ad hoc innovation (Gadrey *et al.*, 1995).

Another typology, introduced by Gallouj and Weinstein (1997) posits that service innovations can be classified into the categories of radical, improvement, incremental, ad hoc, recombinative, and formalisation. This typology suggests that changed service characteristics result in innovation of different forms (Gallouj, 2002).

Toivonen and Tuominen (2009) describe five patterns of innovation specified by their degree of formality and pattern of collaboration. They are internal processes without a specific project, internal innovation projects, innovation projects with a pilot customer, innovation projects tailored for a customer, and externally funded innovation projects (Toivonen and Tuominen, 2009).

Still others classify service innovations by their speed or the degree of newness and novelty (Sundbo, 1997; Avlonitis *et al.*, 2001; de Brentani, 2001).

Breaking away from models that only classified service innovations, Den Hertog (2000) developed a four dimensional model that attributed innovation to changes in one or a combination of the dimensions of a service (den Hertog and Bilderbeek, 1999). The author understood these to be the service concept, client interface, service delivery system, and technological options (Den Hertog, 2000). This framework was later enhanced and extended with the addition of two extra categories, 'new business partner' and 'new revenue model' (Den Hertog *et al.*, 2010).

Though these interpretations and typologies have their merits, many are simply alternative methods for classifying service innovation and its components, emphasising different features, and doing little to further understanding regarding its qualities, or provide any strategic guidance (Toivonen and Tuominen, 2009; Kallio, 2015).

Evidently, as service innovation by title concerns the innovation of services, it must therefore reflect the distinctive characteristics of services (Gallouj and Weinstein, 1997; Sundbo, 1997). Research on the subject has therefore emphasised the role of the customer in the co-creation of value (Rubalcaba *et al.*, 2012), its continuous or incremental nature (Edvardsson and Tronvoll, 2013), less tangible outputs, informal development stages (Salunke *et al.*, 2011), its decentralisation and dispersion (Janssen *et al.*, 2012), use of human capital, and inclusion of process innovations (Hogan *et al.*, 2011).

Often the term service innovation is confused, or used interchangeably, with new service development (NSD) (Kelly and Storey, 2000; Menor *et al.*, 2002; Biemans *et al.*, 2016). However, there are important differences between them. NSD is a term from the service management and marketing literature that describes the architectural elements and processes through which new services are delivered (Cooper, 1994; Storey and Kelly, 2001). It encompasses a series of stages from the generation of an idea through to the market launch of a new service (Goldstein *et al.*, 2002). Generally, NSD processes are measured by the effectiveness of their performance and often similar metrics to new product development (NPD), such as the speed of execution, are used (Menor *et al.*, 2002). However, these formal processes may not be relevant in the development of, for instance, an incremental innovation (Oke, 2007), do not necessarily take place identically across service contexts (Biemans *et al.*, 2016), or in reality even occur in a smooth and linear fashion (Sundbo, 1997). Critics of NSD argue that the sequential, staged approach which informs it, as an adaptation from the manufacturing domain, is inherently unsuitable and fails to capture the dynamic and iterative processes and interactions characteristic of service innovation (Tidd and Hull, 2006; Gremyr *et al.*, 2014).

Although the differences between service innovation and NSD may appear to be only slight, they are important. Specifically, service innovation is more general, focusing on the organisational level (Ordanini and Parasuraman, 2011), while NSD is concerned with activities at the project or process level (Alam and Perry, 2002). Witell *et al.* (2016) emphasises the importance of clearly specifying which concept is being referred to, urging clarification as to whether the innovation process is being referred to or the outcome of that process. Accordingly, as nuances are considered important to this organisational-level study of service innovation, the more general term is accepted and used (Helkkula, 2010).

Central to the concept of innovation is newness either in the idea, product, process, or the degree of newness to the market or firm (Snyder *et al.*, 2016). Service innovations are conceptualised in a variety of ways by authors who tend to emphasise either the development of new service products or increases in the effectiveness or efficiency by which services are delivered (Droege *et al.*, 2009; Witell *et al.*, 2016). Camisón and Monfort-Mir (2012) recognise that innovation in services does not only create new products and processes, but encompasses new ways for services to be distributed and organised. Ojasalo (2009: 219) defines service innovation as the ability "to anticipate changes in customers' behaviour, needs and expectations, and the consequent competence to design better services and create new service concepts". This understanding is mirrored by several authors who interpret the term as how organisations react to changes in their dynamic environment and exploit opportunities (Tajeddini, 2010; Hogan *et al.*, 2011; Kindström *et al.*, 2013). Accordingly, it can be reasoned that the service innovation encompasses far more than creativity or invention (Alsaaty, 2011; Sears and Baba, 2011; Therrien *et al.*, 2011).

Ostrom *et al.* (2010) consider service innovations as creating value for all stakeholders through enhancements to the service offering, processes, or the business model. Riddle (2008) describes service innovations as being intentional, bringing benefit to the customer, improving profitability, being replicable, and may at their basic level be as simple as identifying the unmet need of a customer and designing a service for it. The term is defined by Giannopoulou *et al.* (2011) as the ability to produce solutions for customers, not previously available, through additions or changes to the service concept and by the European Commission (2012: 12) as "new or significantly improved service concepts and offerings". For Den Hertog *et al.* (2010: 500) they are defined as "intangible new ideas or combinations of new ideas (sometimes in combination with physical objects) that together constitute a new value proposition to a client".

For this study, service innovations are conceptualised as *new or significantly improved service outputs that create value for a firm and its stakeholders* (Blommerde and Lynch, 2013; Blommerde and Lynch, 2014).

However, while many of the above classifications and definitions of service innovation emphasise the requirement for its effective management, the majority fail to provide a deeper understanding of how to do so (van der Aa and Elfring, 2002). Consequently, the attention of scholars has progressively turned to service innovation capability (Lillis *et al.*, 2015; Tang *et al.*, 2015; Tsou and Hsu, 2017), detailed in the next section.

4.2.1.3 Service Innovation Capability

Acknowledging the value of discrete service innovations, this section now considers a greater imperative, the capability that underpins their continuous introduction (Siguaw *et al.*, 2006; Janssen *et al.*, 2012). Service innovation capability is understood to be strongly linked with service innovation performance (Kariyapperuma, 2013; Plattfaut *et al.*, 2015; Hariandja, 2016b; Banjongprasert, 2017), meaning that its mastery is an issue of considerable concern for small and medium-sized enterprises (Pöppelbuß *et al.*, 2011; McDermott and Prajogo, 2012; Nootjarat *et al.*, 2012; Plattfaut *et al.*, 2012; Smith-Eckhardt, 2015). However, no common approaches have been used in its analysis and the term has been defined in numerous ways which vary in their scope and comprehensiveness.

Throughout the literature, the terms innovation, innovation orientation, innovation capability, and innovativeness are often used interchangeably and as if they are synonymous (Neely *et al.*, 2001; Panayides, 2006; Siguaw *et al.*, 2006; Walsh *et al.*, 2009; Hogan *et al.*, 2011). However, a careful analysis of their respective definitions leads to the conclusion that each is a distinct concept that, in a major study of service innovation capability, should be clarified and their uniqueness explicated.

Innovation simply describes a singular organisational outcome, such as a new or improved offering (Witell *et al.*, 2016). Innovation orientation is an aspect of an organisation's culture, also understood as a proclivity towards innovation, which guides and directs the actions of employees towards the creation of innovations (Siguaw *et al.*, 2006). Innovativeness describes behavioural characteristics and concerns an organisation's attitude toward innovation (Midgley and Dowling, 1978). Innovativeness and innovation orientation may then be accurately used synonymously as both detail a persisting organisational mind-set underpinning shared assumptions, values, and beliefs (Menguc and Auh, 2006). Importantly, innovation capability is removed from these other concepts. Implying ability in its title, it disregards behavioural characteristics, considering only repeatable competences accomplished through an organisation's routines and processes (Pant, 2013; Plattfaut *et al.*, 2013).

This organisational capability is generally regarded as describing the systematic means and capacity to respond to customer's needs and demands through coordinated activities or new resource configurations (Rivera, 2012; Westerduin, 2012; Plattfaut *et al.*, 2013). To Osei and Owusu (2015) it represents the ability of an organisation to effectively and efficiently combine resources to achieve strategic service innovation goals. For McLaughlin (2012) it is the capability required to deliver service innovations and incorporates many aspects of an organisation, including the competitive environment, routines, and the knowledge and skills of employees and customers (Islam et al., 2015).

Giannopoulou *et al.* (2011) describe SIC as a dynamic capability that, when effectively managed, allows an organisation to adapt to their environment through the repeated and continuous creation of innovations. In their view, it is concerned with assembling the right ingredients for innovation, or creating conditions that enhance the potential for an organisation to innovate its services (Giannopoulou *et al.*, 2011). Gryszkiewicz *et al.* (2013) articulate it as the ability to combine resources to generate new services, while Nada and Ali (2015: 392) go further including both the development of new services and “incremental changes of existing ones”.

For Hariandja *et al.* (2014: 147), “service innovation capability refers to a firm’s ability to develop new services through aligning strategic innovative orientation with innovative behaviours and processes”. O'Cass and Sok (2013) distinguish SIC as central to value creation through routines and processes that result in the development of new services and the improvement of existing ones. For Hogan *et al.* (2011), SIC is considered opaque and difficult to imitate by competitors, describing the ability of an organisation to apply their knowledge, skills, and resources in the pursuit of competitive advantage. Menor and Roth (2008) perceive the concept as a bundle of complementary dimensions related to the ability of a firm to create service innovations, while Kohler et al. (2013) understand the capability to be repeatable patterns embedded in processes that alter and reconfigure operational capabilities to create service innovations.

In essence, the term can be understood as simply as the potential to generate innovative outputs (Neely et al., 2001), the capability to create or develop service innovations (Plattfaut et al., 2012; Hariandja et al., 2014; Janssen and Castaldi, 2014; Janssen, 2014), or a firm’s preparedness for innovation (Börjesson and Elmquist, 2011). Service innovation capability leverages or deploys resources through learned routines and processes that underpin and reinforce all activities relating to the development of new or changed services (Sok and O'Cass, 2011; Janssen *et al.*, 2012; Saunila and Ukko, 2012).

These diverse ideas share several common emphases. By synthesising their critical features, the following definition for service innovation capability was developed for this study: *Service innovation capability describes a key dynamic capability, embedded in the routines or processes of an organisation, with the potential to repeatedly deploy and reconfigure resources in the continuous creation or improvement of services.*

4.2.2 Step 3: Specify the Conceptual Domain of the Construct

The purpose of this step is to specify the conceptual domain of the SIC construct. A construct's conceptual domain is generally divided into the entity or object to which it applies and property to which it refers (Diamantopoulos and Winklhofer, 2001).

As SIC is a firm-level phenomenon, it follows that the examined entity is the organisation itself (Hogan *et al.*, 2011). For this study, maturity is the attribute, characteristic, or property represented by the construct and describes its degree of sophistication or the effectiveness of its performance, corresponding to an organisation's ability to develop or improve its services, compared to best practice (Becker *et al.*, 2009). Since all capabilities can be possessed by organisations to varying degrees, SIC can be designated as a continuous variable, where the extent to which it is effective can be evaluated (Ekionea *et al.*, 2011). This is an alternative to dichotomous representations where organisations are portrayed as possessing either an effective SIC or none at all (Santamaria *et al.*, 2012).

To diagnose the maturity, or degree of effectiveness, of numerous organisational capabilities, the capability maturity model framework is employed in a variety of domains (Wendler, 2012; Corsi and Neau, 2015). Maturity models support systematic capability management by providing insights into an organisation's current capability performance and revealing actions required to diminish the gap with desired levels of capability performance (Verweire and Van Den Berghe, 2004; De Paula *et al.*, 2012). The following subsection explicates the concepts of capability maturity and maturity models.

4.2.2.1 Capability Maturity and Capability Maturity Models

Capability maturity models (CMMs), also referred to as stage models, competency models, or maturity models (Röglinger *et al.*, 2012; Wendler, 2012), are tools used by organisations to determine their efficacy in executing the requirements of a domain of practice and to facilitate the development of improvement plans based on this evaluation (Hynds *et al.*, 2014). They are understood to be of particular value for complex phenomena that cannot be improved easily or at once (Khatibian *et al.*, 2010).

While the term capability maturity, or maturity, is defined in numerous ways depending on the context and domain of reference (Wendler, 2012), with regard to maturity models it refers to a perfected state (Cooke-Davies, 2004); full development (Burger *et al.*, 2011); or the extent to which specific organisational practices are defined, managed, measured, controlled, and effective (Jin *et al.*, 2014). However, while 'full development' implies an organic or natural course, the term 'perfected' suggests external designs or thinking by an individual or group with the capacity to make changes in the organisation. Essmann (2009: 30) further clarifies the term, defining organisational maturity as "a system assessed to be optimally fit for its purpose, as described by its designer". This definition is intentionally generic and deliberately omits a description of the system's purpose.

Maturity models have three elementary functions, often categorised as descriptive, prescriptive, and comparative (Müller-Prothmann and Stein, 2011; Röglinger *et al.*, 2012). The first is to assess the current degree of maturity that an organisation possesses within a specific domain (Jin *et al.*, 2014). This assessment diagnoses the extent to which a competence object, normally a process or organisational capability, fulfils specific quality criteria, ordinarily compared to best practice (Lockamy and McCormack, 2004; Jochem *et al.*, 2011). The second function uses the information gleaned from the assessment to establish an optimum direction and course for improvement (Paulk *et al.*, 1993; Saiedian *et al.*, 1995). It identifies gaps between the best practices described by the model and an organisation's current practices to develop a roadmap that addresses identified weaknesses, prioritises improvement actions, and guides their implementation (Crawford, 2006; Rapaccini *et al.*, 2013). The third function of these models is as an analysis and positioning tool that enables comparisons of capability performance across organisations and industries without divulging any competitively sensitive information (Duffy, 2001). Consequently, maturity models assist organisations in understanding their performance relative to both best practice and competitors (Wendler, 2012).

The objective of CMMs are to support organisations with achieving consistent results in an examined area through activities and practices that are "repeatable, measurable, and continuously improved" (Persse, 2001; Wademan *et al.*, 2007: 100). They accomplish this through the transformation of undisciplined states into those capable of producing predictable outcomes (Denéle Esterhuizen *et al.*, 2012).

There are two classes of maturity models, (i) the lifecycle perspective, where an organisation evolves over time and thus passes through all stages; and (ii) the potential performance perspective, which details the attributes of an examined capability at each level of maturity, but allows the user to decide whether they intend to achieve higher levels (Wendler, 2012).

As many maturity models are based on the original software CMM, they have a similar structure, with five levels of maturity, and conform with the potential performance perspective (Paulk *et al.*, 1999). However, adaptations to the framework have resulted in differences in the number of measured objects and in the number of levels of maturity (Wendler, 2012). While acknowledging that there are differences between existing maturity models, all are structured hierarchically into discrete levels that describe the typical evolution of an organisational capability or its components (Fraser *et al.*, 2002; Essmann, 2009) and all assess these capabilities or their components against predetermined criteria or descriptions of their expected characteristics at each maturity level (Harmon, 2009; Röglinger *et al.*, 2012).

The maturity levels model the development of a competence object over time and describe its evolutionary improvement path from ad hoc and inconsistently performed practices to those that are better organised and more effectively executed (Desouza, 2006; Wademan *et al.*, 2007; Lee *et al.*, 2010). Each level clearly specifies its qualitative characteristics and general requirements to assist managers with better understanding their performance and the benefits of increasing their level of maturity (Jochem *et al.*, 2011; Müller-Prothmann and Stein, 2011). Visser (2011: 81) describes them as a "plateau with a defined level of development", with Walker (2008: 96) stating that each level "represents a significant attainment in an organisation's evolutionary path along its journey to maturity".

These sequential, progressively arranged levels each build upon the previous one, providing sound successive foundations that allow an organisation to incrementally build their organisational capability (Essmann, 2009; Rapaccini *et al.*, 2013). These cumulative requirements, or maturation criteria, ensure improvement steps are achievable, progress can be measured, and areas most in need of improvement are identified (Saiedian *et al.*, 1995; Burger *et al.*, 2011; Röglinger *et al.*, 2012). For models with 5 levels of maturity, there are generally no requirements for the initial level, 2-4 focus on the increasing sophistication or quality of the examined capability, and the highest level describes a state where it is continuously improved (Kruger and Snyman, 2005). Consequently, the organisation never arrive at a place where they cease pursuing improvements (Wademan *et al.*, 2007).

Before an organisation can achieve a maturity level, all the criteria from that level and preceding levels must be satisfied (Jin *et al.*, 2014). Despite appearing as a linear model, the enterprise does not always begin their improvement journey at maturity level 1 (Essmann, 2009). Initially, they are assessed against the requirements of the model and assigned an appropriate level, i.e. one where they have met the requirements for a level and all previous levels. For example, in order to attain maturity level 4, all the requirements for levels 2, 3, and 4 must be fulfilled. Jochem *et al.* (2011) warn that the achievement of a higher maturity level should not be viewed as an end in itself, but as a support for achieving organisational targets. Due to its evolutionary and incremental improvement approach, it is explicitly stated that maturity levels should not be skipped and most authors advise fully adhering to the prescribed path to ensure that no fundamental omissions are made (Paulk *et al.*, 1999; Desouza, 2006; Essmann, 2009).

The maturity assessment measures the extent to which a competence object fulfils quality requirements (Jochem *et al.*, 2011; Wendler, 2012). The assessment methodology used to determine the level of organisational maturity varies from model to model (Röglinger *et al.*, 2012). Generally, either an organisation's current situation is qualitatively matched with maturity descriptions contained in a maturity model, or variables are employed that reflect dimensions of the examined object and the effectiveness with which they are performed (Wendler, 2012; Jin *et al.*, 2014). The assessment can be carried out either by an assessor, who is usually licensed to a specific model, or through a self-assessment mechanism that puts control in the hands of user (Jochem *et al.*, 2011).

The original capability maturity model was developed by Watts Humphrey for Carnegie Mellon University's Software Engineering Institute in 1989 (Paulk *et al.*, 1993). He merged foundational concepts from Crosby's 'Quality is Free' five-stage framework and Shewart-Deming's 'Plan-Do-Check-Act' Total Quality Management improvement program (Wademan *et al.*, 2007; Wendler, 2012). The model was initially designed to address the software development crisis in the 1980s by reducing defects and increasing productivity through the introduction of a set of guidelines that placed an emphasis on organisational processes (Wademan *et al.*, 2007; Essmann, 2009; Jin *et al.*, 2014). However, the software CMM resulted in more than simply streamlining processes, instead changing the behaviour of organisations and supporting improvements through practices that were repeatable, measurable, and continuously improved (Paulk, 2009; Wendler, 2012). As a result, the approach described by the original capability maturity model became incredibly influential and its utilisation quickly spread to other information-intensive industries such as automotive, entertainment, telecommunications, and finance (Rapaccini *et al.*, 2013).

Burger *et al.* (2011) report that the original CMM remains the most widely used maturity model and emphasise its enormous influence on the development of subsequent maturity models. In fact, the wild outgrowth of this approach into other industries has meant the framework has attained widespread acceptance as the standard for process modelling and organisational maturity assessments (Wademan *et al.*, 2007). Successive CMMs have used similar principles to improve various businesses facets by adapting the structure or content of maturity models to new domains of application, with many authors referring to the original CMM as the basis for their own model (Essmann, 2009; Arveson *et al.*, 2010; Denéle Esterhuizen *et al.*, 2012).

Though originally limited to the software engineering industry, the breadth of domains in which maturity models have been successfully applied has expanded considerably. These models can relate to a single area of business activity (i.e. innovation), the activities of a whole firm, or those of a single unit within a large organisation (Müller-Prothmann and Stein, 2011; Wendler, 2012; Jin *et al.*, 2014). These domains have included product design (Caffyn, 1997), knowledge management (Harigopal and Satyadas, 2001; Diakoulakis *et al.*, 2004; Kulkarni and Freeze, 2004), human resources (Wademan *et al.*, 2007), business processes (Harmon, 2009; Van Looy *et al.*, 2013), strategic management (Arveson *et al.*, 2010), cost management (Balachandran and Balachandran, 2005), and project management (Cooke-Davies, 2004; Ibbs *et al.*, 2004; Crawford, 2006) to name a few.

Kasemsap (2017) and others (Essmann, 2009; Röglinger *et al.*, 2012) argue that the maturity model approach is still prospering and growing in popularity and discuss the steadily increasing number of models designed to measure and improve an array of organisational activities. The explanation for this continued growth are the adaptability and flexibility of CMMs to multiple contexts (Wendler, 2012) and the benefits that firms experience, including increased control, incremental improvements, enhanced monitoring and management, predictable and consistent outputs in the focus area, and better use of scarce resources by concentrating on key areas with the greatest impact (Rasula *et al.*, 2008; Essmann and Du Preez, 2009; Li *et al.*, 2011; Tan *et al.*, 2011).

Regardless of the discipline in which the maturity model framework is applied, their objectives remain identical; to assess the current situation and provide guidelines for improvement of a competence object (Jin *et al.*, 2014). CMMs are unified by the same basic principles which systematise capability development and enhance monitoring and management, ensuring predictable and consistent outputs in their area of focus (Rasula *et al.*, 2008; Essmann and Du Preez, 2009; Li *et al.*, 2011). Notwithstanding the number of maturity models and domains to which they apply, none currently exists with the ambition of measuring and improving service innovation capability, revealing the requirement for a new model.

4.2.2.1.1 Criticisms of Maturity Models

As with any imperfect methodology for organisational improvement, the maturity model framework has its critics. For some, they are thought of as step-by-step recipes that oversimplify reality and neglect critical internal and environmental factors (Essmann, 2009; Killen and Hunt, 2013; Niehaves *et al.*, 2014). Röglinger *et al.* (2012) suggest that they disregard the possibility of equifinality, or multiple maturation paths, which could potentially lead to identical results. The authors also denounce the number of maturity models developed for domains that are highly similar and those that fail to adhere to rigorous design principles (Röglinger *et al.*, 2012). Jugdev and Thomas (2002) characterise them as inflexible, impractical, and overwhelming. There are claims too that they overemphasise the need for change and the achievement of an end-state, when its attainment may not be worth the effort or cost (Röglinger *et al.*, 2012; Niehaves *et al.*, 2014). Conversely, Walker (2008) argues that they focus too heavily on processes instead of results, while to Paulk (2009) firms can be more concerned with assessment results than improving against business objectives.

For Marx *et al.* (2012) they lack a sound theoretical foundation and are often derived on the basis of arbitrary methods. According to Doss and Kamery (2006) there can be problems with their application to non-software development functions because key performance areas tend not to exist. Jørgensen *et al.* (2006) argues that maturation may not occur linearly, but in an ad hoc fashion, and that not all capability subdimensions may be of equal importance in the development of maturity. Crawford (2006) suggests that they are highly subjective and can be easily misapplied. Wendler (2012) criticises the lack of testing that occurs with maturity models and affirms that evaluation through solid empirical methods is required to demonstrate their suitability. In fact, many models remain untested and purely conceptual, which raises questions regarding the degree to which they can support organisational improvement (Mullaly, 2006). To overcome these critiques, maturity model research often goes into great detail describing how a model was developed or the design process undertaken (De Bruin *et al.*, 2005; Maier *et al.*, 2012).

Allowing for these criticisms, the prevailing view remains that maturity models are a valuable tool, if rigorously constructed and tested. The framework is generic and adaptable enough to be used in a variety of domains (Strutt *et al.*, 2006), defines capability areas most critical to performance (Yeo and Ren, 2009), establishes common language for an improvement area (Kaner and Karni, 2004), allows for targeted incremental improvements to be made (Sharma and Ali, 2010), can be seen as a library of best practices (Rad and Levin, 2006), dissects key organisational capabilities to allow for greater visibility and granularity (Rendon, 2008), can be used to improve concepts that are difficult to comprehend (Khatibian *et al.*, 2010), and can increase an organisation's motivation for change (Jochem *et al.*, 2011). The consensus in the literature is that their use can be equated with greater predictability, consistency, lower risk, and superior results in a domain (Wademan *et al.*, 2007).

The insights that can be obtained by using the maturity model framework mean that the approach is of immense benefit to performance measurement and management in any domain (Verweire and Van Den Berghe, 2004). Indeed, the approach has been used previously in the study the of innovation capability (Essmann and Du Preez, 2009; Corsi and Neau, 2015).

The Capability Maturity Model Integration (CMMI) examines innovation capabilities, but only for firms on maturity level 4 that wish to progress to level 5 and only in the context of software development organisations (Paulk *et al.*, 1999). The Innovation Capability Maturity Model developed by Corsi and Neau (2015) discusses innovation capability, but only that of manufacturing organisations and focuses primarily on product development processes. The Innovation Capability Maturity Model (ICMM) by Essmann (2009) is designed to assess and improve innovation capability, but its focus on industrial organisations does not account for the specificities of service businesses and fails to reflect their unique characteristics. Similarly, other models for product innovation are not transferrable since they are neither specified to a service context nor consider the practices that enable the enhancement of service innovation capability (Jin *et al.*, 2014). Critically, any attempts at understanding SIC maturity are not grounded in any academic discourse, are sporadic and incomplete, or have been incompletely investigated, meaning they lack validation through empirical testing and cannot be considered legitimate (Li *et al.*, 2010; Müller-Prothmann and Stein, 2011).

Collectively, existing models neglect the identification of factors that enhance service innovation capability in SMEs, do not account for the maturity of this phenomena, and provide no guidance for its strategic management (Blommerde and Lynch, 2013). This study addresses these gaps by clearly detailing the steps through which a service innovation capability maturity model was derived. These are presented in the following sections.

4.2.3 Step 4: Specify the Conceptual Theme

The objective of this step is detail SIC's conceptual theme, or the fundamental attributes or characteristics which are necessary and sufficient for an entity to possess in order to represent an archetype of that construct (Podsakoff *et al.*, 2016). In essence, the characteristics of the construct at various levels of maturity. These must be both common and unique so as to avoid all entities possessing certain characteristics being classified as an instance of the construct, or the other extreme, where overly unique characteristics prevent other researchers from identifying eligible instances as an example of the construct (MacKenzie *et al.*, 2011).

To execute this step, an examination was first undertaken of numerous maturity models from which composite maturity levels were derived (Hartwig and Smith, 2008; Essmann and Du Preez, 2009; Burger *et al.*, 2011; Jin *et al.*, 2014; Corsi and Neau, 2015; Doss *et al.*, 2017). These composite maturity levels are based on the typical evolution of organisational capabilities, derived through a close examination of themes from 73 management and organisation maturity models. These studies are depicted in Table 8. They are cumulative and progressive, where higher maturity levels build upon the requirements of lower levels (De Bruin *et al.*, 2005; Maier *et al.*, 2012) and, accordingly, the requirements for a maturity level and all preceding levels must be met before an organisation are allowed to progress to the next (Van Steenbergen *et al.*, 2010; Pöppelbuß and Röglinger, 2011).

The emergent maturity levels were titled, Initial, Managed, Defined, Measured, and Optimising. Together they illustrate the evolutionary path of organisational capabilities from ad hoc, inconsistent, and poor performance to that which is more disciplined and effective (Wendler, 2012).

The Initial stage is chaotic, reactive, and undisciplined, characterised by ad hoc capability performance and no standardisation. After the implementation of some basic management practices, stage two, Managed, is more controlled. Policies or strategies relating to the capability are partially implemented, but guidelines are not consistently adhered to; and with no feedback mechanisms, results cannot be monitored. In the third stage, Defined, understood to be the breakthrough level, capability performance standards are defined and the organisation is concerned with achieving them consistently. In the Measurement stage, the organisation introduces quantitative metrics to more comprehensively control capability performance. In the final stage, Optimising, focus is on the continuous improvement of capabilities. This level is considered to be an idealistic state which represents the highest possible level of capability maturity, or best practice.

Level Name	Equivalent Maturity Level Descriptor	Supporting Authors
1. Initial	Ad hoc and static/ Ad hoc/ Basic/ Beginning/ Cognitive level/ Disposed/ Initial state/ Initialise level/ Interpretive/ Introspective/ Naïve/ Reactive/ Recognise and comply/ Recognising/ Sleeping/ Solely reactive/ Start maturity/ Start-up/ The undeveloped phase/ Undefined/ Unplanned/ Unrepeatable	(Caffyn, 1997; McRoberts and Sloan, 1998; Holland and Light, 2001; Wadhwa and Rao, 2002; Hillson, 2003; Kaner and Karni, 2004; Lockamy and McCormack, 2004; Martin *et al.*, 2004; Balachandran and Balachandran, 2005; Fisher, 2005; Garrett and Rendon, 2005; Martin *et al.*, 2005; Armitage *et al.*, 2006; Crawford, 2006; Doss and Kamery, 2006; Jørgensen *et al.*, 2006; Kenny, 2006; Mullaly, 2006; Strutt *et al.*, 2006; Chmieliauskas *et al.*, 2007; Pullen, 2007; MacGillivray *et al.*, 2007; Tiku *et al.*, 2007; Wademan *et al.*, 2007; Xiaoyan and Junwen, 2007; Grimshaw and Mike, 2008; Hogan, 2008; Magdaleno *et al.*, 2008; Mortensen *et al.*, 2008; Rasula *et al.*, 2008; Rendon, 2008; Zqikael *et al.*, 2008; Khaiata and Zualkerman, 2009; Minonne *et al.*, 2009; Yeo and Ren, 2009; Albu and Panzar, 2010; Buheji and Al-Zayer, 2010; Chaffey, 2010; Demir and Kocabaş, 2010; Fitterer and Rohner, 2010; Khatibian *et al.*, 2010; Markovic, 2010; Reyes and Giachetti, 2010; Simon *et al.*, 2010; Sohrabi *et al.*, 2010; Zou *et al.*, 2010; Arling and Chun, 2011; Jochem *et al.*, 2011; McKenzie *et al.*, 2011; Rohloff, 2011; Tan *et al.*, 2011; Carcary, 2012; Chen and Fong, 2012; Ekionea *et al.*, 2012; Lianying *et al.*, 2012; Marx *et al.*, 2012; Randeree *et al.*, 2012; Serna, 2012; Bochenek and Blili, 2013; Campos *et al.*, 2013; Corneliu and Diana, 2013; Cronemyr and Danielsson, 2013; Killen and Hunt, 2013; Neverauskas and Railaite, 2013; Rapaccini *et al.*, 2013; Sanchez, 2013; Chung-Yang *et al.*, 2014; Hynds *et al.*, 2014; Masalskyte *et al.*, 2014; Neff *et al.*, 2014; Rae *et al.*, 2014; Ursacescu, 2014)
2. Managed	Advanced processes/ Basic/ Committed/ Control/ Defined/ Developed/ Engaged/ Improving/ Iterance level/ Novice/ Passive/ Plan and initiate/ Planned/ Reactive/ Repeatable level/ Repeatable/ Repeated/ Structured/ Synergistic/ The repeatable organisation/ The underdeveloped phase/ Understanding	(Caffyn, 1997; McRoberts and Sloan, 1998; Wadhwa and Rao, 2002; Hillson, 2003; Kaner and Karni, 2004; Lockamy and McCormack, 2004; Martin *et al.*, 2004; Balachandran and Balachandran, 2005; Garrett and Rendon, 2005; Martin *et al.*, 2005; Armitage *et al.*, 2006; Crawford, 2006; Doss and Kamery, 2006; Jørgensen *et al.*, 2006; MacGillivray *et al.*, 2007; Mullaly, 2006; Strutt *et al.*, 2006; Chmieliauskas *et al.*, 2007; Pullen, 2007; Tiku *et al.*, 2007; Wademan *et al.*, 2007; Xiaoyan and Junwen, 2007; Grimshaw and Mike, 2008; Hogan, 2008; Magdaleno *et al.*, 2008; Mortensen *et al.*, 2008; Rasula *et al.*, 2008; Rendon, 2008; Zqikael *et al.*, 2008; Khaiata and Zualkerman, 2009; Minonne *et al.*, 2009; Yeo and Ren, 2009; Albu and Panzar, 2010; Buheji and Al-Zayer, 2010; Chaffey, 2010; Demir and Kocabaş, 2010; Fitterer and Rohner, 2010; Khatibian *et al.*, 2010; Markovic, 2010; Reyes and Giachetti, 2010; Sohrabi *et al.*, 2010; Zou *et al.*, 2010; Arling and Chun, 2011; Jochem *et al.*, 2011; McKenzie *et al.*, 2011; Rohloff, 2011; Tan *et al.*, 2011; Carcary, 2012; Chen and Fong, 2012; Ekionea *et al.*, 2012; Lianying *et al.*, 2012; Marx *et al.*, 2012; Randeree *et al.*, 2012; Serna, 2012; Bochenek and Blili, 2013; Campos *et al.*, 2013; Corneliu and Diana, 2013; Cronemyr and Danielsson, 2013; Killen and Hunt, 2013; Neverauskas and Railaite, 2013; Rapaccini *et al.*, 2013; Sanchez, 2013; Chung-Yang *et al.*, 2014; Hynds *et al.*, 2014; Masalskyte *et al.*, 2014; Neff *et al.*, 2014; Rae *et al.*, 2014; Ursacescu, 2014)
3. Defined	Adaptive/ Appreciative/ Centralised management/ Competency/ Defining level/ Established/ Evolved/ Extend/ Focused/ Goal oriented/ Integrated/ Intermediate/ Linked/ Manageable/ Management level/ Managing/ Measure and manage/ Medium maturity/ Operational/ Reactive/ Standardisation/ Standardised knowledge/ Structured and proactive/ Structured/ The defined organisation/ The developing phase	(Caffyn, 1997; McRoberts and Sloan, 1998; Holland and Light, 2001; Wadhwa and Rao, 2002; Kaner and Karni, 2004; Lockamy and McCormack, 2004; Martin *et al.*, 2004; Balachandran and Balachandran, 2005; Garrett and Rendon, 2005; Martin *et al.*, 2005; Armitage *et al.*, 2006; Crawford, 2006; Doss and Kamery, 2006; Hirschheim *et al.*, 2006; Jørgensen *et al.*, 2006; Kenny, 2006; Mullaly, 2006; Strutt *et al.*, 2006; Chmieliauskas *et al.*, 2007; MacGillivray *et al.*, 2007; Pullen, 2007; Tiku *et al.*, 2007; Wademan *et al.*, 2007; Xiaoyan and Junwen, 2007; Grimshaw and Mike, 2008; Hogan, 2008; Mortensen *et al.*, 2008; Rasula *et al.*, 2008; Rendon, 2008; Zqikael *et al.*, 2008; Khaiata and Zualkerman, 2009; Minonne *et al.*, 2009; Yeo and Ren, 2009; Chaffey, 2010; Demir and Kocabaş, 2010; Fitterer and Rohner, 2010; Khatibian *et al.*, 2010; Markovic, 2010; Reyes and Giachetti, 2010; Simon *et al.*, 2010; Sohrabi *et al.*, 2010; Jochem *et al.*, 2011; McKenzie *et al.*, 2011; Rohloff, 2011; Tan *et al.*, 2011; Carcary, 2012; Chen and Fong, 2012; Ekionea *et al.*, 2012; Lianying *et al.*, 2012; Marx *et al.*, 2012; Randeree *et al.*, 2012; Serna, 2012; Bochenek and Blili, 2013; Campos *et al.*, 2013; Corneliu and Diana, 2013; Cronemyr and Danielsson, 2013; Killen and Hunt, 2013; Rapaccini *et al.*, 2013; Sanchez, 2013; Chung-Yang *et al.*, 2014; Masalskyte *et al.*, 2014; Neff *et al.*, 2014; Rae *et al.*, 2014; Ursacescu, 2014)

4. Measured	Active/ Administered and oriented/ Advanced/ Advanced/ Aware/ Collaborative/ Controlled/ Credibility/ Evaluation/ Improved/ Integrate and improve/ Integrated/ Integration level/ Managed/ Management level/ Mastering/ Normalised/ Organised/ Predictable/ Proactive/ Quantitatively managed/ Succeeding/ Systemic/ The controlled organisation/ The developed phase	(Caffyn, 1997; McRoberts and Sloan, 1998; Wadhwa and Rao, 2002; Hillson, 2003; Kaner and Karni, 2004; Lockamy and McCormack, 2004; Martin *et al.*, 2004; Balachandran and Balachandran, 2005; Fisher, 2005; Garrett and Rendon, 2005; Martin *et al.*, 2005; Armitage *et al.*, 2006; Crawford, 2006; Doss and Kamery, 2006; Hirschheim *et al.*, 2006; Jørgensen *et al.*, 2006; Mullaly, 2006; Strutt *et al.*, 2006; Chmieliauskas *et al.*, 2007; MacGillivray *et al.*, 2007; Pullen, 2007; Tiku *et al.*, 2007; Wademan *et al.*, 2007; Xiaoyan and Junwen, 2007; Grimshaw and Mike, 2008; Hogan, 2008; Magdaleno *et al.*, 2008; Mortensen *et al.*, 2008; Rasula *et al.*, 2008; Rendon, 2008; Zqikael *et al.*, 2008; Khaiata and Zualkerman, 2009; Minonne *et al.*, 2009; Yeo and Ren, 2009; Albu and Panzar, 2010; Buheji and Al-Zayer, 2010; Chaffey, 2010; Demir and Kocabaş, 2010; Fitterer and Rohner, 2010; Khatibian *et al.*, 2010; Markovic, 2010; Reyes and Giachetti, 2010; Sohrabi *et al.*, 2010; Zou *et al.*, 2010; Arling and Chun, 2011; Jochem *et al.*, 2011; McKenzie *et al.*, 2011; Rohloff, 2011; Tan *et al.*, 2011; Carcary, 2012; Chen and Fong, 2012; Ekionea *et al.*, 2012; Lianying *et al.*, 2012; Marx *et al.*, 2012; Randeree *et al.*, 2012; Serna, 2012; Bochenek and Blili, 2013; Campos *et al.*, 2013; Corneliu and Diana, 2013; Cronemyr and Danielsson, 2013; Killen and Hunt, 2013; Neverauskas and Railaite, 2013; Rapaccini *et al.*, 2013; Sanchez, 2013; Chung-Yang *et al.*, 2014; Hynds *et al.*, 2014; Masalskyte *et al.*, 2014; Neff *et al.*, 2014; Rae *et al.*, 2014; Ursacescu, 2014)
5. Optimising	Adapted/ Commitment/ Continuous learning and changed behaviour/ Continuous level/ Extended/ Full capability/ High maturity/ Integrated and optimised/ Integrated/ Leader/ Leading/ Natural/ Optimisation level/ Optimise and innovate/ Optimise/ Optimised/ Permanent improvement/ Predictive/ Proactive/ Rational/ Reflexive/ Strategic/ Supreme/ Sustained decisionmaking/ The highly developed phase/ The optimised organisation/ Thought leader/ Unattainable or ideal	(Caffyn, 1997; McRoberts and Sloan, 1998; Holland and Light, 2001; Wadhwa and Rao, 2002; Hillson, 2003; Kaner and Karni, 2004; Lockamy and McCormack, 2004; Martin *et al.*, 2004; Balachandran and Balachandran, 2005; Fisher, 2005; Garrett and Rendon, 2005; Martin *et al.*, 2005; Armitage *et al.*, 2006; Crawford, 2006; Doss and Kamery, 2006; Hirschheim *et al.*, 2006; Jørgensen *et al.*, 2006; Kenny, 2006; Mullaly, 2006; Strutt *et al.*, 2006; Chmieliauskas *et al.*, 2007; MacGillivray *et al.*, 2007; Pullen, 2007; Tiku *et al.*, 2007; Wademan *et al.*, 2007; Xiaoyan and Junwen, 2007; Grimshaw and Mike, 2008; Hogan, 2008; Magdaleno *et al.*, 2008; Mortensen *et al.*, 2008; Rasula *et al.*, 2008; Rendon, 2008; Zqikael *et al.*, 2008; Khaiata and Zualkerman, 2009; Minonne *et al.*, 2009; Yeo and Ren, 2009; Albu and Panzar, 2010; Buheji and Al-Zayer, 2010; Chaffey, 2010; Demir and Kocabaş, 2010; Fitterer and Rohner, 2010; Khatibian *et al.*, 2010; Markovic, 2010; Reyes and Giachetti, 2010; Simon *et al.*, 2010; Sohrabi *et al.*, 2010; Zou *et al.*, 2010; Arling and Chun, 2011; Jochem *et al.*, 2011; McKenzie *et al.*, 2011; Rohloff, 2011; Tan *et al.*, 2011; Carcary, 2012; Chen and Fong, 2012; Ekionea *et al.*, 2012; Lianying *et al.*, 2012; Marx *et al.*, 2012; Randeree *et al.*, 2012; Serna, 2012; Bochenek and Blili, 2013; Campos *et al.*, 2013; Corneliu and Diana, 2013; Cronemyr and Danielsson, 2013; Killen and Hunt, 2013; Neverauskas and Railaite, 2013; Rapaccini *et al.*, 2013; Sanchez, 2013; Chung-Yang *et al.*, 2014; Hynds *et al.*, 2014; Masalskyte *et al.*, 2014; Neff *et al.*, 2014; Rae *et al.*, 2014; Ursacescu, 2014)

Table 8: Composite Maturity Levels and Supporting Authors.

4.2.3.1 Service Innovation Capability Maturity Levels

The behavioural characteristics of service innovation capability at each level of maturity were principally derived from Essmann (2009), Müller-Prothmann and Stein (2011), Burger *et al.* (2011), Funchall *et al.* (2011), Denéle Esterhuizen *et al.* (2012), and Rapaccini *et al.* (2013).

1. Initial: Service innovation capability is characterised as ad hoc or chaotic. The organisation is conservative towards innovation and there is low awareness of its benefits or how they can be attained. They are reactive and undisciplined, with a short-term focus, and are consumed with day-to-day operations. Their priorities are maximising short-term revenue or reducing costs. Service innovation successes are unpredictable and inconsistent. If they do occur, it is mainly by 'accident' or as the result of individual efforts and competences, instead of through systematic organisational practices or processes.

2. Managed: The firm's awareness of service innovation begins to increase, and they start to realise that it is necessary to their continued successful operation. Managers have a greater understanding of the firm's service innovation needs and provide support for improvement initiatives. While service innovation management is not carried out according to established or systematic guidelines and is inconsistent and reactive, the firm now recognise and trace the capabilities and activities that enhance innovative service outputs. However, market requirements are poorly addressed, and their primary focus remains operational goals.

3. Defined: This is the breakthrough stage, where the organisation understands the need for the systematic management of service innovation and a cohesive strategy emerges with defined plans and priorities. Senior management are engaged, committed, and encourage employee creativity. Service innovation management is supported through standardised practices and procedures. This does not imply a cumbersome structure, but rather a proactive and planned approach to service innovation. Increased coordination, standardisation of activities, and integrated management result in innovative service outputs that sustain the firm's market share and position.

4. Measured: Standardised service innovation-related practices and processes are quantitatively measured, and the resultant performance data is used in strategic planning. The organisation has a long-term approach and a deep understanding of their service innovation model and its relationship with the requirements and context of the business and its overall strategy. Management are highly committed to service innovation and invest resources to improve necessary skills. The organisation's processes and the roles and responsibilities of staff members are clear, well defined, and understood by all. The use of defined practices, controlled by metrics, enable the pursuit of best practice and ensure that innovative service outputs are achieved consistently.

5. Optimising: This is a final idealistic state which represents the highest possible level of service innovation capability maturity, or best practice. Behaviours and practices related to service innovation are institutionalised and are second nature to staff. These precisely formalised activities are continuously improved based on their qualitative understanding and quantitative measurement. This ensures that the firm retain their position as a service innovation leader. All employees are empowered to be involved in service innovation and creativity and knowledge sharing are widely encouraged and promoted. Synergistic behaviours occur through the alignment of the overall business strategy and explicitly stated service innovation strategy. Ultimately, service innovations are consistently and repeatedly generated, resulting in sustained competitive advantage.

4.2.4 Step 5: Identify the Dimensions of SIC

The aim of the present step is to identify the dimensions of SIC. This construct is appropriately represented as multidimensional as multiple, conceptually distinguishable, and unique characteristics that are central to the generation or improvement of services are apparent in the literature (Pöppelbuß *et al.*, 2011; Witell *et al.*, 2016). This is evident in the work in of many SIC scholars who recognise various pertinent facets of this phenomenon and deconstruct it to enhance understanding (Wang and Ahmed, 2004; Tuominen and Anttila, 2006; Agarwal and Selen, 2009; Ngo and O'Cass, 2009; Hogan *et al.*, 2011). This approach also aligns with the DCV, where it is common for dynamic capabilities; often abstract, higher-order concepts; to be represented using distinct, separate, but interrelated subdimensions in the form of operational capabilities (Desouza, 2006). Indeed, the difficulty of observing service innovation capability directly and its high level of abstraction impede its strategic management and further support the rationale for its examination through its subdimensions (Janssen *et al.*, 2012).

However, because common methods have not been utilised in the study of SIC, the phenomenon has been dimensionalised in a variety of ways that vary in their scope and purpose. While there are studies that catalogue capabilities that enable organisations to manage service innovation, or list the antecedents of service innovation (Den Hertog *et al.*, 2010; Janssen *et al.*, 2015; Kim *et al.*, 2015), these are not reported here. This section identifies only the dimensions of SIC proposed by studies that represent the phenomenon as a hierarchical construct.

Hariandja (2016b) and others (Pöppelbuß *et al.*, 2011; Plattfaut *et al.*, 2012) adopt the viewpoint that SIC is a dynamic capability and dimensionalise the concept into capacities for sensing, seizing, and reconfiguring, identical to the approach used by Teece (2007) for categorising DC attributes.

Zhou and Wei (2010) propose development capability, production capability, marketing capability, and organisational capability as the dimensions of innovation capability in KIBS organisations. Hogan *et al.* (2011) identifies three dimensions, client-focused, marketing-focused, and technology-focused innovation capability. Ngo and O'Cass (2009) note their adherence to resource-based theory and propose three dimensions: possession of, application of, and full utilisation of resources. Tuominen and Anttila (2006) cite managerial innovation capability and technological innovation capability, while Wang and Ahmed (2004) specify behaviour innovativeness, product innovativeness, process innovativeness, market innovativeness, and strategic innovativeness as the dimensions of an organisation’s ability to innovate. Nada and Ali (2015) propose managerial capability, operational capability, strategic capability, and adaptive capability. Zitkiene *et al.* (2015) advance strategy, client, knowledge, network, and technology-focused capabilities as the dimensions of SIC.

From the foregoing dimensionalisations, it is clear that some authors focus on aspects that enable innovations of a particular type and others on the organisational activities integral to the development or improvement of services generally.

4.2.4.1 Dimensionalising Service Innovation Capability

The preceding discussion clearly conveys that SIC has multiple, conceptually distinguishable dimensions. Consequently, anything other than a multidimensional understanding of this phenomenon would be limited and insufficient. However, as common methods have not been utilised in the study of SIC, the aforementioned dimensionalisations have nominated divergent characteristics and none has specified their relationship to each other and the SIC construct. To overcome this obstacle, a novel process was undertaken for this study to concretely discern the subdimensions of SIC and the direction of their relationship to a construct representing this phenomenon.

Initially, a structured literature review was completed that incorporated studies of service innovation capability and service innovation success factors for SMEs. As a result, 50 candidate subdimensions were identified that were individually recognised by various authors as integral to service innovation (Van Riel *et al.*, 2004; Menor and Roth, 2007; Den Hertog *et al.*, 2010). It was critical that this list was complete, correct, and theoretically justified to prevent the omission of any characteristics that would restrict the conceptual meaning of the SIC construct (Bollen and Lennox, 1991; De Bruin *et al.*, 2005).

Next, this large list was reduced through the elimination of items that failed to meet capability criteria. It is for this reason, ‘creativity’, ‘culture’, or ‘leadership’ were not included. The rationale for this decision was rooted in the study’s understanding of ordinary level capabilities as components of a higher-order dynamic capability (Helfat *et al.*, 2007). As described earlier, this class of capabilities are manifest in stable patterns of collective activity that can be invoked repeatedly in the same way (Zollo and Winter, 2002). They are embedded in processes or routines, or groups thereof, illustrating their systematic nature and why they do not incorporate idiosyncratic events and the talents of individuals (Eisenhardt and Martin, 2000). As an example, it is not possible to execute creativity in precisely the same way on multiple occasions as it depends, to a large extent, on individual and contextual factors (Amabile, 1988). Consequently, 14 items were removed that described a behavioural characteristic, trait, proclivity, or aspect of an organisation's culture, rather than actions manifested in routines or processes (Helfat *et al.*, 2007).

From the surplus, a further 17 items were removed due to insufficient evidence or a lack of support that they were a critical subdimension of SIC or enabled service innovation in SMEs. The remaining candidate capabilities were then subjected to a grouping and categorisation exercise and ultimately clustered around four capability areas or subdimensions. An image illustrating this process can be seen in Figure 10.

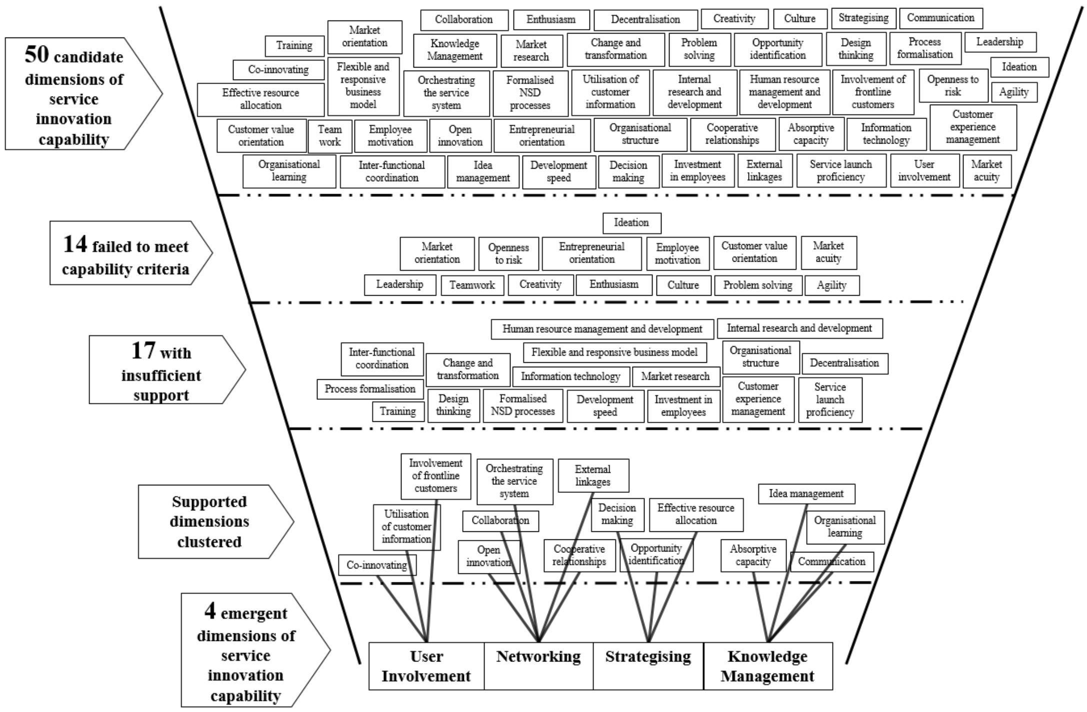

Figure 10: Process of Identifying Subdimensions of Service Innovation Capability.

Initially, while there appeared to be little consensus in the literature surrounding the construct of service innovation capability, underlying commonalities that both met capability criteria and were widely supported could be identified. Specifically, these were user involvement, knowledge management, strategising, and networking

(Blommerde and Lynch, 2014; Blommerde and Lynch, 2016). Table 9 illustrates the support for each of these subdimensions across the literature.

Subdimension	Authors
User Involvement	(Alam and Perry, 2002; Magnusson, 2003; Froehle and Roth, 2004; Lundkvist and Yakhlef, 2004; Lettl, 2007; Menor and Roth, 2008; Payne *et al.*, 2008; Agarwal and Selen, 2009; Carbonell *et al.*, 2009; Essmann, 2009; Den Hertog *et al.*, 2010; Larbig-Wust, 2010; Zhou, 2010; Hogan *et al.*, 2011; Nicolajsen and Scupola, 2011; Ordanini and Parasuraman, 2011; Salunke *et al.*, 2011; Svendsen *et al.*, 2011; Cheng *et al.*, 2012; Janssen *et al.*, 2012; Sjödin and Kristensson, 2012; Dadfar *et al.*, 2013; Milutinovic and Stosic, 2013; Rapaccini *et al.*, 2013; Santos-Vijande *et al.*, 2013; Jin *et al.*, 2014).
Knowledge Management	(Harigopal and Satyadas, 2001; Lawson and Samson, 2001; Numprasertchai and Igel, 2004; Adams *et al.*, 2006; du Plessis, 2007; Lundvall and Nielsen, 2007; Smith *et al.*, 2008; Essmann, 2009; Den Hertog *et al.*, 2010; Storey and Hull, 2010; Zhou and Wei, 2010; Delgado-Verde *et al.*, 2011; Rasmussen and Nielsen, 2011; Chen and Fong, 2012; Denéle Esterhuizen *et al.*, 2012; Janssen *et al.*, 2012; Mehrabani and Shajari, 2012; Gryszkiewicz *et al.*, 2013; Jin *et al.*, 2014).
Strategising	(Chase and Hayes, 1991; Sundbo, 1997; Lawson and Samson, 2001; Adams *et al.*, 2006; Siguaw *et al.*, 2006; Stewart and Fenn, 2006; Menor and Roth, 2007; 2008; Essmann, 2009; Arveson *et al.*, 2010; Den Hertog *et al.*, 2010; Giannopoulou *et al.*, 2011; Huang, 2011; Song *et al.*, 2011; Clausen *et al.*, 2012; Rubalcaba *et al.*, 2012; Gryszkiewicz *et al.*, 2013; Fox and Royle, 2014; Holtzman, 2014; Jin *et al.*, 2014; Roper and Xia, 2014).
Networking	(Bessant *et al.*, 2003; Adams *et al.*, 2006; Mohannak, 2007; Essmann, 2009; Den Hertog *et al.*, 2010; Hsueh *et al.*, 2010; Ngugi *et al.*, 2010; Rampersad *et al.*, 2010; Salunke *et al.*, 2011; Janssen *et al.*, 2012; Mitrega *et al.*, 2012; Mu and Di Benedetto, 2012; Gryszkiewicz *et al.*, 2013; Kindström *et al.*, 2013; Roxenhall, 2013; Mustak, 2014; Rusanen *et al.*, 2014).

Table 9: Subdimensions of Service Innovation Capability and Supporting Authors.

4.2.4.2 User Involvement

The importance of involving users or customers in innovative activities is supported by Agarwal and Selen (2009) who describe it as engagement and collaboration with customers, by Hogan et al. (2011) as a focus on clients, and by Den Hertog et al. (2010) and Janssen et al. (2012) as sensing user needs and co-producing. Similarly, Carbonell et al. (2012), Alam and Perry (2002), and Magnusson (2003), all substantiate the importance of user involvement to service innovation and suggest that it may be more important than for other types of innovation. Indeed, many conceptualisations of service innovation capability conceive user involvement as a key component as often services are simultaneously produced and consumed, meaning that this capability is not only a basis of production, but also plays a pivotal role in determining an organisation's ability to innovate (Salunke *et al.*, 2011; Milutinovic and Stosic, 2013; Hariandja *et al.*, 2014).

Diverse terms are frequently used to describe this concept, including customer interaction or customer partnership (Carbonell *et al.*, 2009), customer participation, knowledge co-creation, customer integration, customer desired role (Dadfar *et al.*, 2013), customer intimacy (Hammett, 2008), co-creation, co-development, collaborative innovation, joint development, participatory innovation, and user-centric innovation (Greer and Lei, 2012). Notwithstanding the diversity of labels used for this concept, all of them highlight understanding customer usage and benefits and the role of this understanding in creating value with the customer through innovation (Carbonell *et al.*, 2009; Greer and Lei, 2012; Dadfar *et al.*, 2013; Tichindelean, 2013). For this study, the title user involvement was selected to refer to this subdimension, as customers tend to be those who pay, whereas users actually consume the service and thus have a more meaningful function (Magnusson, 2003). While these designations may describe the same person, it is important to clearly specify the role that is being referred to.

Carbonell *et al.* (2009: 537) describe the capability as "the extent to which service providers interact with current (or potential) representatives of one or more customers". Bonner (1999) relates it to the broader concept of market orientation which describes acquiring, disseminating, and responding to market intelligence and requires customers to be part of the service transaction, or act as a co-producer (Hariandja et al., 2014).

This capability utilises actual users of a service as sources of knowledge and information, often leading to superior ideas and valuable information about competitors (Alam and Perry, 2002; Lundkvist and Yakhlef, 2004; Santos-Vijande *et* *al.*, 2013). Customer insights and cooperation are critical to discovering their needs (Fung, 2014); identifying problems and solutions; and offering inputs in terms of their likes and dislikes, which to some extent can replace costly and inexact traditional market intelligence (Svendsen et al., 2011; Carbonell and Rodriguez-Escudero, 2014; Melton and Hartline, 2015). Effective execution of this capability can overcome the problems associated with techniques such as ethnography, focus groups, interviews, surveys, and product or concept tests where the firm listens to, rather than collaborates with users (Bosch-Sijtsema and Bosch, 2015). Moreover, involvement of users when developing a service can assist with the attainment of use knowledge about problems and difficulties, ideas for new service opportunities, or behaviours and emotions that are important or sought after (Edvardsson *et al.*, 2012).

To McLaughlin (2012), it is self-evident that organisations who focus on the client are more likely to produce a service that is in line with their needs. The formerly predominant viewpoint of customers as passive actors has now evolved to a point where they are considered co-creators and co-innovators and their levels of participation go far beyond the contribution of ideas or suggestions (Sjödin and Kristensson, 2012; Ngo and O'Cass, 2013; Gemser and Perks, 2015). Users are now actively involved in all stages of innovation processes (Nicolajsen and Scupola, 2011) and play roles in the creation, development, production, and delivery of services (Cheng et al., 2012). Stephen L. Vargo and Robert F. Lusch (2004) contend that all value is co-created, appropriated, and perceived by customers and that market acceptance of an innovation cannot occur without their involvement.

User Involvement capability is defined by Matthing *et al.* (2004: 487) as “those processes, deeds, and interactions where a service provider collaborates with current (or potential) customers at the program and/or project level of service development, to anticipate customers’ latent needs and develop new services accordingly”. This capability relates to continuous collaboration with, and learning from, users in proactive and collaborative roles while innovating services to adapt to their changing needs (Carbonell *et al.*, 2012; Carbonell and Rodriguez-Escudero, 2014; Jin *et al.*, 2014). Cheng *et al.* (2012: 446) define this capability as “the degree to which customers take part in creating, producing, and delivering new services”, stating that selections regarding the "scope, intensity, role, and modes of involvement" must be made. A condensed view of this capability is that by Engström and Elg (2015), who perceive it as using customers as sources of information or as partners in service development.

The capability reflects both the breadth and depth of user involvement, whether it is conducted through one activity or a range of activities and if the involvement is superficial or deep (Carbonell *et al.*, 2012). Matthing *et al.* (2004) understand its key parameters to include the degree of intensity of the involvement, customer characteristics, the objective of the involvement, the phase in the service development process, the role of the customer, the mode of involvement, and the contribution of customers. Alam (2006) recognises the importance of first identifying the right users to involve. Traditionally, the focus has been on lead users, but there is growing evidence that ordinary users can also have an important role (Weber *et al.*, 2012; Gemser and Perks, 2015). Inherent in this capability is consideration of which stage or stages in service development processes interactions should take place (Carbonell *et al.*, 2009). In the opinion of Bonner (1999), it is possible for customers to be involved in all stages in the development of an innovation. They can assist with the generation of ideas, concept development, testing, and commercialisation (Bonner, 1999; Alam, 2006; Alam, 2011).

As with any capability, its presence within firms exists along a continuum, from low levels of possession to high degrees of "user integration as a part of the service process" (Dadfar *et al.*, 2013: 50). Peled and Dvir (2013) are of the view that when this capability is executed effectively, the line between producer and consumer is blurred.

In the context of this study, User Involvement capability incorporates the organisation's ability to employ multiple methods for involving service users in the development of innovations, ensure their involvement at many stages, and integrate users in multiple roles.

Among the benefits to firms are superior new or differentiated services, reduced development times (Ordanini and Parasuraman, 2011); an enhanced ability to predict future market changes (Lin et al., 2010); reduced uncertainty and risk (Cheng et al., 2012); improved service quality and market success (Ngo and O'Cass, 2013); a greater number of innovative ideas (Carbonell and Rodriguez-Escudero, 2014); reduced effort of gaining information, increased customer satisfaction, trust, and loyalty (Peled and Dvir, 2013); facilitation of user education, improved market acceptance, the establishment of long-term relationships with customers (Dadfar et al., 2013); the generation of ideas that users consider to be of greater relevance and value, reduced risk of imitation (Cheng et al., 2012; Jin et al., 2014); and ultimately improved service performance (Carbonell et al., 2009).

4.2.4.3 Knowledge Management

The contention that knowledge management is a subdimension of service innovation capability is supported within diverse literatures by Lawson and Samson (2001) who refer to it as idea management, Gryszkiewicz et al. (2013) under the term intellectual capital, and by Janssen et al. (2012) and Den Hertog *et al.* (2010) as experience-based organisational learning and adaption. Chapman *et al.* (2002) describes knowledge as an organisation's most important asset, while Delgado-Verde et al. (2011) consider firm innovation as the link between an organisation's knowledge and the creation of value for customers. It is similar, in many respects, to 'absorptive capacity' which describes the ability of an organisation to assimilate, manage, and apply knowledge for commercial ends, and which is also linked to innovation success (Cepeda-Carrion *et al.*, 2012).

The Knowledge Management (KM) capability is therefore closely related to an organisation's ability to manage and deploy knowledge assets for innovative purposes. According to du Plessis (2007), it is an umbrella term for a variety of interlocking knowledge-centred activities that an organisation conduct to make knowledge useful and usable for innovation. Knowledge Management capability is described by Rahab *et al.* (2011) and Crossan and Apaydin (2010) as a determinant of an organisation's innovation capability and a managerial lever for innovation. Assimilating, mobilising, and utilising external information is identified by Lin et al. (2010) and Çakar and

Ertürk (2010) as central to a firm's innovation capability. Similarly, Verona (2003) lists the collective capabilities of knowledge creation and absorption, knowledge integration, and knowledge reconfiguration as critical to innovation.

Knowledge Management capability is exhibited by firms that create and disseminate knowledge and embody organisational knowledge in their services and systems (Cepeda-Carrion *et al.*, 2012; Islam *et al.*, 2015). Jin *et al.* (2014) assert that the communication and exchange of information is critical to the successful development of new services and Cepeda-Carrion *et al.* (2012: 111) add that firms with "well-developed or high quality knowledge processing systems are more likely to be innovative".

Central to KM capability is the design of processes, procedures, and structures, or essentially, the 'framework conditions' that promote "efficient use, creation, and diffusions of knowledge" (Lundvall and Nielsen, 2007: 220). It describes the ability of firms to design and implement these structures and systems to effectively manage knowledge for service innovation in a manner that is specific to their operating conditions (Rasmussen and Nielsen, 2011). The procedures through which knowledge is organised and mobilised both as an input and a support for innovation have implications for innovation effectiveness and productivity (Leiponen, 2006; Rasmussen and Nielsen, 2011). Rahab *et al.* (2011: 113) describes the capability as "connected to the capturing, organising, reusing, and transferring" of knowledge in an organisation to make it accessible for all who need it.

For this study, Knowledge Management capability leverages processes and systems to support the effective use of knowledge for service innovation.

Mehrabani and Shajari (2012) describe the organisational benefits derived from effective KM as including improved decision making, process improvements, integration of data, and enhanced collaboration. Van Riel et al. (2004) suggest that it increases the probability of success with an innovation and reduces uncertainty through appropriate structures for gathering, diffusing, and processing information. Knowledge management also facilitates collaborative relationships and assists in the development of a culture that is conducive to creativity and innovation (Islam et al., 2015). To summarise, when an organisation's knowledge processes are well designed and managed, they improve decision making, enable enhanced strategic planning, allow for greater flexibility and adaptation to market changes, and reduce the risk and uncertainty around the development of services (Chapman et al., 2002; Jin et al., 2014).

4.2.4.4 Strategising

There is widespread acknowledgement by academics that strategising is a key component of service innovation capability (Lawson and Samson, 2001; Giannopoulou et al., 2011; Gryszkiewicz et al., 2013). Stewart and Fenn (2006) regard strategy as the foundation for innovation and believe that without it innovation may be blind, directionless, or never occur. Similarly, Rubalcaba et al. (2012) describe strategy as a prerequisite for any sort of innovative activity, and Huang (2011), considers the development and management of a clear service innovation strategy as necessary to fully maximise and exploit a firm's service innovation potential. Equally, Gryszkiewicz *et al.* (2013: 7) insist that without a strategy, interest and attention in service innovation can become too dispersed, arguing that the capability can both "reflect the ambitions and provide the organisational conditions" for a firm's service innovation goals to be achieved. Crossan and Apaydin (2010) understand strategy both as a capability and a managerial lever for innovation.

The foregoing convictions are illustrative that a strategy and vision for service innovation is an important internal driver of innovation capability (Lawson and Samson, 2001; Giannopoulou *et al.*, 2011). Indeed, Oke (2007) describe strategising capability as an area where an organisation must perform well to achieve a good innovation performance. Clearly there are important links between strategy and innovation as this determines the configuration of resources, processes, and systems; underlies decisions about which activities are to be performed; and results in the clear articulation of a common vision (Gryszkiewicz et al., 2013). Allocca and Kessler (2006) particularly stress the importance of a coherent strategy to SMEs as they can suffer greater losses if a new offering misses its mark.

Strategising capability decides "when, where, and how innovation will be used" within an organisation and involves setting the goals and objectives that innovations will be developed in pursuit of (Scheuing and Johnson, 1989; Holtzman, 2014: 25). Björkdahl and Börjesson (2012: 177) describe an innovation strategy as a firm's "conscious and systematic application of an expressed intent… and the extent to which it is understood throughout" that organisation. Nooghi (2015: 341) is of the view that strategic orientation has a huge effect on an organisation's ability to innovate, describing it as "specific instructions by the company to create suitable behaviours for the continual improvement of an organisation's performance". Strategically innovating through services demands high degrees of clarity in thought and competitive positioning, entailing an understanding of who the customer is, what services to offer, and how they can be efficiently delivered (Siguaw et al., 2006).

In the context of this study, Strategising capability encompasses the ability of an organisation to allocate resources, identify specific areas of focus for innovation, and set goals and objectives that service innovations can be developed in pursuit of.

Strategising capability enables firms to overcome their resource constraints in the selection of projects, determine the optimal manner in which to undertake them, evaluate acceptable levels of risk and complexity, respond to the movements of competition, and ultimately generate a continuous stream of purposeful innovations (Sundbo, 1997; Song *et al.*, 2011; Rubalcaba *et al.*, 2012; Jin *et al.*, 2014; Roper and Xia, 2014). Among the benefits of this capability, are that it ensures resources are available for specific new service development projects, developed services are in line with the overall strategy of the organisation, and that their characteristics and delivery mechanisms align with the demands and expectations of customers (Menor and Roth, 2007). Importantly, for SMEs with limited capital or resources, it allows them to decide where investments can "yield the most sustainable results" and make the greatest contribution to firm longevity (Fox and Royle, 2014: 30).

4.2.4.5 Networking

Numerous authors outline the importance of orchestrating and managing networks for innovation and the creation of value (Den Hertog *et al.*, 2010; Ordanini and

Parasuraman, 2011; Janssen *et al.*, 2012; Kindström *et al.*, 2013). Gryszkiewicz et al. (2013). Salunke et al. (2011) refer to this as networking capability and emphasise the value of relational capital and learning from networks that span organisational boundaries.

Service innovation is dynamic, non-linear, highly reciprocal, and influenced to a large extent by actors and forces outside the firm (Mustak, 2014). Relationships with these actors influence the capacity that individual firms have to innovate their services through the dynamic interplay between firm capabilities and the external environment (Mohannak, 2007). In some respects, this capability is related to the concept of open innovation, where external knowledge is used to accelerate internal innovation (Plattfaut *et al.*, 2013).

Carbonell and Rodriguez-Escudero (2014: 119) understand that service innovations are "increasingly the outcome of interfirm cooperations in the form of networks which include stakeholders such as suppliers, customers, competitors, and universities". Networking capability has been described as "the process of innovating services through combining the ideas, knowledge, capabilities, and technologies" of interconnected actors (Mustak, 2014: 152). Mu and Di Benedetto (2012) consider it as an organisation's ability to both exploit its existing ties with external entities and to explore new ones. This requires thinking of firms not as passive network participants, but as strategically building, managing, and leveraging them to their advantage (Mu and Di Benedetto, 2012).

Access to business networks and partners are central to service innovations as they are often co-designed and co-produced (Westerduin, 2012). Indeed, service innovation is increasingly being conducted through the "successful coordination of a network of firms", with the implication that participating in a network increases SIC (Sajib and Agarwal, 2012). Saunila and Ukko (2013) list access to external knowledge as a core component of innovation capability. Lawson and Samson (2001) identify network relationships with suppliers and competitors as a source of innovation. Similarly, Hiekkanen et al. (2012) argue that successful service innovations are the result of a multidimensional service innovation capability that includes the proactive creation, development, and maintenance of relationships with partners.

Perks *et al.* (2012) understand that this capability is more important to SMEs as they have fewer internal resources and can use their networks to compensate for this disadvantage. This describes cases where it is not possible for a service provider to supply all the elements required for a solution on their own merits and thus must cross the boundaries of the organisation (Agarwal and Selen, 2009; Janssen *et al.*, 2012). Interaction with network actors is important to the development of services, with highly innovative firms co-innovating with business partners more frequently (Den Hertog *et al.*, 2010; Westerduin, 2012). These may include stakeholders from academia, associations, or public authorities (Barlatier et al., 2012).

The capability describes a firm's proficiency for understanding the value network in which they operate and their ability to manage and orchestrate coalitions with different partners with whom it is possible to provide new experiences or solutions with (Frishammar *et al.*, 2012). Chen *et al.* (2011) and Plattfaut *et al.* (2012) emphasise the importance of partner identification, evaluation, and selection. Janssen *et al.* (2012) stress the creation and maintenance of relationships in the coordination of innovative activities. In some respects, this capability could also be referred to as understanding the value network and orchestrating the service system (Den Hertog *et al.*, 2010). Orchestration in this context describes the ability of an organisation to "manage and transform the service system, especially external actors that are central to service performance" (Kindström and Kowalkowski, 2014: 104).

For this study, Networking capability refers to an organisation's ability to configure and manage networks, effectively select beneficial partners, and proactively build networks for service innovation.

Firms have a variety of motives for developing this capability, including, access to diverse resources and capabilities, the distribution of costs and risk, a reduction in environmental uncertainty, enhanced knowledge transfer and organisational learning, accelerated service development, and faster and more efficient commercialisation and diffusion of innovations (Greer and Lei, 2012; Kowalkowski and Kindström, 2013; Mustak, 2014; Rusanen *et al.*, 2014). However, the overarching and primary incentive is that the results that can be achieved through a network are greater than could ever be achieved by a firm independently (Hsueh et al., 2010). Networking for innovation can occur through both formal and informal relationships and results in beneficial external knowledge and greater access to resources (Jenssen and Nybakk, 2009).

4.2.5 Step 6: Confirm the Suitability of Dimensions as Formative Indicators of SIC

In order to provide managerial insights and overcome the deficiencies of existing reflective measures, this study represents SIC as a formative construct. When a relationship is modelled in this way, causality is understood to flow from the dimensions to the construct and indicators of the dimensions cause variance in the construct (See §2.3.1 for a full description of the two primary classes of construct) (Law *et al.*, 1998). The appropriateness of representing the relationship between SIC and indicators of its dimensions in this way was assessed using the criteria for both of the primary classes of relational direction, summarised in Table 10.

Criteria	Reflective Indicators	Formative Indicators
1. What is the nature of the relationship between the construct and indicators?	The indicators are manifestations of the construct; the construct causes changes in the indicators.	The indicators are defining characteristics of the construct; the indicators cause changes in the construct.
2. Are the indicators interchangeable?	Yes, the indicators are sampled from the same conceptual domain and share a strong common theme.	No, each indicator captures a unique and essential aspect of the construct's conceptual domain.
3. Are the indicators expected to covary?	Yes, the indicators are strongly correlated with each other.	No, there is no requirement for indicators to be correlated and they may be entirely uncorrelated.
4. Are all of the indicators expected to have the same antecedents and/or consequences?	Yes, the indicators have the same antecedents and consequences.	No, each indicator may differ in its antecedents and consequences on the basis of the unique aspect of the construct's conceptual domain that it taps.

Table 10: Criteria to Determine Whether Indicators are Reflective or Formative.
Adapted from Southwick (2014: 50)

With regard to criterion 1, SIC does not cause changes in its indicators. The maturity, or sophistication of an organisation's ability to innovate its services does not impact on its ability to strategise for service innovation, involve users in the development of innovations, orchestrate networks for service innovation, or manage knowledge to support innovation. Instead, these capabilities, or subdimensions, are indicators of SIC's defining characteristics and changes in their maturity cause changes to the maturity of SIC. For criterion 2, each of the indicators can be designated unique as each captures an essential aspect of SIC's conceptual domain not examined by the others. Specifically, User Involvement capability describes a very different set of competences to those for devising and implementing strategies, or for any of the other subdimensions. Respecting criterion 3, a change in the maturity of SIC can occur as the result of a change in the maturity of a single subdimension, without a change in the maturity of other subdimensions necessarily occurring also. Finally, for criterion 4, User Involvement, Knowledge Management, Strategising, and Networking capabilities are understood to have different theoretically appropriate antecedents and consequences (Polites et al., 2012). Ultimately, examining the four subdimensions against these criteria conclusively supports the notion that they can be accurately represented as formative indicators of SIC.

For MacKenzie *et al.* (2011), it is critical for a researcher to next stipulate how the multiple subdimensions combine to 'form' the focal construct. Conceptually, the subdimensions are causes of the construct, but empirically the construct must be some function of these subdimensions (Edwards, 2001; El Akremi *et al.*, 2015). However, whether this function is additive, multiplicative, or based on "more complex algebraic formulas" must be precisely detailed when describing the manner in which the combination of subdimensions give empirical meaning to the construct (Polites *et al.*, 2012: 25). This structural property describes the relationship between variables and can be direct, where one effects the other; indirect, where the effect of one variable on another is mediated by one or a number of other variables; spurious, in which the effect is a result of multiple correlated or common causes; or unanalysed, in that effects result from the associations among predetermined variables (Edwards and Bagozzi, 2000).

In this study, the maturity score for service innovation capability is determined by its indicators and is an aggregation of the maturity scores achieved by them (Cohen *et al.*, 1990; Podsakoff *et al.*, 2003b; Wong *et al.*, 2008). In line with existing research, where maturity levels are cumulative and progressive and higher levels build upon the requirements of lower ones (De Bruin *et al.*, 2005; Maier *et al.*, 2012), the overall maturity score for SIC corresponds to that attained by the subdimension with the lowest maturity score. This is because this score represents the only maturity level which has been achieved by *all* subdimensions. Consequently, SIC can be regarded as a dependent variable, where a change in the maturity of only one, or a combination, of the subdimensions (independent variables) imply changes in overall service innovation capability maturity (without a change necessarily occurring in the maturity level of any of the other subdimensions) (Bollen and Lennox, 1991; Blommerde and Lynch, 2014). The subdimensions contribute separately to the overall empirical meaning of the construct through a direct, additive model, where there is a linear relationship between the maturity of the subdimensions and that of service innovation capability (Polites *et al.*, 2012). No differential weights were specified for the subdimensions as none were postulated as being more important than the others (MacKenzie *et al.*, 2005).

Figure 11 illustrates a conceptual model for how the maturity score for SIC is assigned. Each of the four subdimensions can be at any of the five composite levels of maturity described in §4.2.3 and are reflectively measured. Details regarding the measurement of the subdimensions are provided later in §5.2. Readers must note that Figure 11 is *not* a measurement model[2] and, rather than depicting four latent variables that are measured by five items, illustrates only that each of variables of interest, User Involvement, Knowledge Management, Strategising, Networking, and the Service Innovation Capability variable, can be at any of the five levels of maturity. With maturity models, as each "maturity level is a prerequisite to the next higher one... [each] encompasses all previous lower levels" (Tan *et al.*, 2011: 6). Therefore, the only maturity level that can be achieved by SIC is one for which *all* previous levels have been achieved by *all* subdimensions (Salvaterra, 2008; Chovanová *et al.*, 2019). The overall maturity score for SIC, then, corresponds to that for the subdimension with the lowest maturity score, as this signifies the only maturity level for which the requirements have been fulfilled by *all* subdimensions.

[2] Critically, it must be understood by readers there is divergence between the conceptual and empirical representation of SIC in this study. Conceptually, in Figure 11, dynamic service innovation capability is a second-order formative construct that is caused by four subdimensions, first-order ordinary level capabilities. However, empirically, SIC is not measured as a higher-order construct, but simply as first-order latent construct with formative indicators (MacKenzie *et al.*, 2011). This is elaborated upon further in §5.3.1.

Figure 11: Conceptual Model Demonstrating How the Maturity Score for SIC is Determined.

4.2.5.1 Capability Interrelationships

For this study, SIC is depicted as a multidimensional construct caused by four interrelated subdimensions represented by formative indicators. Adhering to the principles of the dynamic capabilities view, SIC is represented as a DC and its subdimensions as ordinary level or operational capabilities (Fuchs *et al.*, 2000; Zollo and Winter, 2002; Zahra *et al.*, 2006; Agarwal and Selen, 2009; Kislov *et al.*, 2014).

While User Involvement capability, Knowledge Management capability, Strategising capability, and Networking capability exist in different domains, they are hypothesised to be interdependent. Simply stated, each subdimension describes a single facet of service innovation capability, but their relationships and interplay contribute to the construct's conceptual meaning and determine its empirical meaning. The interactive capability areas can be used in multiple combinations and each is connected to all others in a circular and linked manner (Desouza, 2006). This is in line with Loasby

(2010), who contends that capabilities do not function as isolated units, but instead operate in particular combinations. Accordingly, this study theorises that there is some degree of complementarity between the capability areas, said to occur when "the marginal return to an activity/resource is increased by the presence of another activity/resource" (Menor and Roth, 2007: 830).

For instance, an organisation's strategic intent determines what information or knowledge is considered to be of value (Johnson and Filippini, 2010). This allows for the streamlined identification and application of knowledge, enabling a firm to innovate more productively. Strategising influences the Networking capability through decisions that relate to beneficial collaborations or the coordination of the actors in a firm's organisational network (Song *et al.*, 2011; Hsieh *et al.*, 2012; Mu and Di Benedetto, 2012; Roper and Xia, 2014). Strategy also dictates which customers or users should be included in innovation, in addition to the extent, stages, intensity, channels employed, and incentives offered for their involvement (Magnusson *et al.*, 2003; Lundkvist and Yakhlef, 2004; Carbonell *et al.*, 2009; Nicolajsen and Scupola, 2011; Sjödin and Kristensson, 2012).

Knowledge Management capability informs and improves strategic planning for innovation, supporting critical choices relating to resource use and ensuring that accurate and relevant information and knowledge are available to decision makers at the appropriate time (Johnson and Filippini, 2010; Salunke *et al.*, 2011; Mehrabani and Shajari, 2012; Jin *et al.*, 2014). It facilitates collaborative relationships with networked actors and enables the acquisition and sharing of knowledge and interorganisational learning (Swan *et al.*, 1999; du Plessis, 2007). Similarly, the ability to effectively manage customer knowledge determines an organisation's capacity to innovate or co-create value with them (Quinn, 1999; Belkahla and Triki, 2011).

Networking capability enables an organisation to expand their strategic options through the sharing of risk and access to additional resources or markets (Mohannak, 2007; Lasagni, 2012; Rusanen *et al.*, 2014). It allows organisations to obtain new ideas and useful knowledge through the coordination of interactive learning across organisational boundaries and utilisation of links with other organisations, universities, or research units (Pittaway *et al.*, 2004; Hsieh *et al.*, 2012; Mu and Di Benedetto, 2012; Roper and Xia, 2014). Additionally, many features of Networking capability are similar to those of User Involvement capability and their complementarity enhances an organisation's ability to build and manage customer relationships (Nicolajsen and Scupola, 2011; Holtzman, 2014).

An organisation's service innovation strategy is driven by the needs and requirements of users (Svendsen *et al.*, 2011; Holtzman, 2014). Through effective user involvement these needs can be accurately matched with resources, enabling a business to meet their current and future demands through innovation (Sundbo, 1997; Sjödin and Kristensson, 2012). Customers also play a role in an organisation's knowledge systems, contributing diverse ideas and innovative ways of thinking which can become inputs in the development of innovations (Magnusson, 2003; Lundkvist and Yakhlef, 2004; Chen *et al.*, 2011; Greer and Lei, 2012). Finally, the complementarity between User Involvement capability and Networking capability can enhance the ability of an organisation to build strong, ongoing relationships with network actors (Nicolajsen and Scupola, 2011; Dadfar *et al.*, 2013).

4.2.6 Step 7: Specify the Conceptual Theme of the Dimensions

For this step, the four subdimensions were mapped to each of the five maturity levels. This facilitated the specification of their conceptual theme or the development of clear descriptions of their anticipated properties or characteristics at all levels (Maier *et al.*, 2012). This is illustrated in Figure 12. To determine the evolving characteristics of the subdimensions in SMEs, a variety of studies describing the evolution of similar capabilities through comparable maturity levels and in similarly sized organisations were examined and integrated.

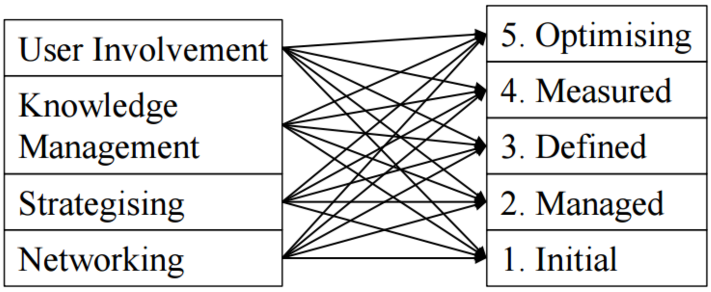

Figure 12: Mapping Capability Areas to Maturity Levels.

4.2.6.1 User Involvement

The behavioural characteristics of the User Involvement capability at each stage of maturity were principally derived from Biemans (1992), Alam (2002), Nagele (2006), Burger et al. (2011), Rapaccini et al. (2013), and Jin et al. (2014).

1. Initial: Users play little or no role in the development of service innovations. They are simply considered as buyers of the service and it is assumed that service developers know what they want.

2. Managed: Users are involved through study and observation, but there is little direct contact. Ideas primarily come through internal channels such as sales reports, feedback, and complaints. The role of the user in innovation is focused on defining the requirements for new or improved services.

3. Defined: Users are loosely involved in the early stages of service development or improvement. They are considered to be experts and important information sources and are surveyed for market analysis and definitions of service requirements. This ensures that their demands and ideas are incorporated into existing and new service innovation projects.

4. Measured: Users are co-designers and have an active, ongoing role and influence on innovation development processes. The firm uses proactive market research techniques to interact with users and they are integrated into both the early stages of ideation and service development and in the verification and testing of new services or service improvements, prior to their launch.

5. Optimising: Users play an intrinsic role in innovation processes and are consistently involved at key decision points. The organisation views users as partners and their ongoing relationship extends beyond single projects. There is constant user participation and interaction through customer groups or clubs which maintain their input and cooperation. Some users are involved as co-designers and co-producers and assist with the creation of solutions that are broad in scope.

4.2.6.2 Knowledge Management

The behavioural characteristics of the Knowledge Management capability at each level of maturity were principally derived from Crossan et al. (1999), Desouza (2006), Rasula et al. (2008), Pee and Kankanhalli (2009), Khatibian *et al.* (2010), Serna (2012), Jin et al. (2014), Oliva (2014), Serenko *et al.* (2014), and Vanini and Bochert (2014).

1. Initial: Little effort is made to formally manage activities surrounding organisational knowledge. Any activities that do occur, do so in an unconscious way that is neither systematic nor uniform. Organisational communication is very poor and this limits the flow of information. The organisation does not have the capacity to attend to external knowledge.

2. Managed: Some basic processes are in place for capturing and utilising organisational knowledge. However, these are inconsistently adhered to by employees whose actions are predominantly guided by past experiences, observations, the recognition of patterns, and intuition; all of which occur at an individual level.

3. Defined: Some knowledge is gathered, documented, and communicated and there is a steadily growing learning culture. A portion of the organisation's vertical and horizontal communication occurs through a basic infrastructure or architecture introduced to support organisational knowledge management. However, while employee roles and responsibilities in this area have been defined and clarified, their shared understandings and actions are generally changed through conscious elements shared at the group level.

4. Measured: Standardised processes for capturing and sharing knowledge are well established in the organisation. Quantitative criteria are used to measure and provide feedback regarding the performance of these processes and foster learning from both successes and failures. However, knowledge sharing and learning are not yet organisation wide and remain limited to certain departments or organisational functions.

5. Optimising: The widespread, automatic sharing of knowledge and regular, transparent open communication are part of the organisation's culture. Individuals readily teach and mentor each other and learning occurs at the organisational level. The organisation understands their knowledge management performance and continuously improves processes and routines relating to organisational learning and the management of knowledge for service innovation.

4.2.6.3 Strategising

The behavioural characteristics of the Strategising capability at each level of maturity were principally derived from Gluck (1982), Kenny (2006), Arveson et al. (2010), and Jin *et al.* (2014).

1. Initial: Strategy gets little attention and there is no formal strategy for service innovation in place. The organisation are primarily concerned with tactical or operational planning that occurs in an ad hoc manner by senior management and does not involve staff. The majority of the organisation's time is spent 'putting out fires' and they have no long-term goals.

2. Managed: There is some strategic planning for service innovation, but these activities are not rigorous, occur only infrequently, and tend to be reactionary. Strategic planning is a financial concern that does not go much further than budgeting and forecasting revenue, costs, and capital requirements.

3. Defined: Formal and comprehensive structures are in place that allow organisations to engage in strategic service innovation planning, primarily using simple forecasting tools. Service innovation begins to become aligned with the overall objectives of the business. Processes are in place to manage resource allocation and ensure sufficient availability to innovation projects. The strategy and objectives are clearly developed, communicated, and accepted. However, there is a static focus on current capabilities, rather than alternatives and the firm does not engage with staff in strategy development.

4. Measured: Employees are engaged in formal strategic planning processes and plans are regularly developed and revised by cross-functional teams. In-depth strategy analysis assists the organisation with understanding future organisational success factors. Resource allocation is dynamic with the purpose of creating new capabilities or redefining the market. Organisational standards and methods relating to strategy development and management are measured and controlled. The objective of service innovations are to outperform similar competitors.

5. Optimising: Processes for the development of service innovation strategies are institutionalised and part of the culture. Strategic service innovation planning is aligned with operational management and resource allocation corresponds to the overall strategy. Strategic planning excellence is continuously improved through adaptations to standards and methods, when required. Service innovation strategies and objectives are regularly communicated and there is 'ownership' by employees at all levels in the form of participation and commitment. The strategic planning framework is shaped around tomorrow's concept of the business and this foresight supports risk management and ideation by identifying upcoming trends, opportunities, and threats. The objective of new or improved services is to do what competitors cannot, or to create new markets.

4.2.6.4 Networking

The behavioural characteristics of the Networking capability at each level of maturity were principally derived from Burger et al. (2011) and Rapaccini et al. (2013).

1. Initial: Other than discrete instances arranged by individuals, networking and collaboration with external parties does not occur. The organisation have a conservative attitude towards opening their boundaries for knowledge sharing or cooperation. Suppliers and other actors are not involved in developing or improving services and no consideration is given to their possible contribution or the impact that changes due to innovations may have on them.

2. Managed: The organisation begins to understand the importance of involving external parties in innovation and becomes receptive towards opening their boundaries for knowledge sharing and cooperation.

3. Defined: There are defined and deployed practices for networking and informal networking is encouraged. Knowledge is shared, to a moderate extent, across organisational boundaries. Some external stakeholders have an input into service innovation initiatives, such as those who are involved with the delivery of detailed tasks related to new or improved services.

4. Measured: An effort is made to integrate all external stakeholders interested in or impacted by new or changed services into innovation activities, but this is not achieved on each occasion. While the organisation does not actively search for other parties with whom alliances can be formed or cooperation can occur, they are amenable to initiating these arrangements to spread risk or establish new sources of revenue. Performance metrics are used to monitor and control interactions and collaboration.

5. Optimised: There are established, institutionalised processes in place for building and maintaining relationships with external stakeholders and any that are interested in or impacted by changes are identified and involved. The organisation learns from their successes and continuously improves these processes, accessing the skills and knowledge of external parties when required, and leveraging and exploiting their relationships with highly skilled parties such as research groups and consultants. Complementary external stakeholders are actively identified, and open innovation and cooperation inspires new services and incremental improvements to existing services.

4.2.6.5 The Service Innovation Capability Maturity Model

The Service Innovation Capability Maturity Model (SICMM), presented in Table 11, is an evolutionary model describing the characteristics of the subdimensions of SIC through a succession of stages which increase in complexity and sophistication as their performance approaches best practice (Desouza, 2006). It is a complex and robust model, informed by the literature, that consists of five levels of maturity and four major capability areas, which can be at any of the maturity levels. This maturity model addresses areas neglected by other studies as the framework is tailored to the service innovation capability of SMEs.

The elemental purpose of SICMM is to cluster best practices associated with the subdimensions of SIC, into logical, attainable, and progressive trajectories that describe their optimal improvement path. A critical challenge when developing SICMM was ensuring that these best practices were captured in a sufficiently generic way so that the model did not become too specific to a firm, sector, or industry; or become extraneous in changing markets (Essmann, 2009). Consequently, the proposed characteristics of the subdimensions do not depend on any rigid conditions and their generalisability facilitates the testing of, or comparison with, the maturity of any SME regardless of its size or industry (Jochem *et al.*, 2011).

This study's central contention mirrors other maturity studies (Essmann, 2009; Jin *et al.*, 2014) and anticipates that the higher the maturity level of each of the four subdimensions, the higher an organisation's overall SIC maturity will be. In the words of Corsi and Neau (2015: 15), "any system reflects the maturity of its subsystems".

While it may seem counterintuitive that the increased formalisation or institutionalisation of four ordinary level capabilities will enhance an organisation's ability to innovate its services, SICMM's primary objective is to add predictability and consistency to the innovative outputs generated by SMEs and its formalised aspects do not equate to a rigid and inflexible structure.

	User Involvement	Knowledge Management	Strategising	Networking
Maturity Level 1: Initial	Users play little or no role in the development of service innovations. They are simply considered as buyers of the service and it is assumed that service developers know what they want.	Little effort is made to formally manage activities surrounding organisational knowledge. Any activities that do occur, do so in an unconscious way that is neither systematic nor uniform. Organisational communication is very poor and this limits the flow of information. The organisation does not have the capacity to attend to external knowledge.	Strategy gets little attention and there is no formal strategy for service innovation in place. The organisation are primarily concerned with tactical or operational planning that occurs in an ad hoc manner by senior management and does not involve staff. The majority of the organisation's time is spent 'putting out fires' and they have no long-term goals.	Other than discrete instances arranged by individuals, networking and collaboration with external parties does not occur. The organisation have a conservative attitude towards opening their boundaries for knowledge sharing or cooperation. Suppliers and other actors are not involved in developing or improving services and no consideration is given to their possible contribution or the impact that changes due to innovations may have on them.
Maturity Level 2: Managed	Users are involved through study and observation, but there is little direct contact. Ideas primarily come through internal channels such as sales reports, feedback, and complaints. The role of the user in innovation is focused on defining the requirements for new or improved services.	Some basic processes are in place for capturing and utilising organisational knowledge. However, these are inconsistently adhered to by employees whose actions are predominantly guided by past experiences, observations, the recognition of patterns, and intuition; all of which occur at an individual level.	There is some strategic planning for service innovation, but these activities are not rigorous, occur only infrequently, and tend to be reactionary. Strategic planning is a financial concern that does not go much further than budgeting and forecasting revenue, costs, and capital requirements.	The organisation begins to understand the importance of involving external parties in innovation and becomes receptive towards opening their boundaries for knowledge sharing and cooperation.
Maturity Level 3: Defined	Users are loosely involved in the early stages of service development or improvement. They are considered to be experts and important information sources and are surveyed for market analysis and definitions of service requirements. This ensures that their demands and ideas are incorporated into existing and new service innovation projects.	Some knowledge is gathered, documented, and communicated and there is a steadily growing learning culture. A portion of the organisation's vertical and horizontal communication occurs through a basic infrastructure or architecture introduced to support organisational knowledge management. However, while employee roles and responsibilities in this area have been defined and clarified, their shared understandings and actions are generally changed through conscious elements shared at the group level.	Formal and comprehensive structures are in place that allow organisations to engage in strategic service innovation planning, primarily using simple forecasting tools. Service innovation begins to become aligned with the overall objectives of the business. Processes are in place to manage resource allocation and ensure sufficient availability to innovation projects. The strategy and objectives are clearly developed, communicated, and accepted. However, there is a static focus on current capabilities, rather than alternatives and the firm does not engage with staff in strategy development.	There are defined and deployed practices for networking and informal networking is encouraged. Knowledge is shared, to a moderate extent, across organisational boundaries. Some external stakeholders have an input into service innovation initiatives, such as those who are involved with the delivery of detailed tasks related to new or improved services.
Maturity Level 4: Measured	Users are co-designers and have an active, ongoing role and influence on innovation development processes. The firm uses proactive market research techniques to interact with users and they are integrated into both the early stages of ideation and service development and in the verification and testing of new services or service improvements, prior to their launch.	Standardised processes for capturing and sharing knowledge are well established in the organisation. Quantitative criteria are used to measure and provide feedback regarding the performance of these processes and foster learning from both successes and failures. However, knowledge sharing and learning are not yet organisation wide and remain limited to certain departments or organisational functions.	Employees are engaged in formal strategic planning processes and plans are regularly developed and revised by cross-functional teams. In-depth strategy analysis assists the organisation with understanding future organisational success factors. Resource allocation is dynamic with the purpose of creating new capabilities or redefining the market. Organisational standards and methods relating to strategy development and management are measured and controlled. The objective of service innovations are to outperform similar competitors.	An effort is made to integrate all external stakeholders interested in or impacted by new or changed services into innovation activities, but this is not achieved on each occasion. While the organisation do not actively search for other parties with whom alliances can be formed or cooperation can occur, they are amenable to initiating these arrangements to spread risk or establish new sources of revenue. Performance metrics are used to monitor and control interactions and collaboration.
Maturity Level 5: Optimising	Users play an intrinsic role in innovation processes and are consistently involved at key decision points. The organisation views users as partners and their ongoing relationship extends beyond single projects. There is constant user participation and interaction through customer groups or clubs which maintain their input and cooperation. Some users are involved as co-designers and co-producers and assist with the creation of solutions that are broad in scope.	The widespread, automatic sharing of knowledge and regular, transparent open communication are part of the organisation's culture. Individuals readily teach and mentor each other and learning occurs at the organisational level. The organisation understands their knowledge management performance and continuously improves processes and routines relating to organisational learning and the management of knowledge for service innovation.	Processes for the development of service innovation strategies are institutionalised and part of the culture. Strategic service innovation planning is aligned with operational management and resource allocation corresponds to the overall strategy. Strategic planning excellence is continuously improved through adaptations to standards and methods, when required. Service innovation strategies and objectives are regularly communicated and there is 'ownership' by employees at all levels in the form of participation and commitment. The strategic planning framework is shaped around tomorrow's concept of the business and this foresight supports risk management and ideation by identifying upcoming trends, opportunities, and threats. The objective of new or improved services is to do what competitors cannot, or to create new markets.	There are established, institutionalised processes in place for building and maintaining relationships with external stakeholders and any that are interested in or impacted by changes are identified and involved. The organisation learn from their successes and continuously improve these processes, accessing the skills and knowledge of external parties when required, and leveraging and exploiting their relationships with highly skilled parties such as research groups and consultants. Complementary external stakeholders are actively identified and open innovation and cooperation inspires new services and incremental improvements to existing services.

Table 11: The Service Innovation Capability Maturity Model.

4.3 Chapter Conclusion

The maturity of an SME's service innovation capability determines their ability to persistently and continuously develop and improve their services and is consequently critical to their performance (McDermott and Prajogo, 2012; Lillis *et al.*, 2015).

However, there is neither a concrete, agreed upon conceptual model of SIC nor an instrument through which its maturity can be assessed. The ramifications of these shortcomings are that the strategic management of this capability is impeded as organisations lack a clear understanding of their SIC performance and are unaware of where resources ought to be directed for its improvement (Enkel *et al.*, 2011; Secundo *et al.*, 2015).

To address these deficiencies, this chapter conceptualised SIC as a construct caused by the organisational capabilities, (i) User Involvement, (ii) Knowledge Management, (iii) Strategising, and (iv) Networking. Consequently, an SME's service innovation capability maturity score can be calculated by aggregating the maturity of these four subdimensions. While these subdimensions are discussed frequently in the service innovation literature (Gryszkiewicz *et al.*, 2013; Santos-Vijande *et al.*, 2013; Fox and Royle, 2014; Rusanen *et al.*, 2014), to facilitate their measurement and management, a clear understanding was required of their observable and distinct characteristics at each hypothesised level of maturity. This was achieved through the synthesis of theoretically derived behavioural characteristics for each subdimension at the five maturity levels, culminating in their representation in a service innovation capability maturity model.

Although it is possible to measure overall service innovation capability maturity using a global reflective indicator (e.g. Using numbers 1-5, with 1 representing poor and 5 excellent, how would you rate your organisation's overall ability to innovate its services?), its assessment through multiple subdimensions is significantly more advantageous (Southwick, 2014). Specifically, the use of a global reflective measure can "diminish the correspondence between the empirical meaning of the construct and its nominal meaning" since the researcher is unaware of the respondent's interpretation of the construct, whether all subdimensions or causes relating to its conceptual meaning have been considered, or the combination in which this has been done (MacKenzie *et al.*, 2011: 327). Conversely, more specific measures ensure that a respondent's focus will be on desired subdimensions and result in more reliable scores.

Since the inadequacies of all existing SIC measures invalidate their usage as a tool to support its strategic management (See §1.1), the intent of the current research is now to design a novel instrument to measure SIC maturity. Because a sound theoretical construct must be the basis for good empirical science (Menor and Roth, 2007), the textual descriptions contained in the Service Innovation Capability Maturity Model will provide the basis for the empirical assessment of an organisation's SIC maturity (Baars *et al.*, 2016). This is discussed in Chapter 5.

Chapter 5: Measurement

5.1 Introduction

The previous chapter detailed the study's conceptual framework. This chapter's focus is on outlining the methodology employed to develop and prepare an index to quantitatively measure the SIC maturity of SMEs based on this framework. As depicted in Table 12, this chapter relates to third and fourth phases of the index construction procedure.

The chapter adopts the following structure. First, measurement items for the index are generated and their content validity is confirmed. Following this, the measurement model is specified, describing the relationships among observed and latent variables.

Chapter	Phase	Step
3. Theoretical Foundation	1. Theoretical Foundation	1. Select an Appropriate Theoretical Foundation
4. Conceptualisation of Service Innovation Capability Maturity	2. Conceptualisation	2. Unambiguously Define SIC
		3. Specify the Conceptual Domain of the Construct
		4. Specify the Conceptual Theme
		5. Identify the Dimensions of SIC
		6. Confirm the Suitability of Dimensions as Formative Indicators of SIC
		7. Specify the Conceptual Theme of the Dimensions
5. Measurement	**3. Development of Measurement Items**	**8. Generate Items to Represent the Construct**
		9. Assess the Content Validity of the Items
	4. Measurement Model Specification	**10. Formally Specify the Measurement Model**
6. Data Collection	5. Testing the Index	11. Pretest
		12. Pilot
	6. Data Collection	13. Collect Data
7. Data Analysis	7. Index Evaluation and Refinement	14. Purify and Refine the Index
	8. Validation	15. Assess Index Validity
	9. Norm Development	16. Develop Norms for the Index

Table 12: Location of Current Index Construction Phases in Thesis.

5.2 Phase 3 - Development of Measurement Items

In this phase, a set of indicators that cover the entire scope of the construct's conceptual meaning are generated and their representativeness is appraised.

5.2.1 Step 8: Generate Items to Represent the Construct

Consequent to developing a conceptualisation of a construct, it is necessary to generate a set of measurement items that fully represent that construct's conceptual domain

(Diamantopoulos and Winklhofer, 2001; MacKenzie *et al.*, 2011; Hoehle and Venkatesh, 2015). Various sources may be employed to establish these indicators, including literature reviews, expert suggestions, interviews or focus groups, deductions from theoretical definitions, or a combination of these approaches (Churchill, 1979; MacKenzie *et al.*, 2011).

The objective of this step is to produce a set of items that capture "all of the essential aspects of the domain of the focal construct" (MacKenzie *et al.*, 2011: 304) in order to measure it adequately and authentically (Kwon and Trail, 2005). With multidimensional constructs, this requires an item, or items, to be developed for each individual subdimension (Diamantopoulos and Winklhofer, 2001; Rossiter, 2002). Integral to this step is the inclusion of indicators that capture the construct and the purpose of the instrument, while minimising items which focus on concepts outside the focal construct's domain (MacKenzie *et al.*, 2011). Accordingly, its implementation is guided by the understanding and definitions developed during previous steps (DeVellis, 2017).

Moultrie *et al.* (2006; 2007) summarise various approaches to measuring the current status of an organisation's attributes or characteristics. The simplest of these is with a binary yes/no response, but the authors warn users that measures of this type provide "little information about 'good practice'" or granularity when scoring (Moultrie *et al.*, 2006: 1164). Likert-type scales are proposed as an alternative, where respondents score the extent of their agreement or disagreement with statement, and while measures of this type offer greater granularity, they fail to provide any insights into 'good practice' (Moultrie *et al.*, 2006).

To overcome this shortcoming, the authors suggest that a Likert-style questionnaire can be adapted and anchor phrases included at either end of the scale (Moultrie *et al.*, 2007). Nevertheless, the authors concede that, though this approach has the "advantage of providing greater insight into the potential extremes of performance", little insights are provided regarding intervening points (Moultrie *et al.*, 2007: 337). Finally, Moultrie *et al.* (2007) describe how maturity principles can be used to extend an anchored scale, imitating maturity models that describe "in a few phrases, the typical behaviour exhibited by a firm at a number of levels of 'maturity'" (Fraser *et al.*, 2002: 244). These phrases, rich 'intermediary descriptions', are provided at each point along the scale and offer "insight into how a firm might progress between each level", improving the objectivity of scores (Moultrie *et al.*, 2007: 338). Assessing maturity in this way allows organisations to understand their current performance and can guide improvement efforts (Maier *et al.*, 2012).

Scales of this type are not unique to the assessment of maturity and several studies have utilised 'defined anchors' (Hackman and Oldham, 1974; 1975; Stufflebeam and Wingate, 2005; Ferner *et al.*, 2011) or 'scale anchors' (Rotundo, 2009) in the form of lengthy descriptions at various scale points (Gardner *et al.*, 1998). One notable class of such measures are Behaviourally Anchored Rating Scales (BARS) (Gillis *et al.*, 2009) which describe "critical incidents of effective or ineffective performance" (Rotundo, 2009: 90) at each scale point to "illustrate multiple performance levels" (Tziner and Kopelman, 2002: 482).

The simplicity and ease of assessing organisational maturity (Aitken, 2011) utilising an extended anchored scale and single-item measure has led to this approach being used in several studies (Crawford, 1999; Crawford, 2001; Aitken and Crawford, 2006; 2007; 2008; Cater-Steel *et al.*, 2008; Patnayakuni and Ruppel, 2010; Aitken, 2011; Marrone and Kolbe, 2011a; b; Besner and Hobbs, 2012). This is technique is in line with the suggestion advanced by Moultrie *et al.* (2006; 2007) and similarly builds upon the concept of the Likert scale, basing assessment on rich 'anchor phrases' (Holgado *et al.*, 2014) or "the descriptions and labels" used in maturity frameworks (Patnayakuni and Ruppel, 2010: 226). To answer, respondents are asked to examine comprehensive descriptions of the characteristics of the examined object and to place their organisation's present capability state or performance at one of the described maturity levels (Crawford, 2001; Patnayakuni and Ruppel, 2010; Marrone and Kolbe, 2011a). Consequently, these so-called 'single-item' measures assess an object along scale points that are double-, triple-, quadruple-, quintuple-, sextuple- etc. barrelled (Crawford, 1999; Patnayakuni and Ruppel, 2010; Aitken, 2011; Marrone and Kolbe, 2011b) and, thus, are more accurately regarded as qualitative descriptions than as traditional 'scale points' .

While utilising a similar approach to assess the maturity of the four subdimensions is an appealing option in the context of this study, the "use of single-item measures in management research has been subject to heavy debate in recent literature" (Fuchs and Diamantopoulos, 2009: 195).

In psychometrics, measures with more items are generally regarded as better. Gardner *et al.* (1998: 899) explain that this idea is rooted in the "domain-sampling model of measurement error" which assumes all tests comprise of a "random sample of items from a hypothetical domain of all items" that can be used measure a construct of interest. However, self-report measures, in reality, are not necessarily created using a random sample of items and, instead, are created by researchers based on their understanding of a construct (Gardner *et al.*, 1998). This results in items that vary in quality and means that it is possible that a single "'good' item can be better than many 'bad' items" when their reliability and validity is evaluated (Gardner *et al.*, 1998: 899).

Nevertheless, multiple-item measures are considered the norm in organisation research (Bergkvist and Rossiter, 2009; Fisher *et al.*, 2015) and are ordinarily employed by academics to assess constructs, or "[t]o be more technically precise…, the *attribute* of the construct (e.g. attitude, quality, liking)" (Bergkvist and Rossiter, 2007: 175), or, in the case of this study, maturity. Conversely, single-item measures are typically discouraged (Wanous *et al.*, 1997; Drolet and Morrison, 2001; Wanous and Hudy, 2001) and their use is sometimes regarded as a 'fatal error' (Fuchs and Diamantopoulos, 2009). This is due to controversy regarding when they are appropriate, with heated debate continuing between methodologists in a number of areas (Sarstedt and Wilczynski, 2009).

Among these are differing reports of their reliability (Kwon and Trail, 2005). Reliability refers to the extent that a scale produces consistent results when repeated measurements are made and "reflects the degree to which a measurement model is free from random error" (Sarstedt and Wilczynski, 2009: 215). Though Cronbach's alpha and composite reliability are widely used to determine a measure's reliability, because they are computed using the correlations between the items of a construct (Sarstedt and Wilczynski, 2009), they cannot be estimated for single-item measures (Wanous *et* *al.*, 1997; Bergkvist and Rossiter, 2007). Petrescu (2013: 101) reports that there is a belief that even if it were possible to estimate the reliability of a single-item measure, "it would be unacceptably low".

However, Rossiter (2002) suggests the notion that 'single items are unreliable' is a consequence of Churchill's (1979) seminal article to support the development of measures of constructs. He contends that his viewpoint was "borrowed from ability-test theory in psychology, where items differ in *difficulty* and there is within-person variation in *ability* to answer them" (Rossiter, 2002: 321). While this means that a single item cannot be used to precisely or reliably estimate an individual's ability in psychology, Rossiter (2002) argues that this is not the case for marketing constructs, and by extension constructs in other domains, which require only basic literacy to answer. Evidence regarding the reliability of single-item measures in more recent research is mixed, with some studies contending that measures of this type can be reliable (Wanous and Hudy, 2001; Fuchs and Diamantopoulos, 2009), while others dispute this (Schmidt and Hunter, 1996; Gliem, 2003).

The predictive validity of single-item measures compared to multi-item measures has been examined in several studies (Bergkvist and Rossiter, 2007). While Sarstedt *et al.* (2016a) contend that the predictive validity of single-item measures lags behind that of multi-item scales, the collective evidence appears to indicate that "single-item scales can have good predictive validity (comparable to those of their multi-item equivalents)" (Fuchs and Diamantopoulos, 2009: 203).

There are mixed arguments, too, regarding the construct validity of single-item measures of constructs or "the degree to which a measure assesses the construct it is purported to assess" (Fuchs and Diamantopoulos, 2009: 202). One on hand, single-item measures may lack construct validity by failing to tap multiple aspects of a construct (Bergkvist and Rossiter, 2007), while on the other, "multiple items might pick up substance from more than one conceptual domain [and] one item that taps the right domain might yield better information" (Petrescu, 2013: 102).

Disagreement exists also regarding the incremental information added to a construct through the inclusion of multiple items, where "a multiple-item measure captures more information than can be provided by a single-item measure" (Bergkvist and Rossiter, 2007: 176). Drolet and Morrison (2001: 198) contend that, though multiple-item scales may achieve "high-reliability indices", the extra items "may add very little information over a one- or, at least, two-item scale". Accordingly, consideration of the wasteful redundancy that arises when items 'drift off' a study's focal attribute (Rossiter, 2002), led the authors to conclude that scale development can be likened to modern art where, "less is more" (Drolet and Morrison, 2001: 202).

Finally, single-item measures are often criticised for being imprecise (Spector, 1992; Fisher *et al.*, 2015) as they "tend to categorise people into a relatively small number of groups" when compared to multiple-item measures (Churchill, 1979: 66). Fuchs and Diamantopoulos (2009: 205) describe the latter class of measures as being more responsive and "able to detect small but important differences" but suggest that this disparity can be overcome through the addition of extra scale points.

Based on the procedure proposed by Rossiter (2002) to support the development of measures, Bergkvist and Rossiter (2007; 2009) maintain that single items are appropriate for 'doubly concrete' constructs. These are constructs for which a single, concrete object is assessed on a single, concrete attribute. Rossiter (2002: 311) uses a measure of IBM's service quality as an example for object, where it "is assumed that the object, IBM, is described similarly by all raters (which makes it concrete) and that it is singular (that is, a single overall company, rather than, say, a set of geographic divisions or departmental divisions)". Single, concrete attributes are those for which "there is no need to use more than a single item… to measure it in the scale" (Rossiter, 2002: 313) as the attribute can be "easily and uniformly imagined" by respondents (Bergkvist and Rossiter, 2007: 176).

While Bergkvist and Rossiter (2009: 607) advocate the merits of measures of this type, claiming that they are "equally predictively valid as multiple-item measures" and that multiple-item measures of doubly concrete constructs "do not appear to discriminate better by capturing more information" (Bergkvist and Rossiter, 2007: 182), others are critical of their view. For instance, Sarstedt *et al.* (2016a: 3202) counter by asserting that "[r]egardless of whether a construct is a doubly concrete construct, a concrete construct, or even just a construct, single items lag behind multi-item scales in terms of predictive validity" and they regard the necessity to utilise expert raters when identifying an object or attribute as concrete as a major flaw.

The uncertainty surrounding the psychometric qualities of single-item measures has led to suggestions that they may be more appropriate as moderator or control variables than as a study's primary construct (Fisher *et al.*, 2015); or should only be used in the early phases of measure development (Joachim, 2012), such as in the case of this research. Ultimately, though debate persists regarding single-item measures and their use, there is some agreement that single items are most appropriately employed when the construct of interest is unidimensional (Fuchs and Diamantopoulos, 2009), unambiguous for respondents (Hair *et al.*, 2012) and sufficiently narrow (Wanous and Hudy, 2001).

Further, Wanous *et al.* (1997) and others (Bergkvist and Rossiter, 2007; Fuchs and Diamantopoulos, 2009; Sarstedt and Wilczynski, 2009; Diamantopoulos *et al.*, 2012) argue that a case for the acceptability single-item measures can be made when practical limitations favour their use. This has led many researchers to employ measures of this type on account of their numerous practical advantages over multiple items, including their convenience (Martínez-López *et al.*, 2013), brevity (Sarstedt and Wilczynski, 2009), high face validity (Wanous *et al.*, 1997), flexibility (Kwon and Trail, 2005), simplicity and ease of use (Kwon and Trail, 2005; Metz *et al.*, 2007), parsimony, ease of administration (Diamantopoulos *et al.*, 2012), reduction in assessment time or respondent fatigue (Fisher *et al.*, 2015), lower costs for data collection and processing (Klein and Rai, 2009; Sarstedt *et al.*, 2016b), higher response rates (Bergkvist and Rossiter, 2007; Fisher *et al.*, 2015), reduction in missing values and response bias (Petrescu, 2013), suitability for populations of limited size, and appeal when recruiting respondents (Sarstedt *et al.*, 2016a).

Due to the practical advantages of single-item measures, evidence that legitimises their use is welcomed by researchers, however, Diamantopoulos *et al.* (2012) caution that they cannot ignore evidence to the contrary that illustrates their riskiness. Petrescu (2013: 112-113) sums up this debate, stating that the use of single-item measures is "not always recommended and might have, in many circumstances, negative consequences". She warns users of their potential issues with reliability and error measurement, but concedes that there are circumstances where they can be successfully employed (Petrescu, 2013).

For this study, because the maturity score for SIC, a latent variable, is determined by indicators of its subdimensions, specification of its content is inextricably linked with indicator specification, and implies that "a *census* of indicators is needed" (Fuchs and Diamantopoulos, 2009: 199). Rossiter (2002: 314) refers to attributes such as this as "*second-order* formed" attributes and suggests that they should be measured through 'concrete' first-order components, each measured using a single 'good item'.

Items for the service innovation capability maturity index (SICMI) were devised *a priori* in order to assess the maturity level for each of the dimensions using only a single question (Diamantopoulos and Siguaw, 2006). This approach was influenced by Mettler (2011: 87), who compares descriptions of a "number of levels of maturity in a simple, textual manner" with "Likert-scale questionnaires with anchor phrases" and by others who employ single-item maturity scales in their research (Crawford, 1999; Crawford, 2001; Aitken and Crawford, 2006; 2007; 2008; Cater-Steel *et al.*, 2008; Patnayakuni and Ruppel, 2010; Aitken, 2011; Marrone and Kolbe, 2011a; b; Besner and Hobbs, 2012). Initially, the development of these items involved the "translation of [the] maturity model into quantifiable factors that can be measured" (Lasrado, 2018: 29), or conversion of the descriptions of the characteristics of each of the subdimensions at each level of maturity (See §4.2.6) into statements written in the language of practitioners (Oh *et al.*, 2007). To support this activity, the literature was closely consulted and relevant descriptions of maturing capabilities (Maier *et al.*, 2012; Jin *et al.*, 2014) and items used in the measurement of organisational maturity (Sledgianowski *et al.*, 2006; Khaiata and Zualkerman, 2009) formed the basis for the first iteration of measurement items.

Next, these draft items were refined further, through the application of instructions for the writing and editing of measurement items (MacKenzie *et al.*, 2011). At this point, effort was made to ensure that the reading difficulty level was appropriate, wording of each statement was as precise and clear as possible, semantic and syntactic factors were accounted for, excessive length or unnecessary wordiness was avoided, jargon or colloquialisms were excluded, multiple negatives dismissed, and infrequently used or unfamiliar words were removed (Diamantopoulos and Winklhofer, 2001; Podsakoff *et al.*, 2003a; DeVellis, 2017). Generally, 'good items' are understood to be those with high clarity and low complexity (DeVellis, 2017), so the objective of this activity was to simplify the items to the greatest extent possible, while fully capturing their content domain, or the maturity descriptions in SICMM.

This research aligns with other studies (Jung and Hunter, 2001; Jung *et al.*, 2001) that treat "single item measures… as if they are interval" variables (El Emam and Birk, 2000: 554). El Emam and Birk (2000) argue that it does not make a practical difference whether scales have unequal or equal intervals, as respondents conceptually adjust for this. Accordingly, this research designates the indicators of the subdimensions as quasi-interval items (Henkel, 1975).

While under Rossiter's (2002) procedure, the object of the items, "a single overall company" (Rossiter, 2002: 311), would likely be regarded as concrete, it is unclear whether their examined attribute, the maturity of the four subdimensions, would perceived in the same way. This is because the double-concreteness of the items (Sarstedt *et al.*, 2016b) was not evaluated according to Rossiter's (2002) recommendations, where expert raters are utilised to confirm that "the object of measurement and the attribute of measurement are clear and unambiguous for those rating the object on the attribute" (Bergkvist and Rossiter, 2009: 607-608). Irrespective of whether these first-order dimensions are doubly-concrete constructs or concrete constructs (Sarstedt *et al.*, 2016a), the use of single-item measures to assess their maturity level could be justified for practical purposes.

Indeed, the objective of this decision was to keep SICMI, a tool intended for practitioners, as short and simple as possible. Though it could be argued that each of the first-order subdimensions are highly complex constructs in themselves and that single ideas could be extracted from them and measurement undertaken with multiple-item scales, this was not the approach taken. This choice mirrors research by Aitken (2011: 254) who decided that the "time and effort required to capture a full and objective assessment of organisational competence" was not feasible for either "the researcher or the participating organisation[s]". Critically, the measurement of specific aspects of the subdimensions would require the addition of many extra items to cover each of their facets. This is similar to an illustration by Fuchs and Diamantopoulos (2009: 203) of a scenario where a "construct becomes so complex" through the addition of "an enormous number of items" (204) that a single question would be the best option for practical application of the measure.

The decision to employ a more straightforward approach to the evaluation of the maturity of the dimensions of SIC for practitioners is comparable also, in some respects, to research by Chiesa *et al.* (1996). In this study, the authors produced two instruments as part of a technical innovation management audit. The first of these was an 'innovation scorecard', which was equivalent to a maturity assessment using a grid or model, and the second was a more detailed or in-depth audit tool (Chiesa *et al.*, 1996). Even though the innovation scorecard was less detailed than the audit tool (Fraser *et al.*, 2002), the authors found that the former approach was preferred by participants and regarded as "sufficient for their needs" (Chiesa *et al.*, 1996: 123). It was the intention of this study to produce a similarly regarded tool to the 'innovation scorecard' by Chiesa *et al.* (1996: 123), as there was a belief that its simplicity made it appropriate for the "average company to use in most situations".

The items developed to measure the maturity of the subdimensions, differ in some respects to traditional single-item measures for which respondents rate the extent of their agreement or disagreement with a positively or negatively worded statement containing a single idea (Price, 1997; Moultrie *et al.*, 2006; 2007). Though they mirror existing research that employs BARS (Rotundo, 2009) or extended anchor scales (Crawford, 1999; Aitken and Crawford, 2007; Cater-Steel *et al.*, 2008; Patnayakuni and Ruppel, 2010; Marrone and Kolbe, 2011b; Besner and Hobbs, 2012) which assess an attribute along a scale with rich descriptions at each point, these scale points appear to violate the guidance for item writing advanced by methodologists (Churchill, 1979; DeVellis, 2017; MacKenzie *et al.*, 2011) who recommend that "[d]ouble-barrelled items… should be split into single-idea statements, and if that proves impossible, the item should be eliminated altogether" (MacKenzie *et al.,* 2011: 304). Indeed, the activities through which the items were generated differs significantly from how items are usually created for measures, where a large initial pool of candidate items is developed from which the measure's items emerge (DeVellis, 2017)

As the psychometric properties (reliability and validity) of the maturity measures for the subdimensions cannot be computed due to their singularity, there is no statistical evidence to support the notion that they measure the dimension that they are supposed to. Readers must note that this is a limitation to this research (See §9.6).

5.2.2 Step 9: Assess the Content Validity of the Items

Next, a researcher must evaluate the content validity of generated items (Hinkin, 1995; Diamantopoulos and Winklhofer, 2001). Content validity is an indicator of the psychometric quality of measures and is defined as the "extent to which a measure's items reflect a particular theoretical content domain" (Hinkin and Tracey, 1999: 175). The goal of this step is to examine whether developed items measure what they intend and fully capture the construct's conceptual meaning (Straub, 1989; Petter *et al.*, 2007). It is important that this matter is swiftly addressed after the generation of items because in cases with inadequate content there is no purpose in proceeding (Schriesheim *et al.*, 1993; Schriesheim *et al.*, 1999). Moreover, establishing content validity is strongly recommended due to the fact it is a precondition to establishing construct validity (Anderson and Gerbing, 1991; Hinkin and Tracey, 1999; Lewis *et al.*, 2005).

As content validity is a theoretical question, subjective assessments are used to make judgements regarding the reasonableness of a measure's item content (Anderson and Gerbing, 1991; Schriesheim *et al.*, 1999; Straub *et al.*, 2004). These are often made by the researcher themselves by carefully and critically examining measurement items, their appropriateness to the theoretically specified content domain, and confirming the absence of item contamination (Schriesheim *et al.*, 1993; Lewis *et al.*, 2005).

An alternative to conducting this evaluation in isolation is to involve a panel of judges (Malhotra and Grover, 1998). However, this approach has drawbacks too and debate continues with regard to whose judgement should be used (Lawshe, 1975; Anderson and Gerbing, 1991). Furthermore, it is acknowledged that the subjective judgements of panellists can be unreliable (Lawshe, 1975) and may not be representative of a study's intended respondents (Yao *et al.*, 2008).

For SICMI, an assessment of the content validity of items and confirmation of their comprehensibility to practitioners was conducted in three parts:

(1) A critical comparison was undertaken with the deductively constructed Service Innovation Capability Maturity Model (See §4.2.6.5) which provided descriptions of each subdimension at each level of maturity (Blommerde and Lynch, 2016). The assessment of content validity was concerned with the extent to which the survey items sampled the maturity of each of the subdimensions in a representative and comprehensive manner. Content validity could be said to have been achieved as the items were representative of the properties of the maturing subdimensions described by the model.

(2) Academic experts were invited to evaluate the items. This review took the form of a content validity check, conducted by four researchers with experience in psychometrics and instrument development, and one late stage PhD candidate (Hardesty and Bearden, 2004). Some concerns were expressed regarding the length of items, the use of academic language to describe evolving subdimensions, and indicators of responses that were socially desirable. Upon completion of the suggested revisions, the content validity of the items was deemed to be acceptable.

Ultimately, the content validity of items was confirmed by verifying that they corresponded to descriptions contained in SICMM and by obtaining the endorsement of an expert panel. The items are detailed in Table 13.

(3) The final component of this step was to conduct a practitioner item review. The purpose of this activity was to confirm that the content valid measurement items

could be comprehended by individuals who were similar to intended users of the index and respondents to the study’s main survey. Five reviewers provided their feedback, none of whom reported any difficulties understanding the items. This suggested that the researcher could proceed without encumbrance to the next stages in the development of the Service Innovation Capability Maturity Model (SICMI).

	1. Initial	2. Managed	3. Defined	4. Measured	5. Optimising
User Involvement	In our organisation, user participation in the development of services is infrequent and ad hoc. In fact, unless a user approaches us, we assume we can develop the services that they want.	We study and observe users with the aim of defining their requirements for new or improved services. Usually, there is no direct contact and we tend to use internal channels like sales reports, feedback, and customer complaints to improve our understanding of their demands.	In our organisation, users are loosely involved in the early phases of developing new services. We view them as 'experts' and information about their specific needs, wishes, and requirements are of great value to us. Surveys or similar techniques are our preferred mechanism for gathering their opinions or insights.	Users have a direct, personal, and active role at each stage of our service development processes. While this role is extensive, it is not fully collaborative. We monitor and track their involvement throughout, from early development, through to the verification and testing of new services or service improvements.	Users play an intrinsic, collaborative role in all phases of our new service development processes. They are treated as knowledgeable innovation partners and our relationship does not dissolve once a project is completed, but instead extends to multiple projects. Because of their value, we make an effort to continuously increase and enhance their input and cooperation at all stages of service development.
Knowledge Management	We do not formally manage communication or knowledge in our organisation and any activities that occur in these areas do so in an ad hoc and unsystematic way.	We have some basic processes in place for capturing or utilising knowledge, but they are not always adhered to by staff who are generally guided by their individual experiences, observations, and intuition.	Our organisation have the basic framework and tools in place to support the systematic gathering, documentation, and communication of knowledge. Employee roles in these activities have been specified, but knowledge sharing chiefly occurs between individuals within groups.	In our organisation, there are standard processes in place for capturing and sharing knowledge. Metrics are used to ascertain the performance of these processes and to provide feedback. Knowledge sharing and learning is not organisation wide, but is presently limited to certain departments or organisational functions.	There is a culture in our organisation in which the widespread, automatic sharing of knowledge and open communication occur. We consider ourselves to be a learning organisation and use our experiences to continually improve how we manage knowledge for service development or improvement.
Strategising	Our organisation have no formal strategies for service development or improvement. Services are developed in an ad hoc way that does not involve staff.	There is some strategic planning in our organisation for the development or improvement of services, but this generally only occurs as a reaction to a specific, urgent problem. It is conducted inconsistently, with erratic employee input, and its focus is primarily on budgeting and costs.	We have formal and comprehensive strategic planning processes in place. Generally, we use forecasting tools which allow us to keep pace with competitors or address niche markets. Our strategy for service development or improvement is communicated and understood.	During strategy development, we strive to identify future success factors, frequently engage with employees, and monitor the activities undertaken to confirm that our internal standards and methods have been adhered to. The aim of developing or improving services is to outperform similar competitors.	In our organisation, standardised processes that integrate the contribution of employees at all levels are in place for deciding which services to develop or improve. We make changes or adjustments to these processes when we believe we can enhance their effectiveness. The resulting strategies are widely communicated and aim to create new markets by doing what competitors cannot.
Networking	Aside from discrete instances arranged by individuals, our organisation does not create or maintain any relationships with external parties for the purpose of enhancing our services. We do not consider the potential impact that changes to our services may have on supply chain actors and have a conservative attitude towards opening our boundaries for knowledge sharing or cooperation.	We are beginning to understand the value and importance of involving external parties in innovation and are becoming receptive to opening our organisation's boundaries for knowledge sharing and cooperation.	In our organisation, defined practices are in place that govern our interactions and partnerships with other organisations. Usually, only significant external stakeholders are permitted to have an input into service development processes. Some knowledge is shared across the boundaries of our organisation and informal discussions, relationships, and associations with stakeholders are encouraged.	When possible, all external stakeholders interested in, or impacted by, our service development activities are integrated into the process. However, this is not achievable on every occasion. Despite not actively searching for compatible organisations, we periodically initiate beneficial alliances or collaborations relating to service development and use performance metrics to monitor and control this interorganisational cooperation.	We have established processes in place for building and managing relationships with our external stakeholders. We learn from our successes and continuously improve these processes. All of our external stakeholders are involved with service development activities and collaborations allow us access to their skills and knowledge. We actively identify new external parties with whom we can create beneficial relationships and maintain and maximise those with highly skilled parties such as research groups and consultants.

Table 13: Content Valid Items for Measuring the Maturity of SIC Subdimensions.

5.3 Phase 4: Measurement Model Specification

Upon generation of a content valid set of items, formal specification of the measurement model must take place (Diamantopoulos and Winklhofer, 2001; MacKenzie *et al.,* 2011). The purpose of this phase is to present the expected relationships between the focal construct and its indicators (Diamantopoulos, 2011; Hoehle and Venkatesh, 2015).

5.3.1 Step 10: Formally Specify the Measurement Model

With formative measures, specifying the relationship between a construct and its indicators is complicated by the requirement to set the scale of measurement and fulfil other conditions in order for all model parameters to be estimated using structural equation modelling software (Heise, 1972; MacCallum and Browne, 1993; Edwards, 2011).

The scale of measurement can be set through any of the following acceptable solutions (MacCallum and Browne, 1993; MacKenzie *et al.*, 2005; Diamantopoulos *et al.*, 2008; Bollen and Davis, 2009a; Diamantopoulos, 2011; MacKenzie *et al.*, 2011):

i. By fixing a path between the latent construct and one of its indicators at some non-zero value, usually 1;
ii. By fixing the variance of the construct at a non-zero value, usually 1; or
iii. By fixing an emitted path from the latent construct to a non-zero value, usually 1.

Thus, the scaling issue was resolved, in a manner that did not interfere with determining the values of path coefficients from the indicators to the latent construct, by constraining to 1 the path from SIC to a global reflective indicator. This item is included to aid with validation and reflectively summarises the index or "the essence of the construct that the index purports to measure" (Diamantopoulos and Winklhofer, 2001: 272). In this case, the global reflective item measured SIC maturity using only a single indicator (Ali et al., 2012; Giovanis, 2013).

A second issue that complicates the specification of constructs with formative indicators, is the '2+ emitted paths rule' (Bollen and Davis, 2009b; MacKenzie *et al.*, 2011). This rule stipulates a latent variable must emit at least two directed paths to theoretically appropriate reflective variables that also have unrestricted error variances (Land, 1970; Anderson and Gerbing, 1988; MacCallum and Browne, 1993; MacKenzie *et al.*, 2005). It is advised that these measures are "caused directly or indirectly by the latent variable" (Edwards, 2011: 375) and accordingly their selection can be as important as the selection of the formative indicators (Diamantopoulos *et al.*, 2008; Wilcox *et al.*, 2008). These supplementary variables can be latent constructs, single indicators, or a blend of both (MacKenzie et al., 2005).

In the case of SICMI, the global reflective item performed another function at this point, where it was employed as an outcome variable to solve model identification problems (Diamantopoulos and Winklhofer, 2001; Jarvis *et al.*, 2003; Edwards, 2011). Further, as it is conceptually expected that SIC, a capability that enables organisations to repeatedly generate innovative service outcomes, would enhance service innovation performance (SIP) (Kariyapperuma, 2013; Plattfaut *et al.*, 2015; Hariandja, 2016b; Banjongprasert, 2017), an endogenous latent construct was added to the model representing this effect (Jarvis *et al.*, 2003; Diamantopoulos, 2011).

In circumstances where the '2+ emitted paths rule' is employed to obtain estimates of a measurement model (Wilcox et al., 2008), it is critical that the researcher is aware of the potential impact of interpretational confounding (Diamantopoulos, 2011). This is defined as a "situation in which the empirically observed meaning between a latent variable and its measures differs from the nominal meaning expected under the original specification" (Kim *et al.*, 2010: 347). In other words, when meaning is assigned to a model from structural criteria, rather than epistemic criteria (Burt, 1976; Howell et al., 2007b).

For SICMI, the model was not understood to be at risk of interpretational confounding as it is predominantly an implication of model misspecification and underidentification (Bollen, 2007; Howell et al., 2007a), neither of which impacted this measurement model.

The final decision when specifying a construct with formative indicators, is whether to constrain or freely estimate the covariances among the indicators of the construct's subdimensions (MacCallum and Browne, 1993; MacKenzie et al., 2005). For the SICMI measurement model, these covariances were freely estimated after consideration of the theoretical and empirical impact of doing so (See §4.2.5.1) (Jarvis et al., 2003; Petter et al., 2007). An illustration of the SICMI measurement model is shown in Figure 13[3].

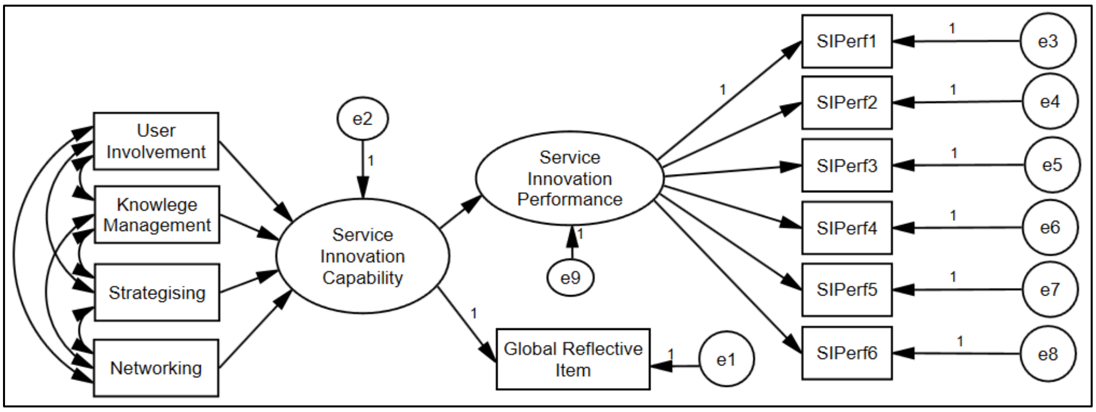

Figure 13: Measurement Model of Service Innovation Capability Maturity.

Figure 13 depicts Service Innovation Capability as a first-order latent construct with four dimensions. Each of these dimensions are measured with a single item, described in §5.2. This approach to measuring DSIC diverges somewhat from the study's conceptual understanding of this phenomenon as a second-order formative construct caused by first-order ordinary level capabilities. As the maturity levels are cumulative and progressive (See §4.2.5), a respondent's overall SIC maturity score is the same as that achieved by the subdimension with the lowest maturity score. Assigning SIC maturity scores in manner is in harmony with existing maturity model literature, where a maturity level is only achieved when its requirements have been fulfilled by *all* dimensions (De Bruin *et al.*, 2005; Salvaterra, 2008; Maier *et al.*, 2012; Chovanová *et al.*, 2019). Appendix A provides further details regarding how an organisation's overall maturity score is determined.

[3] Readers must note that the measurement model described in this chapter is not the study's original measurement model. For details on the original measurement model and rationale for modifications see §6.2.2.1.

5.4 Chapter Conclusion

This chapter has related all activities surrounding the translation of descriptions of the evolving characteristics of the subdimensions of SIC, contained in a conceptual maturity model, into statements written in the language of practitioners. It detailed how these statements were carefully formulated and their content validity confirmed by a panel of six expert judges. Further, it outlined the recognition obtained through an item review with five practitioners, that these items were clear and comprehensible. Following this, details were provided of the actions undertaken to formally specify the measurement model so as to obtain estimates for all parameters necessary to successful index construction.

In order to complete the remaining steps in the procedure for developing SICMI, quantitative survey data were required. The next chapter overviews the activities undertaken to prepare for the collection of these data, including the testing of the index, and clarifies the sampling approach utilised, the composition of the questionnaire, and the administration of the survey.

Chapter 6: Data Collection

6.1 Introduction

This chapter provides a detailed description of phases 5 and 6 of the index construction procedure (See Table 14). These concern the preparation of the index for large-scale data collection and administration of the survey. For all analyses, two software packages were used: Statistical Package for the Social Sciences (SPSS) Version 23.0.0.3 and Analysis of Moment Structures (AMOS) 23.

Chapter	Phase	Step
3. Theoretical Foundation	1. Theoretical Foundation	1. Select an Appropriate Theoretical Foundation
4. Conceptualisation of Service Innovation Capability Maturity	2. Conceptualisation	2. Unambiguously Define SIC
		3. Specify the Conceptual Domain of the Construct
		4. Specify the Conceptual Theme
		5. Identify the Dimensions of SIC
		6. Confirm the Suitability of Dimensions as Formative Indicators of SIC
		7. Specify the Conceptual Theme of the Dimensions
5. Measurement	3. Development of Measurement Items	8. Generate Items to Represent the Construct
		9. Assess the Content Validity of the Items
	4. Measurement Model Specification	10. Formally Specify the Measurement Model
6. Data Collection	**5. Testing the Index**	**11. Pretest**
		12. Pilot
	6. Data Collection	**13. Collect Data**
7. Data Analysis	7. Index Evaluation and Refinement	14. Purify and Refine the Index
	8. Validation	15. Assess Index Validity
	9. Norm Development	16. Develop Norms for the Index

Table 14: Location of Current Index Construction Phases in Thesis.

The chapter is structured as follows. First, details are provided of pretesting the questionnaire and of two pilot studies. Next, the sampling approach and the composition of the study's questionnaire are described. Following this, details of the survey's administration are provided, including the response rate and representativeness of responses. Afterwards, a description is given of the approach undertaken to prepare data for analysis by identifying and handling outliers and testing for normality, followed by an overview of the profile of respondents.

6.2 Phase 5 – Testing the Index

The objective of the fifth phase is to rigorously test the index. It consists of two steps. In the first of these, feedback is obtained regarding the adequacy of the questionnaire and any issues or problems experienced or identified by reviewers are located and eliminated (Cannell *et al.*, 1989). The second step involves a trial run, or pilot, of the final administration of the instrument with a small sample representative of the target population (Straub, 1989).

6.2.1 Step 11: Pretest

The pretesting of measures and questionnaires is an activity that is widely recommended by methodologists (Rossiter, 2002; Stratman and Roth, 2002; Lewis *et al.*, 2005; Skinner *et al.*, 2009; Yi, 2009; MacKenzie *et al.*, 2011). Pretests have a qualitative character and provide feedback regarding the adequacy of questions, facilitating the revision of an instrument through the location and correction of weaknesses or ambiguities (Cannell *et al.*, 1989; Straub, 1989). Elimination of these and other issues is an essential task prior to large scale data collection and is linked to the later objective of establishing construct validity (Anderson and Gerbing, 1991). For this study, the pretest consisted of two parts; a pretest with academics, and a pretest with practitioners.

6.2.1.1 Academic Pretest

The objective of the academic component of the pretest was to refine and improve the questionnaire by utilising the experience and knowledge of researchers and faculty members at Waterford Institute of Technology. To achieve this, a panel of 11 academic staff were provided with a modified version of the questionnaire, designed specifically to collect their views, comments, and suggestions.

This resulted in some changes to formatting, the addition of text to further clarify one question, minor alterations to the wording of other questions, removal of indicators of socially desirable responses in the subdimension maturity questions, and the inclusion of a progress bar at the bottom of each of the questionnaire's pages. It was suggested too that some incentive should be offered to participants and it was decided that they would be offered a report of the study's full findings in exchange for completing the questionnaire.

Concerns were also raised about the time given in which it was anticipated that the questionnaire could be completed and the length of response options for the subdimension maturity questions. The comment about the projected completion time was kept under review and was considered further during the practitioner pretest. With regard to the length of the response options for the subdimension maturity questions, their text was revised and shortened to the greatest extent possible. However, an appropriate balance was struck between their length and the level of description for each maturity level so that neither comprehension nor their conceptual meaning would not be lost.

6.2.1.2 Practitioner Pretest

Best practice for a practitioner pretest recommends that a questionnaire is tested under realistic data collection conditions, using similar procedures, with a small group of respondents (Hunt *et al.*, 1982; Cannell *et al.*, 1989; El Emam and Madhavji, 1995). It is advised that these respondents, sometimes referred to as the review panel, are representative of the focal population and selected from segments of that population who are to be sampled for the pilot or main study (Cannell *et al.*, 1989; Anderson and Gerbing, 1991). Generally, the review panel are asked to complete the questionnaire, evaluating clarity, layout, length, quality of instructions, unfamiliar words or terminology, sentence structure, and instances where the required information or response form is ambiguously specified (Cannell *et al.*, 1989; Anderson and Gerbing, 1991; Easterby-Smith *et al.*, 2002).

For this step with SICMI, 11 managers of SMEs were invited to complete a modified version of the questionnaire. They were selected because of their representativeness of the population of service organisations from which the pilot and main study's samples would be drawn. They were asked to examine item wording and instructions, answer categories, the length of the questionnaire, and requested to provide any other suggestions to improve the instrument (Hunt *et al.*, 1982). These additional questions are depicted in Table 15.

What is your opinion of the introductory email? Did it provide sufficient information? Would it have encouraged you to participate in the survey? Do you have any thoughts on how it could be improved?
What is your opinion regarding the clarity of instructions in the survey? Did you understand how to answer each question, what information was required, and how to submit your answer? Were any instructions confusing?
What was your view of the second question regarding 'User Involvement capability'. Could you understand what it was asking? Did you understand the answer categories? [A copy of the question was provided to remind pretest panellists]
What was your view of the third question regarding 'Knowledge Management capability'. Could you understand what it was asking? Did you understand the answer categories? [A copy of the question was provided to remind pretest panellists]
What was your view of the fourth question regarding 'Strategising capability'. Could you understand what it was asking? Did you understand the answer categories? [A copy of the question was provided to remind pretest panellists]
What was your view of the fifth question regarding 'Networking capability'. Could you understand what it was asking? Did you understand the answer categories? [A copy of the question was provided to remind pretest panellists]
What was your general opinion of the questions in the survey? Did you understand what was being asked? Was the language clear? Was any terminology used that was unfamiliar to you?
What was your general opinion of the answer categories in the survey? Were any options missing? Did you understand the options?
What is your opinion of the survey's length? It is designed to take less than 10 minutes. Did it take you longer? Did you think its length was excessive?
Do you have any other feedback or suggestions that you believe will enhance this survey?

Table 15: Review Panel Questions.

There was harmony among the review panel that all questions were comprehensible, instructions were easy to follow, and the questionnaire was well laid out. However, some suggestions and comments obtained during this step resulted in changes. Specifically, the introductory or invitation email was edited to be more concise, as it was suggested that this could improve response rates; clarification was provided on the cover page that any collected data would be stored securely; an 'other' response category was added to one question asking about the respondent's principal customers; and where the terms 'study' and 'project' were formerly used interchangeably to refer to this research, revisions were made so that the term 'study' was used exclusively.

There was some disagreement among the review panel with regard to how long it took to complete the questionnaire. Some suggested that it took less than ten minutes, while others reported a time in excess of this. On the basis of these divergent views, the introductory email and cover page were revised to state that the questionnaire's expected completion time was 'approximately 10 minutes'.

Other suggestions and comments were that the questionnaire had too many questions and that a personalised report for each respondent could be offered, specifying how their SIC maturity could be improved. The first comment described an issue that was constantly under consideration throughout the design of the questionnaire. Indeed, one of the primary objectives of the questionnaire's design was to reduce its length while obtaining any response data required for analysis and which could provide valuable descriptive insights. Ultimately, with 21 questions and an expected completion time of approximately 10 minutes, the questionnaire's length and time commitment were shorter than many comparable studies (Fu, 2010; Schaefer, 2014; Zahoor, 2017) and were not considered excessive. The second comment was disregarded due to the anticipated time required to write up a large number of individual reports with customised instructions for improving weak subdimensions. Instead, it was decided that a report of the study's overall findings would be the only incentive offered for participation.

Once these revisions were incorporated into the design of the survey, it was then pilot tested (MacKenzie *et al.*, 2011).

6.2.2 Step 12: Pilot

When developing a new measure, researchers are advised to follow up pretests with a pilot study (Anderson and Gerbing, 1991; Bryman, 2004). These "provide a testing ground or dry run for final administration of the instrument" (Straub, 1989: 161) and allow researchers to identify possible problems that may be encountered when using a survey instrument (Litwin, 2003; Saunders *et al.*, 2003). When selecting samples for a pilot test, the most important criterion is their representativeness of the desired population (Hinkin, 1998; Oppenheim, 2000; MacKenzie *et al.*, 2011).

Prior to the main survey in this research, two pilot studies were undertaken. Samples for all studies were obtained from the databases of RIKON (Research in Innovation, Knowledge, and Organisational Networks), a research group at Waterford Institute of Technology. These studies were administered using SurveyMonkey, professional survey management software. The purpose of the first pilot study was to ascertain whether SICMI worked as expected and to determine the number of invitations that should be sent to obtain a minimum of 200 SME responses for structural equation modelling. The second pilot study was to confirm that modifications to the questionnaire, implemented following the first pilot study, were successful and to support the calculation regarding the required number of invitations. These are now summarised in turn.

6.2.2.1 Pilot Study 1

The first pilot study commenced on January 10th, 2018. Emails were sent to 5,131 contact email addresses, inviting recipients to participate in a survey of service innovation capability. It remained open for 14 days, during which time 371 responses were obtained from 313 service organisations, 95 of which were by SMEs.

An examination of response information revealed that 46.5% (2,384) of recipients of the invitation email opened it, 12.8% (659) of this group clicked the link to answer the questionnaire, 56.3% (371) of these completed the questionnaire, and of this cohort, 25.6% (95[4]) were SMEs. This allowed for a calculation to be made of the number of invitations that needed to be sent to obtain a minimum of 200 responses by service SMEs (See §6.3.1.1.4). The result indicated that approximately 20,000 invitations would be required.

[4] Readers must note that with smaller samples, SEM can be unreliable and parameter estimates unstable (See §6.3.1.2.4) (MacCallum *et al.*, 1996).

The reader should note that the measurement model tested during this pilot and illustrated in Figure 14, differs from that reported in §5.3.1. This model's scale of measurement was set by constraining to 1 the path between the formative latent construct and the global reflective item (Bollen and Davis, 2009a) and it fulfilled the '2+ emitted paths rule' with two directed paths to the aforementioned global reflective item and a construct measuring organisational performance (Bollen and Davis, 2009b). The original selection of this construct as an outcome of SIC complied with the literature which regards organisational performance as a consequence of the ability to develop or improve services (Tang *et al.*, 2015; Omar *et al.*, 2016). Organisational performance was measured using a scale by Li and Atuahene-Gima (2001) (See Appendix B). Covariances among the four indicators were freely estimated (MacKenzie *et al.*, 2005). See Appendix C for a copy of the questionnaire used for this pilot study.

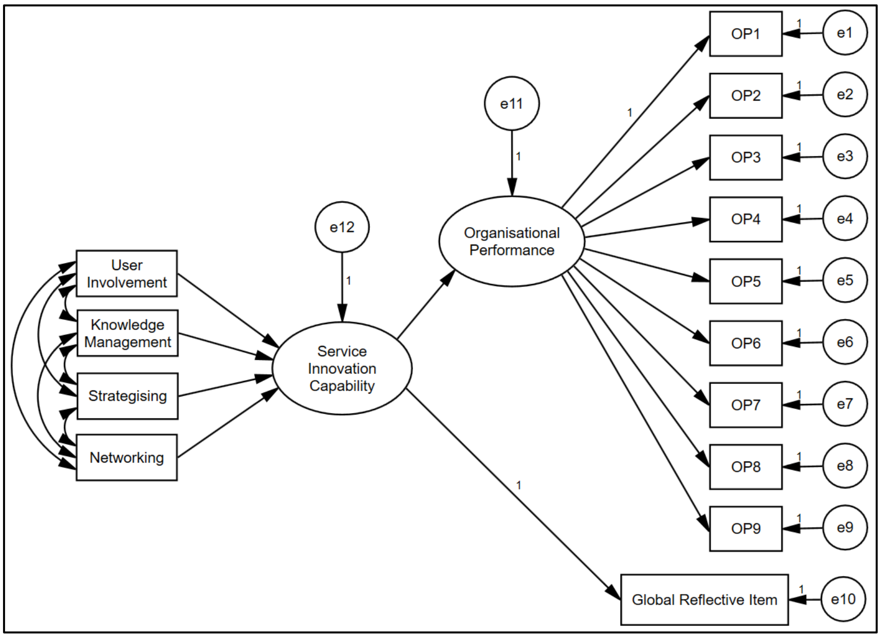

Figure 14: Original Measurement Model - Organisational Performance Outcome Variable.

An examination of the estimates for this measurement model (See Table 16) revealed that the values for three of the four standardised path coefficients from the subdimensions to the formative latent construct were within the anticipated range. The estimate for KM was somewhat unexpected as it had a nonsignificant path coefficient with a negative sign. Additionally, while the path coefficient for UI was close to statistical significance, it was marginally above .05.

	Standardised Estimate	Standard Error	t-value	Sig.
UI → SIC	.251	.045	1.903	.057
KM → SIC	-.045	.059	-.297	.767
S → SIC	.487	.072	2.870	.004
N → SIC	.336	.067	2.139	.032

Table 16: Pilot 1 – Path Coefficients and Significance.

Other estimates obtained for this measurement model were mixed. Specifically, goodness-of-fit statistics for the measurement model were highly unsatisfactory with four of the five recommended indices outside of an acceptable range (Table 17). These indices "evaluate the extent to which the relationships hypothesised in the measurement model are consistent with the sample data" (MacKenzie *et al.*, 2011: 312) and reporting them is advised when developing a new index (Diamantopoulos and Winklhofer, 2001). However, the model had a level of predictive power (65.8%) that was above the accepted threshold (50%) for new measures (See §7.2.1.2.1) (MacKenzie *et al.*, 2011). Together, these results indicated that there was likely an issue with the model's specification.

Statistic	Acceptable Value	Result
χ^2	p > .05	p = .000
χ^2/df	2-5	2.327
CFI	>.90-.95	.837
RMSEA	<.06-.10	.119
SRMR	<.05-.08	.0975

Table 17: Goodness-of-Fit Indices for Pilot 1.

Significant energy was devoted to identifying and resolving the causes of these problems and various checks and tests were undertaken. First, it was confirmed that there were no administration issues when exporting, preparing, or obtaining model estimates using these data. This included ensuring that there was harmony between the numerical values in the data file exported from SurveyMonkey and the actual responses by participants and that none of the variables were incorrectly assigned when using the SEM software. Following this, responses were segregated by their industry or sector to discern whether data were normally distributed within these groups. They were not. The 'Bollen-Stine bootstrap *p*' (Bollen and Stine, 1992) is a post hoc adjustment to account for nonnormality of data in SEM. This computes an adjusted *p* value and a model is rejected if it is below .05. This analysis was performed by setting the number of bootstrap samples to 1,000[5] with results indicating that the model fit better in 987 samples and that the Bollen-Stine bootstrap *p* was .014, rejecting the model. Finally, detailed examinations were undertaken of histograms and Q-Q plots.

Ultimately, it was concluded that there were two major issues. The distribution of some variables was markedly different from normality and that there was too little correspondence between the SIC construct and the Organisational Performance outcome variable.

An examination of the distribution of variables indicated that those which deviated most significantly from normal distribution were those measuring the subdimensions. While it was expected that there would be some extreme low and high responses, i.e. 1s and 5s; a higher volume of those closer to the middle, i.e. 2s and 4s; with the highest frequency being those in the middle, i.e. 3s; this was not the case. Histograms of these variables indicated that they were severely nonnormally distributed.

The lack of correspondence between variables presents a problem unique to formative measurement models as the empirical meaning of a latent construct can be altered by the choice of reflective outcome variables (Howell *et al.*, 2007b; Edwards, 2011). For example, an organisation may report maturity scores of 1 for each of the subdimensions and a score of 5 for their organisation's performance. The disparity between these values is detrimental to the model's predictive power as the aggregated score estimated for the SIC construct, determined by both the exogenous and endogenous variables, would be higher than 1, and provide unclear results regarding whether the subdimensions are predictors of SIC.

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[5] Initially, the bootstrapping estimation method would not run as a standardised regression weight could not be computed between two variables, one of whose estimated variances was not positive. After deselecting 'Standardised estimates' in the analysis properties, the bootstrapping could be completed.

Two distinct solutions were formulated to address each of the identified issues:

- Originally, when the subdimension maturity questions were generated, their text informed respondents that the answer categories were ordered from low to high. Additionally, the text of each response option began with both the number of the maturity level and its title. During the academic pretest, it was suggested that this could lead to socially desirable responses, where organisations chose a maturity level that was higher than their actual capability performance. As a result of this suggestion, the labels used for the response options were removed. However, upon reflection, the merit of their reinclusion was considered. This is because it should be clear to respondents which response option describes a high level of maturity and which describes a low level of maturity. Consequently, the maturity level numbers, titles, and the original instruction regarding the ordering of responses were reintroduced. It was anticipated that this adaptation would allow respondents to more easily identify their level of capability maturity, instead of depending exclusively on the textual descriptions, and result in the expected distribution of these variables, one that was closer to normality (Sang Gyu and Jong Hae, 2017).

- While the objective of these changes was to address empirical problems, consideration was also given to conceptual issues. Indeed, with regard to the lack of correspondence between responses to the Organisational Performance measure and SIC maturity scores, further consideration led to the conclusion that this was reflective of reality. Specifically, this is what should be expected as SIC is only a single factor that contributes to an organisation's performance. In response, the decision was made to remove this variable from the measurement model and replace it with a measure of service innovation performance (Kariyapperuma, 2013; Hariandja, 2016b; Banjongprasert, 2017). This outcome variable was similarly supported by the literature but had a much closer link or theoretical correspondence to SIC and had far fewer determinants than organisational performance (MacKenzie *et al.*, 2011; Plattfaut *et al.*, 2015). Accordingly, the questionnaire was modified, and this new question added to an appropriate section. It was anticipated that this change would significantly improve the predictive power of the SIC measure.

These revisions, summarised in Table 18, were tested using an updated version of the questionnaire in a second pilot study (See Appendix D).

Pilot 1 Questionnaire and Measurement Model	**Revised Questionnaire and Measurement Model**
Exclusively textual response options, describing each of the subdimensions at each level of maturity.	Inclusion of numbers, titles, and instructions that clearly indicate whether response options relate to high or low maturity.
Organisational performance variable is not a direct effect of SIC maturity.	Service innovation performance variable represents a direct effect of SIC maturity.

Table 18: Summary of Revisions to Pilot 1 Questionnaire and Measurement Model.

6.2.2.2 Pilot Study 2

The second pilot study was active for 24 days between the 31st of January and the 23rd of February, 2018. Invitations to participate in the study were sent to 2,419 unique contact email addresses. During this time, 137 responses were obtained from service organisations, 39 of which had between 10 and 249 employees and were suitable for analysis[6].

Changes to the measurement model (as described in §5.3.1), reflected by changes in the questionnaire (as detailed in §6.3.1.1), were deemed successful and collected data, when analysed, provided comparatively superior results. Indeed, as a consequence of changes from the first pilot study, improved goodness-of-fit statistics could be estimated. Following the removal of 1 prediction outlier (Aguinis *et al.*, 2013), 38

[6] Information regarding responses indicated that 42.9% (1,037) of recipients opened the invitation email and of these 13.3% (322) clicked the link to begin the survey. Of those who commenced answering the questionnaire, 51.86% (167) completed it. 23.35% (39) of these responses were by service SMEs. These percentages, in combination with those obtained from Pilot 1, supported the calculation that approximately 20,000 invitation emails were needed to obtain a minimum of 200 responses by service SMEs (See §6.3.1.2.4).

responses remained for analysis[7], where 42.9% of the variance in the construct was explained by the indicators. Though the predictive power of the model were below the conventionally accepted threshold of 50% (MacKenzie *et al.*, 2011), in combination, the above results were indicative of an improved model.

Goodness-of-fit statistics were close to acceptable values (χ^2=56.069, p = .023, Relative χ^2 [χ^2/df] = 1.515, CFI = .875, RMSEA = .118, SRMR = .1347) (Hu and Bentler, 1999). Further, though the standardised path coefficients for UI and KM differed from those obtained in Pilot 1, the standardised path coefficients from the exogenous variables to the SIC construct were predominantly significant. These are reported in Table 19[8].

	Standardised Estimate	**Standard Error**	**t-value**	**Sig.**
UI → SIC	-.335	.077	-3.596	<.001
KM → SIC	.229	.091	2.163	.031
S → SIC	.500	.091	4.849	<.001
N → SIC	.123	.092	1.285	.199

Table 19: Pilot 2 – Path Coefficients and Significance.

As the results obtained from Pilot 2 were based on only 38 responses and showed a substantial improvement from those obtained in Pilot 1, the decision was made to employ the measurement model and questionnaire tested here for the main study. This logic is in line with generally accepted practices within the literature, where it is expected that estimates obtained using CB-SEM and samples of less than 50 will be unreliable and unstable (Shah and Goldstein, 2006; Aguinis and Harden, 2009; Hoyle and Gottfredson, 2015). Indeed, it was anticipated that a large sample of data would produce reliable and stable results that would support the measurement model through an increase in its predictive power and allow the contribution of each of the indicators

[7] Readers must note that sample size (38) for this pilot study is extremely small given that there are 22 variables in the model, 11 of which are unobserved. This meant that caution was required when making generalisations to the population as a whole (De Beuckelaer and Wagner, 2012).

[8] To account for the nonnormality of data, the 'Bollen-Stine bootstrap *p*' (Bollen and Stine, 1992) was likewise calculated for Pilot 2. The number of bootstrap samples was set to 1,000, with results indicating that the model fit better in 461 samples and that the Bollen-Stine bootstrap *p* was .539, meaning that the revised model could be accepted.

of the subdimensions to be accurately estimated (MacCallum et al., 1996; Weston and Gore Jr, 2006).

6.3 Phase 6 – Data Collection

Once the measurement model has been formally specified and the index tested, data must be obtained from a sample of respondents to assess the measure's psychometric properties and confirm and its validity. Two issues central to this phase are the size of the sample and how representative they are of the population for which the measure is being constructed (MacKenzie *et al.*, 2011).

6.3.1 Step 13: Collect Data

The purpose of this step is to detail all major activities the relate to the collection of data. It commences by describing the design and composition of the questionnaire, elaborates on issues related to population and sampling, and provides details of the administration of the survey. Afterwards, it considers the survey's response rate and measures taken to prepare data for analysis. It concludes by reporting a profile of respondents.

6.3.1.1 Composition of the Final Data Collection Vehicle

Any modifications to the questionnaire, described in previous subsections, were made with the objective of retaining its flow and minimising its length. Indeed, the questionnaire was designed to be as short as possible while still collecting all required data (Bryman, 2004). Its completion time, based on the results from Pilot 2, remained at approximately 10 minutes, a length considered to be reasonable. Excepting two instances, where respondents could enter a perceived barrier to service innovation or a description of their principal activities when they were not addressed by the existing response options, all questions were closed-ended, meaning that they were easy to answer for busy professionals.

In the following subsections, details regarding the questionnaire are outlined, including additional measures adopted from other authors and information about its composition and structure. A copy of the questionnaire is included in Appendix D.

6.3.1.1.1 Additional Measures

A key requirement of rigorous quantitative research is that the measures used in a study are legitimate (Hair *et al.*, 2009). While this could not yet be confirmed for the untested SICMI, additional measures, necessary for estimation of the measurement model (See §5.3.1) or included in the questionnaire to enhance analysis, did meet these standards. As constructs with reflective indicators, they are measured using scales (See §2.3.1.1) for which quality is determined by their reliability and validity (Hair *et al.*, 2009). Reliability describes the measure's ability to produce the same results, while validity is the accuracy with which a variable is measured (Bryman and Bell, 2007).

Reliability is usually assessed with Cronbach's Alpha (α), a value that ranges from 0 to 1. .70 is the recommended minimum, but values closer to 1 are more desirable (Cronbach and Meehl, 1955). Validity is assessed in studies in which an original measure is developed and involves an examination of its content, dimensions, and confirmation that it behaves as expected for a legitimate measure of that construct (Dooley, 2001).

For this study, four scales were used that were developed by other authors. Service innovation performance was measured using a scale from Chen *et al.* (2011: 1343) (α = 0.86); NSD performance with a scale from Yang *et al.* (2016: 285) (α = 0.947), adapted slightly to align its wording with other questions; organisational performance with a measure by Li and Atuahene-Gima (2001: 1133) (α = 0.88); and the perceived competitiveness of a respondent's industry, using a scale from Asare *et al.* (2013: 528) (α = 0.92). These were selected because they: (1) had Cronbach's Alpha values of above 0.70, (2) were firm-level measures, (3) had more than three items, and (4) their reliability and validity had been previously established. All items were measured using five-point scales.

Appendix B provides details of all scales adopted or adapted for inclusion in this study.

6.3.1.1.2 Demographic Variables

Nine demographic variables were included in the questionnaire.

- Firm age describes the number of years that the organisation has been in operation. The response options were: Less than 1 year; 1-2 years; 3-5 years; 6-10 years; 11-20 years; and More than 20 years.
- Firm size was determined by the number of employees, consistent with other studies (O'Regan *et al.*, 2004; Hipp and Grupp, 2005; Jantunen, 2005). While the focus of this research was on small and medium-sized enterprises, i.e. those with 10-249 employees, response options were included for micro-firms, with fewer than 10 staff, and large organisations, with 250 staff or more (CSO, 2012). These options were: 5 employees or fewer; 6-9 employees; 10-19 employees; 20-49 employees; 50-149 employees; 150-249 employees; and 250+ employees.
- The respondent's position in the organisation was sought with the response options: CEO/Owner; Managing Director; Part of management; and Employee (non-management).
- Principal customers were determined using three options: Business-to-business (B2B), where their services were predominantly sold to other businesses; Business-to-consumer (B2C), where services were predominantly sold to consumers; and an 'other' category, which described an organisation's principal customers as government agencies, not-for-profit organisations, or others neither classified as a business or a consumer.
- The principal activities of respondent organisations were ascertained using the following options: Advertising, market research, or public opinion polling; Agricultural; Architectural or engineering; Business or management consulting; Construction; Cleaning or industrial cleaning; Design or graphic design; Education or training; Energy; Environmental; Facilities or property management; Fashion; Financial; Health and safety; Healthcare or social care; Information and communications technology; Insurance; Law; Media or entertainment; Real estate; Recruitment, human resources, or employment; Repair or recovery of vehicles or machinery; Research and development; Retail or wholesale; Sale, hire, or leasing of machinery or equipment; Sanitation and waste disposal; Security or investigation; Sport; Tourism or hospitality; Transport, distribution, or storage; and an open-ended text box where activities not included in other response options could be entered.

- Organisational turnover related to the 2016 figure. Response categories were carefully designed to incorporate both very small and very large organisations, specifically: <€249,999; €250,000-€499,999; €500,000-€999,999; €1 million-€1.99 million; €2 million-€10 million; €11 million-€25 million; €26 million-€50 million; and >€50 million.
- Ownership was determined by asking whether the organisation was domestically owned or foreign owned.
- The location of the respondent's organisation or branch was established with the following response options: Outside of the Republic of Ireland; Carlow; Cavan; Clare; Cork; Donegal; Dublin; Galway; Kerry; Kildare; Kilkenny; Laois; Leitrim; Limerick; Longford; Louth; Mayo; Meath; Monaghan; Offaly; Roscommon; Sligo; Tipperary; Waterford; Westmeath; Wexford; and Wicklow.
- Finally, the presence of NSD processes was determined by asking whether organisations had standard processes in place for the development of new services.

6.3.1.1.3 Questionnaire Design and Structure

A professional tool for the development and administration of online surveys, SurveyMonkey, was used for all primary research in this study. This tool provides unique features that facilitate the design of well laid out, easy-to-use, and unambiguous questionnaires.

"Since there is no help from an interviewer for the respondent taking a web survey, the design of self-administered web questionnaires is even more important" for achieving high data quality than for other methods of survey data collection (Lozar Manfreda *et al.*, 2002: 1). Accordingly, best practices for the design of online questionnaires were closely adhered to for this study. These advise that a questionnaire is simple to comprehend and navigate; not of excessive length; does not have too many open-ended questions; requires only a minimum of computer skills; contains questions that are short, clear, easy to read, and in an appropriate font size; begins with a cover page that explains the questionnaire's purpose, establishes its credibility, and assures the confidentiality of responses; does not contain answer categories that overlap or selections that cannot be undone; and utilises colour and design to appear appealing and sophisticated, without placing excessive demands on a respondent's hardware or software (Couper, 2000; Lozar Manfreda *et al.*, 2002; Lozar Manfreda and Vehovar, 2002; Van Selm and Jankowski, 2006; Andrews *et al.*, 2007; Regmi *et al.*, 2016).

Observing these guidelines, a simple format with concise, clear, and unambiguous instructions for each question was prepared (Dillman, 2000). Instructions are typically divided into three classes: general instructions, transitional instructions, and question-answering instructions (Bourque and Fielder, 2003), all of which were employed in the composition of this study's questionnaire.

It is standard for general instructions to be a part of a questionnaire's introductory material, expanding on the information in survey's invitation, briefly stating its purpose, to whom it is directed, and the expected completion time (Plumb and Spyridakis, 1992; Akkerboom and Schmeets, 1998; Johnson-Kozlow *et al.*, 2011). The second class are transitional instructions. These describe instructions at parts of the questionnaire where there are transitions from one topic to another (Bourque and Fielder, 2003). Their purpose is to inform the respondent that the topic of questions is changing and that the next set of questions address a different subject. Transitional instructions allow the respondent to 'catch their breath', changing the focus of their thinking, and providing flow and continuity through the directions that guide their answering of the questionnaire (Dillman, 2000). The final class of instruction is used to assist respondents with answering individual questions (Bourque and Fielder, 2003).

Effort was expended to create a compelling flow and logical structure for respondents by dividing the questionnaire into sections with related items clustered together (Baker, 1991). Important variables were placed close to the beginning, while demographic questions that may be sensitive or unnerve respondents were placed at the end (Wisker, 2008), conforming with the design recommendation of moving from general questions to specific ones (Oppenheim, 2000).

As the cover page would be examined first, it was carefully designed to have a positive impact, providing respondents with key information about the questionnaire and its completion, and assuring them of the confidentiality and secure storage of responses (Bourque and Fielder, 2003). Both the logos of Waterford Institute of Technology and the RIKON research group were used as headers for each page, adding an impression of legitimacy and professionalism. Colours were utilised throughout, with a green corresponding to that in the RIKON logo, used as a banner for each page, to indicate progress on the progress bar, to distinguish the rows in questions that had multiple items, and for the 'Next' and 'Submit' navigation buttons at the bottom of the questionnaire's pages.

All decisions regarding the design and structure of the questionnaire were taken so that respondents would perceive it as stimulating or interesting, easy to complete, and professional. A familiar closed-ended response format was used throughout the questionnaire, excepting two instances where text boxes were included. The purpose of this design choice was to ensure that answering the questionnaire was simple, allowing respondents to focus on the substance of the inquiry, and to be certain that it would be easy to answer for busy professionals (Dillman, 2000). The questionnaire was designed to be as short as possible while still collecting required data (Bryman, 2004). Its completion time was approximated to be approximately 10 minutes, a length considered to be reasonable.

The questionnaire had 9 pages (including a cover page and 'thank you' page), comprising 22 questions, divided into 4 sections:

- Section A began the survey with a screening question: 'Is your organisation a service business?'. Those responding negatively were disqualified from participating in the survey and data were not collected.
- Section B contained four questions that assess the maturity of each of SIC's subdimensions.
- Section C had five questions which asked respondents to identify barriers to service innovation, report their perceived service innovation performance using both a six-item and single-item measure, their NSD performance on a

five-item scale, and the performance of their organisation compared to competitors on nine listed items.

- Section D collected background information on respondents and measured the duration the organisation had been in operation; the number of employees; the respondent’s position in the organisation; whether the business was B2B, B2C, or principally sold their services to customers of other types; their principal activities; turnover for 2016; whether they were domestically owned or foreign owned; where the organisation or branch was located; and if they had standard processes in place for the development of new services. Four items were then used to measure the perceived competitiveness of the respondent’s industry and a single global item reflectively measured service innovation capability maturity. Finally, if respondents chose, they could enter an email address to which a report of the study’s findings would be sent.

6.3.1.2 Population and Sampling

6.3.1.2.1 Definition of the Unit of Analysis

A study’s unit of analysis refers to the entity that is the focus of the research (De Vaus, 2001). Management research will have one of the following units of analysis: (1) individuals, (2) teams, or (3) organisations (Gupta et al., 2006). For this study, the unit of analysis is clarified within the research objectives as the organisation. Organisations are defined by Rollinson (2008: 4) as “social entities brought into existence and sustained in an ongoing way by humans to serve some purpose, from which it follows that human activities in the entity are normally structured and coordinated towards achieving some purpose or goals”. These structured activities have identifiable parts that are repeated and relatively enduring and are what the survey intends to quantify (Blackler and Shimmin, 1984; Rollinson, 2008).

While organisations are the unit of analysis, they cannot complete questionnaires. This means that individuals with the required knowledge of that firm and its activities must be selected to complete the survey. For this research, a Chief Executive Officer (CEO) or owner, Managing Director, a member of management, or an employee with sufficient knowledge of their organisation’s capabilities and performance were anticipated to be credible and reliable respondents (Pearce *et al.*, 1987; Sharfman, 1998; Church and Waclawski, 2007).

6.3.1.2.2 Definition of the Population of Interest

The population of interest for this study are all for-profit Irish service SMEs, organisations that are hypothesised to possess a service innovation capability that is performed to some degree. Manufacturing organisations were excluded, as the study was concerned only with the SIC of service SMEs, as were not-for-profit organisations, which are regarded are as unique from and distinct to for-profit organisations (Goulet and Frank, 2002). SMEs are designated as organisations with 10-249 employees and an annual turnover not exceeding €50 million. This aligns with the broadly utilised European classification that labels organisations smaller than this as micro-firms and bigger than this as large organisations (European Commission, 2003; CSO, 2012). This population is a sizeable and heterogeneous group of organisations from a variety of industries and sectors.

6.3.1.2.3 Sampling Approach

To obtain responses to a survey that are representative of a population, a researcher must decide whether a census will be undertaken or a sample of that population utilised (Bryman and Bell, 2007). If the second option is selected, they must choose whether to employ probability or non-probability sampling and select an appropriate sampling method (Kane and Brún, 2001).

A census describes research where each unit of a population has the chance to respond to a survey, while a sample provides only a segment or a subset of that population with an opportunity to respond (Creswell, 2003). For this study, a sample of the population had to be employed due to the absence of any sampling frame (Bryman and Bell, 2007), or the availability of information about the focal population, specifically, a list of all Irish service SMEs and their contact details. While it was not possible to perform a census, the use of a representative sample ensures that results can be used to make inferences about the population of interest (Kane and Brún, 2001).

The next matter that requires consideration is whether a probability or non-probability sample is used. A probability sample is one that has been randomly selected and each unit of the population have a known and equal chance of selection. In contrast to this, a non-probability sample is composed of units of the population that "have not been selected using a random selection method" (Bryman and Bell, 2007: 182). Due to probability theory, the former class of sample are more likely to represent the characteristics of the population (Dooley, 2001). However, in order for selection to be random, a complete sampling frame or list of all members of that population is required. As this was not available to the researcher, a non-probability sample was used.

Non-probability samples are generally divided into two classes, accidental and purposive (Etikan *et al.*, 2016). An accidental sample, otherwise referred to as a convenience or haphazard sample (Latham, 2007), is a sample "simply available to the researcher by virtue of its accessibility" (Bryman and Bell, 2007: 197). A purposive sample, referred to as a judgemental sample (Panacek and Thompson, 2007), is defined as the selection of units of a population "based on specific purposes" associated with answering the research questions or achieving its objectives (Teddlie and Yu, 2007: 77). Accidental sampling was deemed inappropriate as it would be unknown whether those targeted would be representative of the population of interest (Bryman and Bell, 2007). Therefore, a purposive sample was judged the most appropriate method to select organisations that were likely to be both service-based and with between 10 and 249 employees.

6.3.1.2.4 Sample Size

Sample size refers to the number observations obtained through data collection (Dimitropoulos *et al.*, 2011), such as the number or responses to a survey (Cobanoglu *et al.*, 2001). The required sample size for a study is usually informed by its objectives and the tests that will be used to analyse data. However, while there is agreement that larger samples are more desirable (Pallant, 2010), opinions diverge regarding their appropriate size.

This is particularly true for studies such as this which employ sophisticated statistical techniques, such as SEM (Fornell, 1983; Schumacker and Lomax, 2010). Though there is agreement that, with smaller sample sizes, SEM is unreliable, and precise estimates of a model cannot be obtained (MacCallum *et al.*, 1996), there is a lack of consensus in the literature with regard to what constitutes an adequate sample size or how it should be calculated (Weston and Gore Jr, 2006; Westland, 2010). Indeed, there is no harmony among authors and suggestions range from 100 to 5,000 (Hinkin, 1998; MacCallum *et al.*, 1999; Schumacker and Lomax, 2010). The most frequently observed recommendations are those by Anderson and Gerbing (1988) who suggest a sample of 150; Weston and Gore Jr (2006) who propose a figure of 200; and that of Hair *et al.* (2009) which recommends a sample of *at least* 200 observations, where increases can be made dependent on the characteristics of the model and the data.

It is proposed by others that an adequate sample size for reliable estimates when utilising SEM, can be determined by evaluating the ratio of respondents to the number of variables being analysed (MacCallum *et al.*, 1999). For this protocol, various suggestions exist ranging from 3:1 to 10:1 (Hinkin, 1998; MacCallum *et al.*, 1999). Another recommendation for the size of a sample is that there are 10-20 responses, referred to as cases, for each measured variable (Schreiber *et al.*, 2006; Westland, 2010; Kline, 2011), or 5-10 cases per free parameter (Schreiber *et al.*, 2006; Weston and Gore Jr, 2006). A free parameter is a term to used describe values that must be estimated in the analysis or that are not specified beforehand. In general, more complex models (Lei and Wu, 2007), those with a large number of items (Schreiber *et al.*, 2006), or those with data that violates normality (Hair *et al.*, 2009), require a larger number of cases (Gefen *et al.*, 2011b).

Another critical consideration when determining the size of a sample, is the power of the study (See §6.3.1.4.2). Generally, when $\alpha = .05$, $v = 60$, and a sample size of 200 is obtained, power will be .80, a figure that is broadly accepted[9] (Lipsey, 1990; Cohen, 1992).

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[9] α is the alpha or Type I error and is commonly referred to as the level of significance. This is usually set to .05 in social science research. v is the number of degrees of freedom.

With these considerations in mind, the objective of the main survey was to obtain a minimum sample of 200, detailed in the following section.

6.3.1.3 Survey Administration

Data collection for the study's main survey was undertaken over 24 days, between March 14th and April 6th, 2018. During this time, five waves of emails were sent, each containing a link that permitted a single response from the recipient of that invitation.

(1) The initial invitation was sent to 19,892 unique contact addresses on a Wednesday morning at 10 am, judged from interactions with practitioners to be a suitable day and time that allowed for attention to be devoted to competing the questionnaire. It alerted recipients to the survey and appealed for their participation. **(2)** Two days later, on Friday 16th, while the survey would still be fresh in their memory, discrete reminders were sent to non-respondents and to those that had partially completed the questionnaire. **(3)** One week from the mailing of the initial invitation, Wednesday 21st, a second mailing of unique reminders to non-respondents and partial respondents was sent. **(4)** Again, after another week had elapsed, on Wednesday 28th, a third mailing of separate reminders for both non-respondents and partial respondents was sent. **(5)** A final mailing of reminders, appealing to those who had not responded or who had partially responded, was sent two days prior to the close of the survey, on April 4th.

Discrete text was formulated for each of these mailings, conveying a similar, but distinct message. The initial invitation email adhered to guidelines advocated by Dillman (2000) and was short, positively worded, assured confidentiality and anonymity, specified who ought to complete the questionnaire, provided contact details for the researcher, informed the recipient that answering the questionnaire would not take long, and stressed the importance of the research project and the recipient's contribution. Subsequent emails likewise adhered to best practices for motivating participation in a survey, alerting recipients that a report of the study's findings could be earned through participation, and were written in an increasingly insistent tone that made an urgent and serious request for the receiver's response (Fox et al., 1998; Erdogan and Baker, 2002; Baruch and Holtom, 2008). The text of the introductory and reminder emails is presented in Appendix E, along with a content description of the messages inherent in each.

6.3.1.4 Type I and Type II Errors and Statistical Power

6.3.1.4.1 Type I and Type II Errors

The majority of multivariate statistical techniques require inferences from the results of a single sample to the population of interest (Hair et al., 2009). As there are assumptions involved, an acceptable level of statistical error is essential. The acceptable level of error is known as alpha (α) or Type I error and is commonly referred to as the level of significance (Pericchi and Pereira, 2013). In social science research, α is usually set at .05 (Pituch and Stevens, 2016). However, when testing any null hypothesis (H_0), Type II error or beta (β) is also involved. Whereas Type I error describes the probability of erroneously rejecting H_0 when it is true, Type II error occurs when H_0 is not rejected, though it is false (Banerjee et al., 2009).

Both classes of error can produce spurious results and must be carefully considered by quantitative social science researchers (Pituch and Stevens, 2016). β is frequently referred to as statistical power (Fitzner and Heckinger, 2010) and is elaborated upon in the following subsection.

6.3.1.4.2 Statistical Power

Statistical power describes the probability of correctly rejecting a false null hypothesis (Schmitz et al., 1998). The type of statistical power that is important in the context of this study, is the statistical power of SEM with regard to overall model fit (MacCallum et al., 1996). Understanding statistical power is important as it allows good models to be differentiated from bad models which can hinder progress in a research discipline with theories that depart from reality (Hermida et al., 2015). The chi-square statistic and others address only Type I error, the probability of rejecting a correct model, but entirely neglect any evaluation of Type II error, the probability of not rejecting an incorrect model. Nevertheless, the power of structural equation models is rarely reported in academic literature (McQuitty, 2004; Hermida et al., 2015).

With structural equation modelling, statistical power (π) is a function of three factors: (1) sample size, (2) degrees of freedom, and (3) α. The recommended value for acceptable statistical power is .80 or above (MacCallum et al., 1996; Cohen et al., 2003). The statistical power of this study is calculated in §7.5.

6.3.1.5 Response Rate and Sample Representativeness

Invitations to participate in this survey were sent via email to 19,892 contacts drawn from the databases of the RIKON research group. This included 825 addresses to which the invitation email could not be delivered and 1,318 that had blocked emails sent through SurveyMonkey. After the initial invitation and four reminders, there were 767 incomplete or partial responses and 1,199 completed questionnaires. Of those completed, 375 were by respondents that did not believe that their business was predominantly service-based and who did not qualify for the study.

This reduced the number of responses to 824, a valid-response rate of 4.14%. Response rates at this level are not uncommon for organisational research utilising an online survey methodology and previous studies exhibit rates in a similar range (cf. Ziltener (2013), Richardson (2015), Dressler (2015), Carter (2016), Espinosa (2016), and Sieger et al. (2016), response rates ranging from 3%-5.9%). As indicated, the actual response rate was 20.64% when all responses are considered. Table 20 lists the response statistics.

Responses	**Number of responses**
Undeliverable email	825
SurveyMonkey emails blocked	1,318
Incomplete or partial response	767
Not a service organisation	371
Subtotal:	3,281
Completed questionnaires	824
Total:	4,105
Sample size:	19,892
Response rate (including all responses):	20.64%
Response rate (based on completed questionnaires only):	4.14%

Table 20: Response Rate.

As the population of interest for this study were service organisations classed as SMEs, with between 10 and 249 employees and an annual turnover not exceeding €50 million (European Commission, 2003), responses by those outside of this cohort were excluded from the analysis. This resulted in the removal of 513 cases. This left a total of 311 responses by service SMEs who covered a range of geographical regions in the Republic of Ireland and seven who were located in other jurisdictions. As the population of interest for this study were Irish small and medium-sized service enterprises (See §6.3.1.1.2), all responses by international organisations were removed, leaving 304 cases remaining.

When examining the representativeness of responses, one major concern is nonresponse bias. This describes the effect that occurs when respondents to a survey differ substantially from non-respondents which prevents researchers from saying "how the entire sample would have responded" (Armstrong and Overton, 1977: 396). To overcome this issue, researchers often compare the demographic variables of respondents and non-respondents against known values from the population, identifying whether there are significant differences between these groups (Guthrie *et al.*, 2009). However, for this study publicly available background data on respondent organisations could not be obtained, necessitating a test for non-response bias of another kind.

As it is widely accepted that late respondents, or those who require additional prompting, are similar to non-respondents (Bryman, 2004), an extrapolation method, recommended by Armstrong and Overton (1977), was used to test for bias. This involved the comparison of 204 early responses, or those submitted during the survey's first week, with 48 that were submitted in the final week that the survey was active, deemed to be late and therefore reflective of non-respondents. As the variables of interest were all categorical, chi-square tests were used to compare these groups (Armstrong and Overton, 1977). The results of these tests are depicted in Table 21.

Variable	Chi-Square	Sig.
Firm Age	2.530	.639
Firm Size	4.324	.229
Principal Customers	2.898	.235
Industry or Sector	25.864	.526
Revenue	5.396	.494
Irish Owned	.441	.506
Location	21.469	.431

Table 21: Chi-Square Tests Comparing Early and Late Respondents.

These results confirmed that there were no significant differences between early respondents and late respondents. As a result, concerns regarding representativeness of the sample or the detrimental impact of nonresponse bias could be disregarded, allowing collected responses to be utilised for analysis.

6.3.1.6 Data Preparation

Once the survey closed, all data were downloaded from SurveyMonkey in an Excel format which facilitated their importation into SPSS. All variables of interest were then renamed for convenience and additional values computed to represent reflective constructs. There were no missing values for completed responses as the questionnaire was designed in such a way that it could not be submitted unless every question was answered. Following this, data were prepared for multivariate analysis by identifying and appropriately handling any influential outliers and testing the normality assumption.

6.3.1.6.1 Outliers

The examination of data for outliers is a critical step in their preparation for analysis. This activity is generally recommended by statisticians when performing analyses, as it allows researchers to identify any overly influential data points that may be distorting results (Militino et al., 2006; Sisman, 2010; Buzzi-Ferraris and Manenti, 2011). Indeed, it is supported by Bollen and Jackman (1990: 257) who warn social scientists to be sceptical "of empirical results that are unduly sensitive to one case (or to a very small number of observations)". In scenarios such as this, observations that are distinct to the majority of other data points drive results and reduce their accuracy, painting a misleading picture (Cook, 2000).

Aguinis et al. (2013) recognise three categories of outliers, error outliers, interesting outliers, and influential outliers. Error outliers describe data points that are different to others as a result of inaccuracies or errors in observation, recording, preparation, computation, coding, or manipulation. Interesting outliers are observations that are accurate or have not yet been confirmed as error outliers. They can potentially offer researchers valuable or unexpected knowledge. With influential outliers, there are two classes, model fit outliers and prediction outliers. The former are data points that alter the fit of a model, while the latter describe those that alter parameter estimates.

As these classes of outliers are fundamentally different, the authors recommend distinct best practices for dealing with each of them (Aguinis et al., 2013). These necessitate that the class of outlier of interest to a researcher is defined and that an identification and handling technique congruent with that class is applied. This suggestion improves the replicability of studies by eliminating the arbitrary manipulation of results in order to prove a hypothesis or support other findings.

For this study, the outliers of interest were prediction outliers. These were cases that negatively affected the predictive power of SICMI through large differences between the scores for the four indicators of the subdimensions and the global reflective item. The appropriate method for identifying outliers of this type is an influence technique such as Cook's Distance, commonly referred to as Cook's D (Cook, 1977; Cook and Weisberg, 1982). The larger a value for Cook's D, the more influential the case. The conventional approach for identifying outliers using this statistic is the formula 4/n, where n represents the number of observations (Bollen and Jackman, 1990; Altman and Krzywinski, 2016). Therefore, the threshold for this statistic was .01315[10], with values above this figure being designated as outliers.

Next, Cook's D was plotted. As illustrated in Figure 15, several observations seemed to be influential data points that deviated from others. However, it was not possible to precisely diagnose outliers simply by examining the plot.

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[10] 4/304 = .01315789473

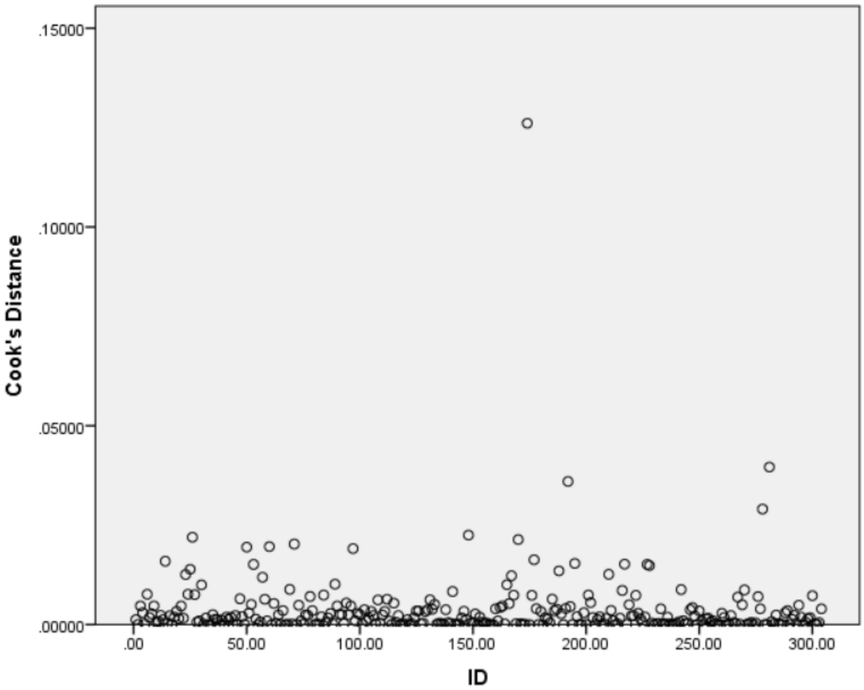

Figure 15: Plot of Cook's D Statistic.

Instead, these extreme observations were located using the SPSS software, where, adhering to the guidelines suggested by Aguinis et al. (2013), they were removed from the analysis. In total, there were 20 cases for which Cook's D was larger than .01315, 6.58% of the dataset. Once excluded, 284 valid cases remained, constituting a dataset that satisfied the recommendations that at least 200 cases are used for structural equation modelling and that there are 15-20 cases for each measured variable (Hair et al., 2009; Kline, 2011).

Best practice stipulates that to ensure there is full transparency, key results should be reported both for analyses in which outliers have been included and those for which they have been removed (Aguinis et al., 2013). As the objective of this step was to identify and handle any outliers that negatively impacted a specific parameter estimate, the predictive power of SICMI, the value for R^2 is the one of note. Prior to the removal of outliers, this figure was .395, indicating that the four subdimensions explained 39.5% of the variance in the SIC construct. Following the removal of outliers, their predictive power increased to .556, signifying that 55.6% of the variance in the SIC construct was explained by the subdimensions.

6.3.1.6.2 Normality

The next step in preparing data for analysis was testing for normality. Normality is a fundamental assumption or requirement for many statistical methods and parametric tests[11] (Hair et al., 2009). It refers to the distribution of sample data and its correspondence to a normal distribution. When data are normally distributed, they can be plotted as a symmetrical, mesokurtic (bell-shaped) curve where the highest frequency of scores are centred around the mean and lower frequencies towards the extremes or tails (Russo, 2004; Ahad et al., 2011).

First, univariate normality was tested through an examination of figures for skewness and kurtosis. These provide information about the shape of the distribution. Skewness measures the symmetry of the distribution of data and kurtosis, the peakedness (Tabachnick and Fidell, 2007). When the distribution of data differs significantly from normal distribution, it can be observed in values for these two measures that deviate from zero (Hair et al., 2009). Generally, when values for skewness and kurtosis are above two and seven, respectively, it is considered to be indicative of nonnormally distributed data (West et al., 1995; Curran et al., 1996). In Table 22, it can be observed that all values for the skewness and kurtosis of key variables fell below this threshold.

[11] Other fundamental assumptions are linearity, homoscedasticity, and adequate sample size. The former two were deemed to be met through graphical examinations and statistical tests, the latter is fully explored in §6.3.1.2.4.

	Skewness		Kurtosis	
	Statistic	**Std. Error**	**Statistic**	**Std. Error**
UI	.279		-1.165	
KM	-.133		-1.121	
S	.136		-1.110	
N	.078		-.958	
SIP1	-.978		.760	
SIP2	-1.381	.145	4.367	.288
SIP3	-.462		-.241	
SIP4	-.932		1.427	
SIP5	-.458		-.714	
SIP6	-.420		.137	
GlobRef	-.286		-.279	

Table 22: Skewness and Kurtosis of Key Variables.

Next, a review was conducted of Kolmogorov-Smirnov (K-S) and Shapiro-Wilk (S-W) test results. The K-S and S-W tests are univariate procedures that examine whether score distributions vary from normal distribution (Field, 2009). Significant results were obtained for all variables in these tests, below the cutoff point of .05, indicating a deviation from normality. However, it is recognised that these tests can be too sensitive or inaccurate with larger samples (Pallant, 2010). Following this, an inspection of histograms and Q-Q plots largely indicated univariate normality in the distribution of key variables, an example of which, for the global reflective item, is depicted in Figure 16 and Figure 17.

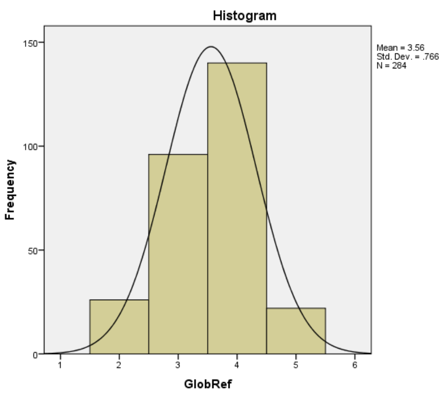

Figure 16: Histogram Illustrating the Distribution of the Global Reflective Item.

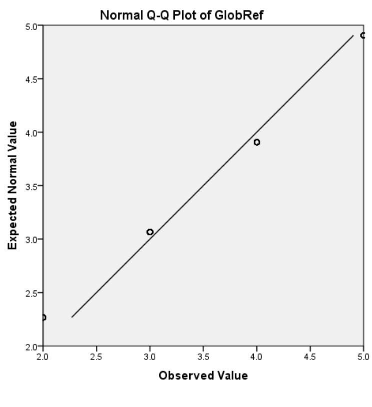

Figure 17: Q-Q Plot Illustrating the Distribution of the Global Reflective Item.

While the figures in Table 22 are demonstrative that most univariate distributions are somewhat normal, “univariate normality does not guarantee the multivariate normality of one’s data” (Morrison *et al.*, 2017: 1333). Indeed, as the joint distributions of variables may depart substantially from multivariate normality (Maciniosh, 1997), an assumption that is required for many statistical techniques, it is recommended that multivariate normality is also tested (Rencher, 2012). To achieve this, Ragatz *et al.* (2002) and others (Petersen *et al.*, 2003; Akgün *et al.*, 2006; Gao *et al.*, 2008; Oppong and Agbedra, 2016) suggest examining Mardia’s coefficient (Mardia, 1970), a statistic that can be generated using the AMOS software. When Mardia’s coefficient is zero, data are normally distributed. When results for this statistic are above five, it is indicative of data that are nonnormally distributed (Byrne, 2013). A value of 20.413 for Mardia’s coefficient with a t-value of 10.171 was obtained for this study’s data, suggesting that data are not normally distributed.

Though Mardia’s coefficient suggested a multivariate nonnormal distribution (Lee, 2015), collectively, the results obtained from the foregoing tests and charts indicated that data were *approximately normally distributed* (Ong and Puteh, 2017). Although any violation to the normality assumption is not ideal, SEM is robust to this with larger sample sizes, as was the case with this study (Anderson and Gerbing, 1988; Cohen *et al.*, 2003; Marsh *et al.*, 2004). As a result, CB-SEM (See §2.3.2) could be used for analyses in the validation of SICMI.

6.3.1.6.3 Common Method Bias

Finally, to further scrutinise the validity of results, a post hoc test for CMB was undertaken using Harman’s one-factor or single-factor test (MacKenzie and Podsakoff, 2012). For this procedure, “all the variables of interest are entered into a factor analysis” and, if (a) a single factor emerges or (b) one ‘general’ factor accounts for the majority of covariance in the variables, then common method variance is present (Podsakoff and Organ, 1986: 536). Though this approach has been criticised (Malhotra *et al.*, 2006) for failing to statistically control or partial out method effects; for its insensitivity, which may indicate that either CMB is a problem or that measures of constructs lack discriminant validity; and that it offers no guidelines with regard to how much variance a ‘general’ factor should account for to alert researchers to issues with CMB, it continues to be widely used (Podsakoff *et al.*, 2003a). Accordingly, this test should be considered only as an indication whether common method bias may be an issue.

For this study, results of Harman's one-factor test indicated that a single factor accounted for 40.760% of the variance of variables of interest. As neither of the conditions suggested by Podsakoff *et al.* (2003a) were fulfilled by this test, this supports the notion that CMB does not represent an issue with this research.

6.3.1.7 Profile of Respondents

The previous section described the cleaning process for the data through which 20 responses were removed from the sample. This resulted in 284 cases that could be utilised in the procedure to validate SICMI. This section presents a descriptive analysis of these participants.

Among the respondents, 43% were part of management, 29.2% were a CEO or owner, 19.4% were Managing Directors, and the remaining 8.5% were non-management employees with sufficient knowledge of their organisation's capabilities and performance to answer the questionnaire.

With regard to the age of respondent organisations, 53.9% were more than 20 years old, 26.4% were 11-20 years old, 10.9% had been in operation for 6-10 years, 7% for 3-5 years, while the remaining 1.8% were 1-2 years old. The range in size of respondent organisations was illustrative that a good cross-section of SMEs had been obtained, with 44.7% employing 10-19 persons, 29.6% with 20-49 employees, 21.1% with 50-149 employees, and 4.6% in the 150-249 employees grouping. Concerning their principal customers, 56% of respondents described their activities as predominantly B2B, 36.6% as predominantly B2C, while the remaining 7.4% were best classified as 'other', predominantly providing their services to government agencies, not-for-profit organisations, or others neither classified as a business or a consumer. Respondents represented a variety of industries and sectors, as depicted in Table 23.

	Frequency	Percent
Advertising, market research, or public opinion polling	5	1.8
Agricultural	7	2.5
Architectural or engineering	35	12.3
Business or management consulting	10	3.5
Construction	19	6.7
Cleaning or industrial cleaning	6	2.1
Design or graphic design	2	.7
Education or training	14	4.9
Energy	4	1.4
Environmental	8	2.8
Facilities or property management	5	1.8
Financial	18	6.3
Health and safety	2	.7
Healthcare or social care	12	4.2
Information and communications technology	22	7.7
Insurance	4	1.4
Law	3	1.1
Media or entertainment	1	.4
Real estate	6	2.1
Recruitment, human resources, or employment	4	1.4
Repair or recovery of vehicles or machinery	6	2.1
Research and development	3	1.1
Retail or wholesale	13	4.6
Sale, hire, or leasing of machinery or equipment	11	3.9
Sanitation and waste disposal	3	1.1
Security or investigation	11	3.9
Sport	1	.4
Tourism or hospitality	25	8.8
Transport, distribution, or storage	24	8.5
Total	284	100.0

Table 23: Respondent Industry or Sector.

In terms of revenue, 37.3% of respondents reported a figure of €2-10 million, 24.3% between €1-1.99 million, 13.4% were between €500,000 and €999,999, 10.6% of respondents belonged to the €11-25m category, 7.7% to that of €250,000-499,999, and 4.2% reported less than €249,999 in revenue, 2.5% between €26m and €50m. These organisations were located in various regions, with responses from 22 of Ireland's 26 counties being included in the analysis (See Table 24). Of these 90.8% were owned domestically, with the remainder, 9.2%, having foreign owners.

	Frequency	Percent
Carlow	8	2.8
Cavan	6	2.1
Clare	6	2.1
Cork	33	11.6
Donegal	5	1.8
Dublin	118	41.5
Galway	10	3.5
Kerry	9	3.2
Kildare	12	4.2
Kilkenny	7	2.5
Limerick	11	3.9
Louth	2	.7
Mayo	4	1.4
Meath	5	1.8
Monaghan	1	.4
Offaly	2	.7
Sligo	2	.7
Tipperary	7	2.5
Waterford	14	4.9
Westmeath	4	1.4
Wexford	13	4.6
Wicklow	5	1.8
Total	284	100.0

Table 24: Location of Respondents.

6.4 Chapter Conclusion

Initially, this chapter provided an account of the rigorous pretesting of this study's measure and offered a summary of two pilot studies, through which problems with the index were identified and corrected. Following this, the sampling approach, the composition of the final data collection vehicle, and details of the survey's administration were overviewed. Next, the response rate was calculated, and the representativeness of the sample confirmed by testing for nonresponse bias. Subsequently, details were provided of how the data were prepared for analysis through the removal of prediction outliers and ascertaining that the remaining 284 cases were approximately normally distributed in order to utilise SEM procedures. Finally, a profile was provided of the respondents in the dataset.

In the next chapter, the remaining steps in the study's best practice index construction procedure are detailed (MacKenzie *et al.*, 2011).

Chapter 7: Data Analysis

7.1 Introduction

In the previous chapter, activities undertaken to prepare and test the index were described. Further, details were provided regarding the design of the questionnaire, the approach to sampling, survey deployment, and the preparation of data for analysis. The focus of this chapter is data analysis. As illustrated in Table 25, it encompasses the three final phases in the study's index construction procedure.

The chapter begins by describing analyses relating the measurement model and activities respecting its purification and refinement. Following this, the validity of the structural model is considered. Finally, normative values for the study's maturity index are reported to aid users with interpretation of their scores.

Chapter	Phase	Step
3. Theoretical Foundation	1. Theoretical Foundation	1. Select an Appropriate Theoretical Foundation
4. Conceptualisation of Service Innovation Capability Maturity	2. Conceptualisation	2. Unambiguously Define SIC
		3. Specify the Conceptual Domain of the Construct
		4. Specify the Conceptual Theme
		5. Identify the Dimensions of SIC
		6. Confirm the Suitability of Dimensions as Formative Indicators of SIC
		7. Specify the Conceptual Theme of the Dimensions
5. Measurement	3. Development of Measurement Items	8. Generate Items to Represent the Construct
		9. Assess the Content Validity of the Items
	4. Measurement Model Specification	10. Formally Specify the Measurement Model
6. Data Collection	5. Testing the Index	11. Pretest
		12. Pilot
	6. Data Collection	13. Collect Data
7. Data Analysis	**7. Index Evaluation and Refinement**	**14. Purify and Refine the Index**
	8. Validation	**15. Assess Index Validity**
	9. Norm Development	**16. Develop Norms for the Index**

Table 25: Location of Current Index Construction Phases in Thesis.

7.2 Phase 7 – Index Evaluation and Refinement

Once quantitative data are obtained, a newly developed measure must be evaluated (Rossiter, 2002). The objective of this phase is to complete a series of statistical tests that can inform decisions regarding its purification through the omission of items (Hinkin et al., 1997; Diamantopoulos and Winklhofer, 2001).

7.2.1 Step 14: Purify and Refine the Index

To support decisions relating to the purification of an index, researchers are advised to assess the goodness of fit of the measurement model, the validity of indicators at the construct level, and the validity of individual indicators (MacKenzie et al., 2011). As a result of these statistical tests, weak items can be identified and eliminated (Hoehle and Venkatesh, 2015). These tasks are described in the subsections that follow.

7.2.1.1 Evaluate the Goodness of Fit of the Measurement Model

Upon estimating a measurement model, researchers are advised to determine whether "(1) the solution is proper, (2) the individual relationships hypothesised are statistically significant, and [whether] (3) the relationships (as a group) are consistent with the sample data" (MacKenzie *et al.*, 2011: 311). These preconditions are necessary to the evaluation of the validity of both individual items and the constructs they measure (MacKenzie et al., 2005).

The calculation of estimates for the SICMI measurement model confirmed that (1) the AMOS software could generate a solution, none of the values in this solution were negative, and (2) that three of the relationships between the indicators and the service innovation capability construct were statistically significant (See §7.2.1.3.1) (Byrne, 2013). In order to fulfil the third precondition, (3) evidence of the validity of the measurement model was obtained through a sequence of tests for goodness-of-fit, reported hereafter[12] (MacKenzie et al., 2011).

7.2.1.1.1 Chi-Square (χ^2) Statistic

Initially, the significance of the chi-square (χ^2) statistic was calculated. χ^2 is an absolute fit index used to assess whether a model adequately accounts for sample data

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[12] At this point, an examination was made of the standardised residual covariance matrix and modification indices. All but one of the 49 (2.04%) standardised residual covariance values was lower than 1.96. Field (2009: 216) suggests that they constitute evidence that a model is a "poor representation of the actual data" only if "more than 5% of cases" are higher than 1.96, suggesting that the model was an acceptable fit. Modification indices did not indicate that eliminating any parameter would improve model fit (Worthington and Whittaker, 2006). While they showed that an improvement to model fit could be achieved by allowing measurement errors to correlate, introducing these changes post hoc without a theoretical basis would be invalid (Gerbing and Anderson, 1984; Hermida, 2015) and were not implemented.

(Krishnan and Ganesh, 2015). This is indicated by a non-significant p-value, which substantiates the acceptability of a model by confirming that there are sufficient similarities between its predicted and observed covariance matrices (Roberts et al., 2010).

While a p-value of above .05 is recommended (Hu and Bentler, 1999; Barrett, 2007), for this study a result of p = .000 (χ^2 = 106.039, df = 37) was obtained. However, this is not unusual as the χ^2 criterion is "rarely met" (O'Rourke and Hatcher, 2014: 144). Indeed, due the sensitivity of this test to data that are nonnormally distributed and the size of samples (Steiger, 1990; Arbuckle, 2012), statisticians recognise that there are limitations to how χ^2 can be properly employed and urge caution when using this statistic (Bentler and Bonett, 1980; Baumgartner and Homburg, 1996; Byrne, 2013). In response, alternative indices to assess model fit have been sought. One prominent example is the relative or normed χ^2 (χ^2/df), proposed by Wheaton et al. (1977), for which values of between 2 and 5 are recommended (Marsh and Hocevar, 1985; Schreiber et al., 2006). For SICMI, a χ^2/df value of 2.866 was achieved, indicating acceptable model fit.

Nevertheless, criticisms of the chi-square statistic necessitate the reporting of supplementary goodness-of-fit indices (Bagozzi and Heatherton, 1994; Marsh et al., 1996; Nevitt and Hancock, 2000).

7.2.1.1.2 Comparative Fit Index

Next, the comparative fit index was calculated. The CFI is one of the most popular fit indices due to its resistance to the effects of sample size (Hooper et al., 2008). Values for this statistic range between 0 and 1, with those closer to 1 indicating a better fit between the model and data. Many guidelines recommend a value of no less than .90 (Barrett, 2007; Van de Schoot et al., 2012; Byrne, 2013), with some proposing the more conservative figure of .95 (Hu and Bentler, 1999; Hooper et al., 2008). For this test, a value of .934 was obtained for SICMI, which is within the acceptable range.

7.2.1.1.3 Root Mean Square Error of Approximation

Subsequently, the root mean square error of approximation was calculated. This statistic is regarded as being among the most informative fit indices as it accounts for the number of parameters estimated in a model (Hooper et al., 2008). Recommended values for RMSEA have decreased over the last 30 years and, while those of above .10 were considered good until the nineties (Hooper et al., 2008), present consensus is that better values are those much closer to 0, with suggestions of .06 (Hu and Bentler, 1999), .07 (Steiger, 2007), and .08 being proposed as indicative of a good fit (Kline, 2011; Van de Schoot et al., 2012). Nevertheless, values of between .08 and .10 can still be interpreted as a mediocre, but acceptable fit (MacCallum et al., 1996; Schubert et al., 2017).

While the satisfactory .081 RMSEA figure obtained from analysis of this study's data was moderately above recent conservative recommendations, this was somewhat accounted for by the statistic's sensitivity to data that are not entirely normally distributed (Curran et al., 2003), or approximately normally distributed as was the case with the data employed for this test. Consequently, attention was given to one other key measure of goodness of fit.

7.2.1.1.4 Standardised Root Mean Residual

Finally, the standardised root mean square residual was calculated. Values for SRMR range from 0 to 1, with guidelines suggesting that acceptable values are those of less than .08 (Hu and Bentler, 1999; MacKenzie et al., 2011) or ideally below .05 (Steiger, 1990). For this measure of fit, an acceptable result of .0482 was obtained.

7.2.1.1.5 Summary of Results for Measures of Goodness-of-Fit

The results obtained for all measures of goodness-of-fit are summarised in Table 26.

Statistic	Acceptable Value	Result
χ^2	p > .05	p = .000
χ^2/df	2-5	2.866
CFI	>.90-.95	.934
RMSEA	<.06-.10	.081
SRMR	<.05-.08	.0482

Table 26: Goodness-of-Fit Indices for SICMI Measurement Model and Acceptable Values.

While researchers may be tempted to cite only the indices that indicate an acceptable model fit, this practice is strongly discouraged (Babin *et al.*, 2016; Hair *et al.*, 2017). Selectively reporting only certain statistics or claiming that a value is acceptable when compared to an outdated cutoff is poor practice that can mask underlying problems or misspecifications with a measurement model (Anderson and Gerbing, 1988; Hooper *et al.*, 2008). The present study has avoided this practice, honestly and transparently reporting results for goodness-of-fit statistics and their presently accepted thresholds. Critically, the indices that have been reported are those for which inclusion is strongly advocated by methodologists in procedures for the development and validation of new measures (Hinkin, 1995; Diamantopoulos and Winklhofer, 2001; Skinner *et al.*, 2009; MacKenzie *et al.*, 2011). This combination of fit statistics presents a true picture of model fit by minimising the inadequacy of individual measures (McDonald and Ho, 2002).

Collectively, these fit indices can be interpreted as evidence supporting the acceptability of the hypothesised SICMI measurement model (MacKenzie et al., 2011).

7.2.1.2 Validity of Indicators at the Construct Level

The next activity recommended in the purification and refinement of an index is to assess the validity of indicators at the construct level (Diamantopoulos and Winklhofer, 2001; MacKenzie et al., 2011). This requires an assessment of the R^2 statistic for the indicators.

7.2.1.2.1 Assess the R^2 Statistic for the Indicators

To assess the validity of a set of indicators that represent the only antecedents of a formative latent construct, researchers are advised to examine the value of the R^2

statistic (Williams *et al.*, 2003; Diamantopoulos *et al.*, 2008). R^2, which is known as the coefficient of determination, specifies the degree to which variance is shared by the indicators of a construct and the construct itself (Edwards, 2001).

The statistic is interpreted by many academics (Fornell and Bookstein, 1982; Pavlou and Fygenson, 2006; Marakas *et al.*, 2007; Lowry *et al.*, 2008; Andreev *et al.*, 2009; Sosik *et al.*, 2009; Henseler *et al.*, 2012; Ringle *et al.*, 2012; Hair *et al.*, 2014) as the explanatory power of a measure or the ability of indicators to "predict the variance in dependent variables" (Hair *et al.*, 2016: 109). Values for R^2 can range from 0 to 1, where higher values signify greater predictive ability. While recommended values for this statistic vary across disciplines, for instance in consumer behaviour research .20 is considered acceptable (Hair *et al.*, 2016), .50 is the recommended cutoff in the development of new measures (MacKenzie *et al.*, 2011).

Critically, the R^2 value for SICMI was .556, signifying that the indicators accounted for over half of the variance in the SIC construct, a figure deemed to be acceptable for a newly constructed index (Williams et al., 2003; Diamantopoulos, 2006; MacKenzie et al., 2011).

7.2.1.3 Evaluate Individual Indicator Validity

Next, a test of individual indicator validity is advised by means of an examination of the strength and significance of the path coefficient from each indicator to the formative construct and confirmation that there is not excessive multicollinearity (MacKenzie *et al.*, 2011).

7.2.1.3.1 Strength and Significance of Indicator-Construct Relationships

The magnitude of path coefficients indicates the unique contribution that each indicator makes to the latent construct, where the larger the value, the greater the importance of that indicator as a predictor of the latent construct (Diamantopoulos and Winklhofer, 2001). Bollen (2011: 365) asserts that path coefficients provide evidence of the validity of individual indicators and suggests that "researchers should examine the sign, magnitude, and statistical significance of these coefficients". Only indicators that make a significant contribution should be kept in an index, while it advised that those that do not are excluded (Bollen, 1989; Diamantopoulos *et al.*, 2008).

While it is recommended that path coefficients should have a ‘nonnegligible magnitude’ (Bollen, 2011), there are no accepted guidelines regarding the strength of indicator-construct relationships estimated using CB-SEM techniques (MacKenzie *et al.*, 2011). For PLS-SEM it is generally accepted that for samples of under 1,000, standardised path coefficient scores of below .10 are not significant and those above .20 are significant (Hair *et al.*, 2016). Ideal scores, are those of above .3 (Chin, 1998). For both PLS-SEM and CB-SEM, t-values are an important criterion when evaluating relationships of this type, where those in excess of 1.96, where $\alpha = .05$, are deemed as signifying the presence of a significant relationship (Balog, 2011; Teo, 2011; Hair *et al.*, 2016).

SICMI path coefficients and their significance are reported in Table 27.

	Standardised Estimate	**Standard Error**	**t-value**	**Sig.**
UI → SIC	.213	.028	3.254	.001
KM → SIC	.024	.035	.322	.747
S → SIC	.401	.044	4.563	<.001
N → SIC	.270	.038	3.410	<.001

Table 27: Path Coefficients and Significance.

Three of the values obtained for path coefficients were significant, with p-values that were less than or equal to .001 and t-values greater than 1.96, collectively providing convincing evidence that a significant relationship exists. However, despite a positive association between Knowledge Management capability and SIC, this relationship was not statistically significant and, consequently, will be addressed in §7.2.1.4.

7.2.1.3.2 Multicollinearity

Multicollinearity describes a situation in which two or more independent variables are highly correlated with each other (Wilcox *et al.*, 2008). While multicollinearity is desired for measures of reflective constructs and confirms that “items are measuring the same phenomenon”, with formative measures it can present a problem (Petter *et al.*, 2007: 634). This is because the indicators of formative constructs represent a unique contribution to the construct and are not interchangeable or required to covary (Jarvis *et al.*, 2003; Andreev *et al.*, 2009; Yang *et al.*, 2011; Schmiedel *et al.*, 2014). Therefore, the presence of excessive multicollinearity suggests that multiple indicators tap into the same aspect of the construct, causing a destabilising effect through redundant items (Petter *et al.*, 2007; Henseler *et al.*, 2009; Ali *et al.*, 2012) and preventing the contribution of individual indicators from being accurately assessed (Fornell *et al.*, 1991; Rossiter, 2002).

To confirm that multicollinearity is not an issue, researchers are advised to calculate the tolerance and the variance inflation factor (VIF) statistics (Andreev *et al.*, 2009; Urbach and Ahlemann, 2010; Wong, 2013). For this study, the collinearity diagnostic was undertaken by regressing the global reflective item, a 'stand in' for the SIC construct, on the four indicators (Gefen *et al.*, 2011a).

The tolerance value for indicators is considered to be acceptable when above .1 (Lin, 2008; York, 2012), as was the case for each of the indicators in SICMI. The traditional threshold for the VIF statistic is 10 (Diamantopoulos and Winklhofer, 2001; Aslam and Amin, 2015; Pulles *et al.*, 2016; Park *et al.*, 2017), but in the context of formative measures more restrictive heuristics of 5 (Hair *et al.*, 2011; Hassan *et al.*, 2015) or 3.3 have been recommended (Diamantopoulos and Siguaw, 2006; Petter *et al.*, 2007; Cenfetelli and Bassellier, 2009; Schmiedel *et al.*, 2014).

The results of this analysis are presented in Table 28. These illustrate that there is no evidence of excessive multicollinearity among the indicators as none of the VIF values are larger than even the most restrictive threshold of 3.3. The implication of this test is that each indicator taps a distinct aspect of the construct, or in other words, that the subdimensions measure distinct attributes of SIC.

	Tolerance	**VIF**
UI	.799	1.252
KM	.579	1.726
S	.454	2.203
N	.546	1.832

Table 28: VIF and Tolerance Values for Indicators.

7.2.1.4 Eliminate Problematic Indicators

Collectively, the purpose of the foregoing activities was to identify problematic indicators. These are indicators that do not have a significant path coefficient to the latent construct or those that are redundant, with large VIF values (Petter *et al.,* 2007; MacKenzie *et al.,* 2011). While multicollinearity was not an issue for the KM indicator, its path coefficient to the SIC construct (.024) was non-significant (p = .747), suggesting that it should be removed from the measure.

However, if deciding to eliminate an item, it is critical that the remaining indicators fully capture all aspects of the construct (See §5.2.1) (Bollen and Lennox, 1991; Diamantopoulos and Winklhofer, 2001; MacKenzie, 2003). Indeed, the careless removal of indicators can present a risk to content validity (Hair *et al.*, 2016). Consequently, the KM capability subdimension was reconsidered. As it encompasses an organisation's ability to leverage its processes and systems to deploy knowledge assets in the development of service innovations (Lundvall and Nielsen, 2007) and describes, to a large extent, these processes, procedures, and structures (Rasmussen and Nielsen, 2011; Cepeda-Carrion *et al.,* 2012), it could be argued that 'KM capability' does not, in fact, describe a 'organisational capability' under the study's definition. This designates a capability as a stable pattern of collective activity embedded in an organisation's routines and processes, but distinct from them (Eisenhardt and Martin, 2000). The combination of this conceptual argument with the empirical evidence, formed a strong case for the removal of this subdimension and its indicator and it was expected that the resulting index would now measure only relevant subdimensions.

It is not unusual for items to be "added, dropped, or reworded" as a result of the index purification process (MacKenzie *et al.*, 2011: 317). If this occurs, the psychometric properties of the measure can be altered, and the researcher is advised to re-estimate the measurement model. If items are added or reworded, this requires a new sample of data. However, in the case of SICMI, as an item was only dropped, re-estimation of the revised measurement model could be undertaken using the original dataset (MacKenzie *et al.,* 2011). Figure 18 depicts the revised measurement model; Table 29, its goodness-of-fit indices; Table 30, path coefficients between the indicators and construct and their significance; and Table 31, the covariance between the formative indicators.

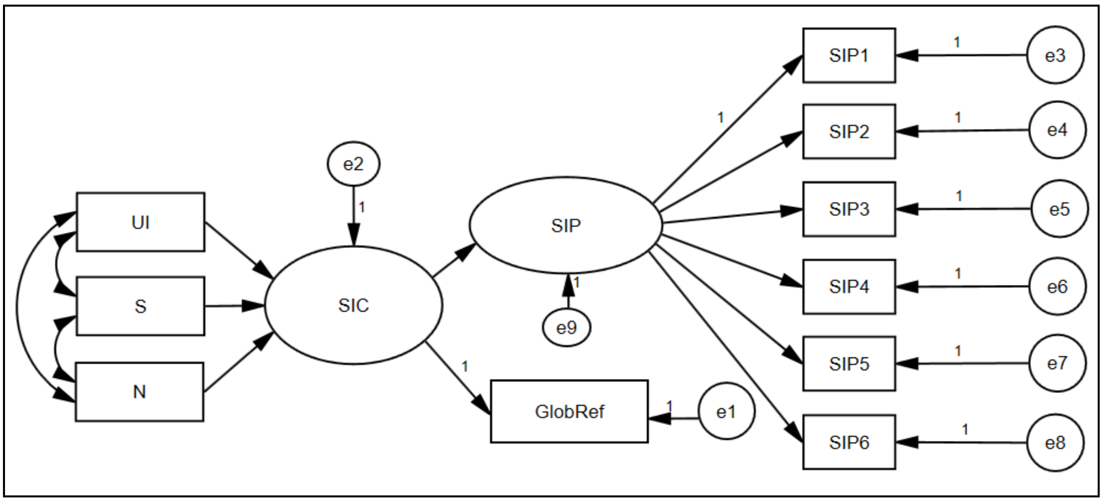

Figure 18: Revised Measurement Model.

Statistic	Acceptable Value	Result
χ^2	p > .05	p = .000
χ^2/df	2-5	2.833
CFI	>.90-.95	.936
RMSEA	<.06-.10	.080
SRMR	<.05-.08	.0486

Table 29: Goodness-of-Fit Indices for Revised Measurement Model.

	Standardised Estimate	Standard Error	t-value	Sig.
UI → SIC	.214	.027	3.273	.001
S → SIC	.413	.040	5.201	<.001
N → SIC	.275	.037	3.508	<.001

Table 30: Path Coefficients and Significance for Revised Measurement Model.

			Estimate	S.E.	C.R.	P[13]
S	<-->	N	.852	.094	9.098	***
KM	<-->	N	.736	.096	7.652	***
N	<-->	UI	.643	.102	6.323	***
KM	<-->	S	.861	.096	8.977	***
S	<-->	UI	.595	.096	6.197	***
KM	<-->	UI	.542	.102	5.305	***

Table 31: Covariances Between Formative Indicators.

With regard to the goodness-of-fit indices, the removal of the KM indicator resulted in marginally improved values for χ^2/df ($\chi^2 = 87.831$, $df = 31$), CFI, and RMSEA, but a minor deterioration in that for SRMR. The value of the R^2 statistic remained the same at .556. Minor improvements could be observed too in the path coefficients from the indicators to the SIC construct.

As a result, the revised measurement model was deemed to be acceptable and permitted SICMI to progress to the final stages of its development.

7.3 Phase 8 – Validation

Once the psychometric properties of a measurement model can be regarded as acceptable, researchers are advised to validate the construct that it is used to measure by confirming that responses to index items behave as would be expected if they were valid indicators of the focal construct (MacKenzie *et al.*, 2011). The objective of this phase is to confirm that the measured construct is accurately represented by its underlying measures.

7.3.1 Step 15: Assess Index Validity

This step examines whether the SIC construct is accurately represented by its indicators; investigating if, within its nomological network, evidence of the formative construct's theorised relationships with other constructs can be found; and confirming that its indicators are distinct from those of other constructs. To achieve this, known groups validity, nomological validity, and discriminant validity are assessed (MacKenzie et al., 2011).

[13] *** = $p < .001$

7.3.1.1 Known Groups Validity

Known groups validity is a validation method that assesses whether a measure is able to distinguish between groups that should provide higher or lower average scores (Cronbach and Meehl, 1955). It requires the comparison of groups with recognised differences on a measure and a determination as to whether the mean of their scores differ in the hypothesised direction (MacKenzie *et al.*, 2011). If the groups differ in the predicted way, it can be used as evidence for the measure's validity.

This study classifies the sample into two known groups: (1) those who have standard processes place for the development of new services and (2) and those that do not. Because standard processes for the development of new services are positively associated with User Involvement (Carbonell *et al.*, 2009; Kaasinen *et al.*, 2010; Cheng *et al.*, 2012), Strategising (de Jong *et al.*, 2003; Grawe *et al.*, 2009; Edvardsson *et al.*, 2013), and Networking capabilities (Chesbrough, 2003; Zaninelli, 2011; Lin *et al.*, 2012; Edwards *et al.*, 2015), it is expected that the presence of these processes will have a positive association with the reported maturity level for each subdimension. As depicted on Table 32, t-tests indicate that UI maturity was higher among organisations with standard service development processes in place (t = 6.027, p = .000). Mean differences were also significant at the at the .000 level for Strategising (t = 7.463) and Networking (t = 6.763) capabilities.

Do you have a standard process in place for the development of new services?		**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
User Involvement	Yes	120	3.39	1.343	.123
	No	164	2.48	1.206	.094
Strategising	Yes	120	3.68	1.004	.092
	No	164	2.76	1.044	.082
Networking	Yes	120	3.61	1.117	.102
	No	164	2.71	1.090	.085

Table 32: Differences in Subdimension Maturity Scores Between Known Groups.

The results of these analyses can be considered as evidence that the measures of the dimensions are valid and provide support for the SICMI through known groups validity.

7.3.1.2 Nomological Validity

Next, the validity of the construct was examined through its nomological network. Andreev *et al.* (2009: 8) assert that nomological validity is demonstrated when "hypothesised linkages (structural paths) between latent variables are found [to be] significantly greater than zero and their signs are in the expected causality direction". Generally, this is evidenced by strong and significant path coefficients from a formative latent construct to another reflectively measured construct with which a relationship is hypothesised (Diamantopoulos and Winklhofer, 2001; Giovanis, 2013; Park *et al.*, 2017). The reflective construct can be an antecedent, outcome, or any other related variable (Helm, 2005; MacKenzie *et al.*, 2005), but if the theoretical relationship is justified empirically, it provides the researcher with confidence in the validity of the construct (MacKenzie *et al.*, 2011).

It is theoretically justified to expect that organisations with a more mature service innovation capability will demonstrate higher service innovation performance (Kariyapperuma, 2013; Plattfaut *et al.*, 2015; Hariandja, 2016b; Banjongprasert, 2017). Consequently, the relationship between the formative latent construct and its hypothesised outcome, service innovation performance, represented using a scale adopted from Chen *et al.* (2011), was estimated. An examination of the strength and significance of the standardised path coefficient from SIC to SIP ($\beta = .744$, $p < .001$, t-value = 7.100)[14], as illustrated in Figure 19, indicated that the theorised relationship between the two unobserved variables was strongly supported by the data (Hair *et al.*, 2016) and indicative of the construct's nomological validity (McDaniel and Gates, 1999).

[14] The estimated value for R^2 was .554, indicating that SIC predicts 55.4% of the variance in SIP.

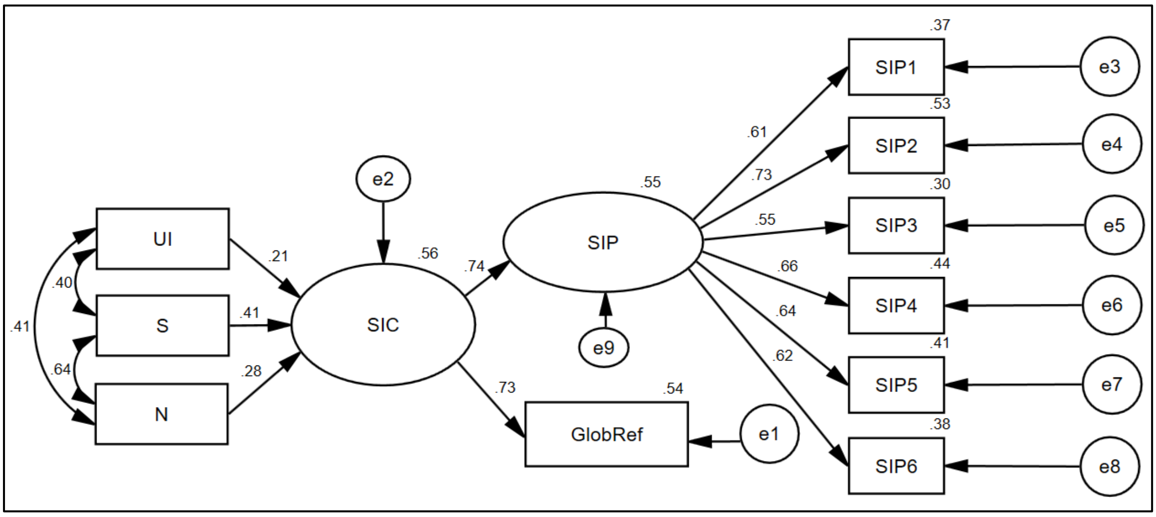

Figure 19: Measurement Model with Estimates.

7.3.1.3 Discriminant Validity

In addition to demonstrating that the focal construct is accurately represented by its indicators and behaves in a manner consistent with the nomological network, it is incumbent upon the researcher to also illustrate that the indicators of a construct are "distinguishable from the indicators of other constructs" (MacKenzie *et al.,* 2011: 324). This is referred to as discriminant validity (Andreev *et al.*, 2009).

To ascertain a construct's discriminant validity, it must be confirmed that it is "less than perfectly correlated with a measure of another distinct construct" that is reflectively measured (MacKenzie *et al.*, 2011: 324). For this study, this step was fulfilled by correlating the SIC construct with a variable that was not included in the model, representing NSD. The NSD construct is similar in many respects to SIC, but differs by describing the architectural elements and processes through which new services are delivered (See §4.2.1.2) (Cooper, 1994; Storey and Kelly, 2001). The results for Pearson's correlation coefficient between the two summated variables was .407 with p = .000. Based on the interpretation of correlation coefficients by De Vaus (2002), the correlation between these variables was significant with a 'moderate to substantial' strength of association. As the variables are less than perfectly correlated with each other, they are interpreted as distinct. In other words, SICMI provides a measure of service innovation capability rather than of another concept with which it shares some similarities (McDaniel and Gates, 1999).

Collectively, this evidence, in combination with that accumulated during other steps in the measure's development, strongly suggested the validity of SICMI (MacKenzie *et al.*, 2011).

7.4 Phase 9 - Norm Development

The final phase in the index construction procedure requires the reporting of normative values or norms for a measure in order to aid users with the interpretation of scores. The importance of norms is supported by Spector (1992) who argues that scores are meaningless without a frame of reference or an existing distribution with which a comparison may be made (MacKenzie *et al.*, 2011).

7.4.1 Step 16: Develop Norms for the Index

To calculate this distribution, researchers are required to administer the instrument to a sample representative of the population of interest that is sufficiently large to achieve stable parameter estimates (Urbina, 2014). Norms for that population can then be calculated for the mean and standard deviation of scores and allow the shape of the distribution to be examined and skewness or kurtosis to be observed. In fulfilling the final step of the study's index construction procedure, these values are reported below.

Details of the characteristics of this study's normative sample are provided in §6.3.1.7. Table 33 presents mean maturity scores for each of the subdimensions.

	Mean Score
User Involvement	2.86
Strategising	3.15
Networking	3.09

Table 33: Mean Maturity Scores for the Subdimensions of SIC.

The mean of scores for service innovation capability maturity was 2.3451 and the standard deviation was 1.04693. As organisational size is a metric that can be easily and rapidly understood by the managers of SMEs, it employed to assist users of SICMI with ascertaining the effectiveness of their SIC compared to their counterparts. Table 34 summarises average SIC maturity scores for each of the surveyed size groupings.

It reports the 150-249 employee cohort as that with the highest average scores for SIC maturity and the 10-19 employee category as that with the lowest average scores. This finding is explored further in §8.6.3.

	Mean	N	Std. Deviation
10-19 employees	2.2835	127	1.01495
20-49 employees	2.3571	84	1.03717
50-149 employees	2.4000	60	1.15274
150-249 employees	2.6154	13	.96077
Total	2.3451	284	1.04693

Table 34: Average SIC Maturity Scores and Organisation Size.

The distribution of the sample's SIC maturity scores showed a little skewness with a figure of .612, indicating a shape somewhat close to normal distribution, and only minor kurtosis, with a figure of -.322. The negative value for kurtosis indicates that there are less responses in the tails than there would be in a normal distribution (Abbott, 2016). The distribution of scores for SIC maturity is depicted in Figure 20.

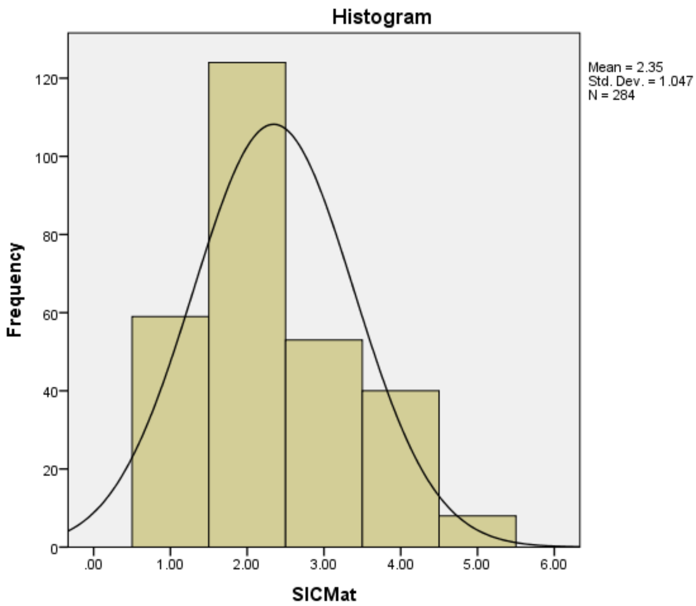

Figure 20: Histogram Illustrating the Distribution of SIC Maturity Scores.

It is likely that these norms, once established, will change over time. Therefore, it is recommended that the period in which the norms are defined is reported and that they are updated periodically (MacKenzie *et al.*, 2011). This suggestion is included in §9.7, Future Research Directions. Nevertheless, the norms detailed in this section can be considered representative of the service innovation capability maturity of Irish SMEs in April 2018.

7.5 Analysis of Model Power

Finally, it is necessary to address the statistical power of the index. As discussed in §6.3.1.4.2, a study's statistical power (π) is its probability of rejecting a false null hypothesis about its measurement model (Hermida *et al.*, 2015). π is a function of three factors: (1) sample size, (2) degrees of freedom, and (3) α.

Two options are available to researchers when determining the π of a model. The first is a comparison of that model with tables of power estimates for different sample sizes and degrees of freedom, reported by MacCallum *et al.* (1996) and McQuitty (2004). The second option is through the use of statistical software with power assessment functionality (MacCallum *et al.*, 1996; McQuitty, 2004). As statistical software can make an exact calculation of a model's π, rather than the approximation that can be obtained by using the tables, the G*Power 3.0.10 software was selected for this purpose (Faul *et al.*, 2007).

The null hypothesis (H_0) is that the model is a good fit with data representative of the population of interest. Therefore, the desired outcome when testing this null hypothesis, is that it is accepted.

The final SICMI measurement model had 31 degrees of freedom; a sample size of 284 was employed; α was set at .05; and the effect size used in the π calculation was .3, a standard effect size. The software's output reported that π was .8145965 The implication of this result is that it is very likely the SICMI model fits the population of interest well, as the probability of rejecting a false null hypothesis is above the acceptable threshold of .80 (MacCallum *et al.*, 1996; Cohen *et al.*, 2003).

7.6 Chapter Conclusion

In this chapter, SICMI was confirmed as a valid measure of SME service innovation capability maturity. The activities undertaken in the measure's validation adhered to the recommended two-step modelling approach (Anderson and Gerbing, 1988) and first consisted of purifying and refining SICMI by subjecting its measurement model to tests of goodness-of-fit, validating individual indicators by assessing the R^2 statistic to evaluate their collective predictive power, calculating the strength and significance of path coefficients from the indicators to the construct, and confirming the absence of excessive multicollinearity. While the model had a good fit and predicted an acceptable level of variance in the focal construct, these tests identified that the indicator for the KM capability subdimension was problematic and had a weak and non-significant path coefficient to the latent construct. After considering both the theoretical and conceptual implications of its removal from the measure, it was eliminated. All of the earlier statistical tests were then repeated for the revised three-indicator measure and new indices reported, revealing minor improvements to some goodness-of-fit statistics and estimates for path coefficients. These confirmed the adequacy of both the indicators and measurement model and allowed SICMI to proceed to the final steps in its development.

These steps were dedicated to assessing the adequacy of the formative SIC construct and confirmed that responses to measurement items behaved as anticipated at the construct level. This was achieved through known groups validity, where it was confirmed that expected differences could be observed between the subdimension maturity scores of respondents with standardised processes in place for the development of new services and those who did not; through nomological validity, where a hypothesised effect on another variables, expected by theory, was large and significant (Kline, 2011); and through discriminant validity, which confirmed that the SIC construct was less than perfectly correlated with another distinct, but closely related phenomenon, NSD performance. Finally, norms were developed to aid users of SICMI in deriving meaning from their scores.

Each of the analyses described in this chapter can be considered as a portion of the evidence that collectively substantiate the validity and legitimacy of SICMI as a measure of SIC maturity. As a result, the new measure can be considered a valuable tool for SMEs.

The next chapter discusses the study’s key findings in greater detail.

Chapter 8: Discussion

8.1 Introduction

The major goal of this doctoral study is to advance service innovation capability literature and practice through the development and validation of a psychometrically sound measure of its maturity in SMEs. Integrating best practice recommendations to support the development of measures, a new procedure was synthesised. Adhering to each of the steps prescribed by this procedure enabled an original and novel, formative measure of service innovation capability maturity to be created.

The purpose of this chapter is to discuss the findings of this research within the context of its literature base. This is addressed in the following sections.

8.2 Synthesising a Procedure to Support the Development of a Formative SIC Maturity Measure

To inform the construction and validation of this study's original formative measure of SIC maturity, an examination of extant methodological literature was undertaken. This revealed a dominance of guidelines or procedures based "on classical test theory and the assumptions it makes about the relationship between a construct and its indicators" (Jarvis *et al.*, 2003: 199). This imbalance in the literature meant that most procedures (Gerbing and Anderson, 1988; Hinkin *et al.*, 1997; DeVellis, 2017) blindly adhere to the instructions advanced by Churchill (1979) to direct the development of reflective measures and emphasise exploratory factor analysis and internal consistency (Molina-Castillo *et al.*, 2013) as opposed to activities that are relevant to the construction of formative measures (Diamantopoulos and Siguaw, 2006; Coltman *et al.*, 2008). Some notable exceptions to this include, Diamantopoulos and Winklhofer (2001), Rossiter (2002), and MacKenzie *et al.* (2011). However, while these studies attempt to address this imbalance by providing valuable insights into the development and validation of multi-item measures of formative constructs, critical steps are missing from each relating to the conceptualisation of a construct, specification of a measurement model, or the rigorous examination of a structural model (MacKenzie *et al.*, 2011).

For instance, Diamantopoulos and Winklhofer (2001) fail to devote adequate attention to the purification and refinement of an index or assessing its structural model, Rossiter (2002) offer guidelines that may confound the meaning of a construct's definition and questionably include the "rater as an integral part of the construct" (Diamantopoulos, 2005: 5), and MacKenzie *et al.* (2011) do not include up-to-date instructions for specifying a measurement model in a manner that allows the path coefficients from all subdimensions to the focal construct to be estimated. Critically, significant gaps in these procedures mean none could be used to support the development of a formative SIC maturity measure as this requires a rigorous evaluation of the structural model, a clear description of the conceptual theme for both the construct and its subdimensions, and specification of the measurement model in a manner that allows estimates for all parameters to be obtained.

It was for these reasons, a new and unique procedure was synthesised that integrated the guidelines and best practices proposed by numerous authors (Churchill, 1979; Gerbing and Anderson, 1988; Hinkin *et al.*, 1997; Diamantopoulos and Winklhofer, 2001; Rossiter, 2002; MacKenzie *et al.*, 2011; DeVellis, 2017) into a single logical, incremental sequence of steps to support the construction of this study's focal SIC maturity index. This procedure, summarised in Table 35, was able to overcome major gaps in the instructions proposed by existing studies relating the development and validation of measures (Churchill, 1979; Diamantopoulos and Winklhofer, 2001; Rossiter, 2002; MacKenzie *et al.*, 2011; DeVellis, 2017) and allowed pertinent methodological advancements and updates to be included throughout the design and testing of the index (Johnson *et al.*, 2012; Aguinis *et al.*, 2013; Lee *et al.*, 2013; Molina-Castillo *et al.*, 2013; Urbina, 2014; Bollen and Diamantopoulos, 2015; Podsakoff *et al.*, 2016).

Procedural Phases and Steps	Application to SICMI
1. Theoretical Foundation **(1)** Select an Appropriate Theoretical Foundation	**(1)** The Dynamic Capabilities View was selected as the measure's theoretical foundation as it has prior scholarly acceptance as an appropriate basis for the study of service innovation capability and facilitates the examination of intangible capabilities that are embedded in routines and processes that are diffused throughout an organisation.
2. Conceptualisation **(2)** Unambiguously Define SIC **(3)** Specify the Conceptual Domain of the Construct **(4)** Specify the Conceptual Theme **(5)** Identify the Dimensions of SIC **(6)** Confirm the Suitability of Dimensions as Formative Indicators of SIC **(7)** Specify the Conceptual Theme of the Dimensions	**(2)** '*Service innovation capability describes a key dynamic capability, embedded in the routines or processes of an organisation, with the potential to repeatedly deploy and reconfigure resources in the continuous creation or improvement of services'*. **(3)** The construct's property was specified as its maturity (effectiveness or performance) and the examined entity as the organisation itself. **(4)** Through the examination of maturity level themes from 73 management and organisation maturity models, five composite maturity levels for SIC were derived. These were labelled, Initial, Managed, Defined, Measured, and Optimising. The behavioural characteristics of SIC at each of these maturity levels were based on descriptions of the evolution of similar capabilities through comparable levels of maturity. The properties of SIC maturity are both similar and discernible across SMEs. They are unique in that they clearly represent the effectiveness of SIC to varying degrees and are distinct from the properties of other constructs. **(5)** Unique characteristics cannot be removed without restricting the conceptual meaning of SIC, so the construct is multidimensional. User Involvement, Knowledge Management, Strategising, and Networking capabilities were proposed as its dimensions. **(6)** The appropriateness of representing these subdimensions as formative indicators of the SIC construct was confirmed by examining them against the criteria for both of the primary classes of relational direction. The structure of this relationship was specified as direct and additive, where the maturity of SIC is an aggregate of the subdimensions. This is determined by selecting the value of the subdimension with lowest maturity score as it is the only maturity level achieved by *all* subdimensions. **(7)** The characteristics of each of the subdimensions at each maturity level were derived from the literature and represented in a service innovation capability maturity model.

3. Development of Measurement Items **(8)** Generate Items to Represent the Construct **(9)** Assess the Content Validity of the Items	**(8)** Measurement items were developed *a priori*. The descriptions of the characteristics of each of the subdimensions at each level of maturity in the SICMM were translated into statements. Best practice guidelines were adhered to regarding how they were written. **(9)** The measurement items were assessed for content validity in two stages. First, a careful and critical examination confirmed that the conceptual meaning of the measurement items for the subdimensions corresponded to the SICMM upon which they were based. Second, through a content validity assessment conducted by four experienced doctoral level researchers and a late-stage PhD candidate. The comprehension of content valid items was then evaluated by individuals similar to intended respondents.
4. Measurement Model Specification **(10)** Formally Specify the Measurement Model	**(10)** In order to obtain estimates for the model using CB-SEM techniques, the scale of measurement was set by constraining to one the path from SIC to a global reflective item; and two directed paths were included to both a theoretically appropriate reflective outcome variable (service innovation performance) and the global reflective item. The covariances between the indicators were freely estimated.
5. Testing the Index **(11)** Pretest **(12)** Pilot	**(11)** To obtain feedback about the clarity and usability of the questionnaire and correct any weaknesses or ambiguities, it was pretested with a panel of 11 academics and 11 practitioners, representative of the study's target population. All suggestions were considered and any beneficial changes, implemented. **(12)** The index was tested through two pilot studies in order to identify and correct any problems. The first pf these had 95 responses from service SMEs and revealed that some modifications to the measurement model and questionnaire were required to enhance its predictive power and improve the distribution of responses. The second pilot obtained 39 responses from service SMEs and verified that the changes made as a result of the first had been successful.
6. Data Collection **(13)** Collect Data	**(13)** From the 19,892 emails sent inviting recipients to participate in a study of service innovation capability, 824 responses were received. Of these, 304 were from SMEs located within the Republic of Ireland and eligible for inclusion in analyses. After 20 prediction outliers were eliminated, 284 cases remained.
7. Index Evaluation and Refinement **(14)** Purify and Refine the Index	**(14)** To inform decisions regarding the purification of the index through the elimination of items, a set of statistical tests were undertaken using these data. These tests evaluated the measurement models' goodness of fit (χ^2 = 106.039, χ^2/df = 2.866, CFI = .934, RMSEA = .081, and SRMR = .0482), the validity of indicators at the construct level through an examination of the value for R^2 (.556), and individual indicator validity (the paths from three of the four indicators to the SIC construct were significant and all VIF values were below 3.3). This resulted in the removal of the Knowledge Management capability and re-estimation of the revised three-indicator measurement model, repeating all statistical tests reported earlier (χ^2 = 87.831, χ^2/df = 2.833, CFI = .936, RMSEA = .080, SRMR = .0486, R^2 = .556, all path coefficients from the indicators to the SIC construct were significant, and all VIF values below 3.3).

8. Validation **(15)** Assess Index Validity	**(15)** The structural model was assessed through tests to confirm that responses to the measure behaved as expected for a valid measure of that construct. Specifically, the measure was validated through known groups validity, where it was established that there was a significant difference in the mean scores for subdimensions of those who had standard processes in place for the development of new services and those who did not; through nomological validity, where empirical evidence was obtained of an hypothesised linkage with an established outcome variable, service innovation performance (.744, $p < .001$, t-value = 7.100); and discriminant validity through the less the perfect correlation of scores (.407 with $p = .000$) for the construct with a similar, but distinct construct, NSD performance.
9. Norm Development **(16)** Develop Norms for the Index	**(16)** Norms were developed to aid in the interpretation of scores by calculating the mean (2.3451), standard deviation (1.04693), and by examining the distribution of data for skewness (.612) and kurtosis (-.322). Results indicated that skewness was close to normal distribution, while the value for kurtosis suggested that there were fewer responses in the tails. Any other key analyses to help users of SICMI derive meaning from the measure were also reported.

Table 35: Summary of Procedural Steps in the Construction and Validation of SICMI.

This study's synthesised procedure commences by selecting an appropriate theoretical foundation. Though this phase has important implications regarding the assumptions made by the designer of a measure about its relationships with other variables and how results are interpreted (Ramirez-Portilla, 2015), it is frequently overlooked by methodologists (Hinkin *et al.*, 1997; MacKenzie *et al.*, 2011; DeVellis, 2017). The procedure employed by this study also diverges somewhat from existing guidelines with an augmented and purpose-specific conceptualisation phase. During this, in addition to SIC's conceptual theme being specified, or levels of maturity elaborated, those for each of the identified subdimensions are detailed also. This is reminiscent of Moultrie *et al.* (2007: 338), who endorses the inclusion of extended "descriptions at each point along [a] scale" to measure capability maturity.

Best practice guidelines relating to the development of measurement items (Churchill, 1979; Diamantopoulos and Winklhofer, 2001; DeVellis, 2017) and the assessment their content validity (Hinkin *et al.*, 1997; Rossiter, 2002; MacKenzie *et al.*, 2011) produced a set of items that fully represented the conceptual domain of SIC. Limited instructions were available to guide the specification of the study's formative measurement model (Diamantopoulos and Winklhofer, 2001; MacKenzie *et al.*, 2011), necessitating the assimilation of additional recommendations that would allow estimates for each of the required parameters in SICMI to be obtained (MacCallum and Browne, 1993; MacKenzie *et al.*, 2005; Diamantopoulos *et al.*, 2008; Bollen and Davis, 2009a; Diamantopoulos, 2011).

Following the utilisation of a modernised approach to pretesting the study's questionnaire, updating existing recommendations proposed by Hunt *et al.* (1982), Cannell *et al.* (1989), and Collins (2003) to online surveys, two pilot studies were undertaken to identify and correct any issues with the index. Data were then collected and recent best practice directions to support the removal of outliers were executed (Aguinis *et al.*, 2013). This allowed all remaining cases to be used to assess the study's measurement model (Hinkin *et al.*, 1997; MacKenzie *et al.*, 2011). At this point, there is a major divergence in the instructions for developing reflective and formative measures. While studies guiding the development of the former class of measure aim to reduce the set of items and test the significance of a scale through factor analysis and assessments of internal consistency reliability (Churchill, 1979; Hinkin, 1995; DeVellis, 2017; Gerbing and Anderson, 1988), the focus of those adhered to for the validation of this study's measure were to confirm that together the indicators explained at least half of the variance in the SIC construct, that each was significantly related to this construct, and that multicollinearity between indicators was not present (Diamantopoulos and Winklhofer, 2001; MacKenzie *et al.*, 2011).

With regard to establishing construct validity, this study's synthesised procedure augmented existing recommendations and provided convincing evidence that responses to the measure "behave as one would expect if they were valid indicators of the focal construct" (MacKenzie *et al.*, 2011: 315). It achieved this through tests of known groups validity (MacKenzie *et al.*, 2011), nomological or criterion-related validity (Hinkin *et al.*, 1997; Diamantopoulos and Winklhofer, 2001; Rossiter, 2002), and discriminant validity (Churchill, 1979). Finally, while the development of norms for a measure is advised by only two methodologists (Churchill, 1979; MacKenzie *et al.*, 2011), the importance with which this step is regarded for the interpretation of meaning from scores, warranted its inclusion.

A comparison of the best practice procedure employed in the construction and validation of SICMI with those utilised for the development of other measures of SIC, further supports the measure's legitimacy and this study's methodological contribution (See §9.3.2). While Table 36 illustrates that recommended procedural steps are ignored or implemented arbitrarily in the development of other measures, each have been performed in the systematic construction of SICMI. The deviation of existing measures from accepted best practices in their development, challenges their soundness, and illuminates possible deficiencies that reduce their value to researchers and practitioners.

Phase	Step		Designer of Measure: (Wang and Ahmed, 2004)	(Tuominen and Anttila, 2006)	(Ngo and O'Cass, 2009)	(Thambusamy and Palvia, 2011)	(Hogan *et al.*, 2011)	(Daugherty *et al.*, 2011; Grawe *et al.*, 2009)	(Tang, 2015)	(Tang *et al.*, 2015)	**SICMI**
Theoretical Foundation	Select an appropriate theoretical foundation	Select a theoretical basis to assist with specifying the relationships among variables.	×	✓	✓	✓	✓	✓	✓	✓	✓
Conceptualisation	Unambiguously define the construct	Clearly and concisely define the construct.	✓	×	✓	✓	✓	✓	✓	✓	✓
	Specify the conceptual domain of the construct	Specify the property to which the construct refers and the entity to which the property applies.	×	×	×	×	×	×	×	×	✓
	Specify the conceptual theme	Describe the necessary and sufficient attributes or characteristics something must possess to be an example of the construct. Consider the stability of the construct over time.	×	×	×	×	×	×	×	×	✓
	Specify construct dimensionality	Determine whether the construct is unidimensional or multidimensional and how the dimensions relate to each other and the construct.	✓	✓	✓	×	✓	×	×	×	✓
Development of Measurement Items	Generate items to represent the construct	Generate and precisely write a set of items that fully represent the construct's conceptual domain.	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Assess the content validity of items	Evaluate the extent to which the items represent the construct's content domain.	×	✓	✓	×	✓	×	×	×	✓
Model Specification	Formally specify the measurement model	Specify the empirical relationships between indicators and the focal construct.	✓	×	×	×	×	✓	×	×	✓
Testing the Measure	Collect data to test the measure	Obtain data from a sample representative of the focal population to identify potential problems with the measure.	×	×	×	✓	×	×	×	×	✓
Data Collection	Collect Data	Obtain data from a representative sample, sufficiently large to examine the psychometric properties of the measure.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Measure Evaluation and Refinement	Measure purification and refinement	Decide whether the measure requires refinement or purification through the elimination of items by evaluating the model's goodness of fit and the validity of indicators.	✓	×	×	×	✓	×	×	×	✓
Validation	Assess measure validity	Assess the validity of the measure at the construct-level.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Norm Development	Develop norms for the measure	Develop norms to aid in the interpretation of scores on the measure.	×	×	×	×	×	×	×	×	✓
Formative Approach			×	×	×	×	×	×	×	×	✓
Maturity			×	×	×	×	×	×	×	×	✓

Table 36: Procedural Steps Adhered to in the Development of SIC Measures, Including SICMI.

8.3 Conceptualising and Dimensionalising the SIC Construct

Prior to considering this study's final conceptualisation of SIC, it is important to understand the purification and refinement of SICMI which resulted in the elimination of the indicator for the KM capability subdimension. The removal of this indicator appears to contradict services and service development literature which regards activities relating the management of knowledge as critical to service innovation (Chapman *et al.*, 2002; Leiponen, 2006; Den Hertog *et al.*, 2010; Gryszkiewicz *et al.*, 2013; Jin *et al.*, 2014; Janssen *et al.*, 2015) and raises questions about why it was excluded from this study's final model.

Decisions relating to the elimination of items for formative measures are of far greater importance than those for reflective measures (Diamantopoulos and Siguaw, 2006; Coltman *et al.,* 2008). This is because these items are not interchangeable, and each represents an essential, separate, and distinct aspect of a formative construct's conceptual domain (Jarvis *et al.*, 2003; Covin and Wales, 2012). Consequently, "the elimination of formative items from the item pool has to be theoretically justified rather than purely based on statistical properties" (Diamantopoulos *et al.,* 2008: 1210) due to the detrimental effect on a construct's content validity (Hair *et al.*, 2016) when remaining items fail to fully capture all aspects of the construct (MacKenzie, 2003).

The rationale for eliminating the KM capability subdimension, described in §7.2.1.4, was based on both empirical and conceptual criteria. The path coefficient from this subdimension to the SIC construct was both weak and nonsignificant and, when paired with the contention that it did not constitute a capability according this study's definition, presented a strong argument for its removal. Capabilities are understood in the present study as stable patterns of activity through which organisations achieve their goals (Loasby, 2006; Daugherty *et al.*, 2011). They are embedded in their routines or processes, or groups thereof, but, importantly, are distinct from them (Ethiraj *et al.*, 2005; Janssen *et al.*, 2012). KM capability was defined in §4.2.4.3 as an organisation's ability to leverage their process and systems to support the effective use of knowledge for service innovation (Lundvall and Nielsen, 2007; Rahab *et al.*, 2011). A close examination and comparison of this understanding with that for organisational capabilities, suggests that 'KM capability' describes only the routines and processes which support the effective use of knowledge for service innovation, and not an organisational capability (Börjesson and Elmquist, 2011; Felin *et al.*, 2012).

However, it is important to realise that the elimination of the KM indicator does not signify that knowledge management is not of importance to the SIC of SMEs. It very clearly is, and facets of knowledge management continue to be represented by aspects of indicators of the remaining subdimensions. Specifically, by the importance assigned to accurate, relevant, and timely knowledge for effective innovation planning and decisions regarding resource use (Johnson and Filippini, 2010; Salunke *et al.*, 2011; Mehrabani and Shajari, 2012); the requirement to acquire and share knowledge with networked actors during interorganisational cooperation and learning (Pittaway *et al.*, 2004; du Plessis, 2007; Mu and Di Benedetto, 2012), and the significance of managing customer ideas and knowledge when innovating or co-creating value with them (Magnusson *et al.*, 2003; Belkahla and Triki, 2011; Greer and Lei, 2012). This recognition that each of the subdimensions, operational capabilities, consists of activities that relate to the management of knowledge, aligns with Cepeda and Vera (2007) who consider these as their cornerstone and with Agarwal and Selen (2009: 438), who maintain that knowledge management underpins the “development, evolution, and use” of dynamic capabilities.

The elimination of the indicator for KM resulted in a revised three-indicator structure that included UI, Strategising, and Networking capabilities. Its validity was further substantiated by the fact that, in addition to each indicator making a distinct contribution to the construct, together they explained the majority of its variance. This study’s multidimensional representation of the focal construct is line with existing research, where the prevailing view is that SIC has “more than one conceptually distinguishable facet” (MacKenzie *et al.*, 2011: 300) and is most appropriately modelled in this way (Hogan *et al.*, 2011; Nada and Ali, 2015; Zitkiene *et al.*, 2015).

Nevertheless, while there is some consensus among researchers that a complete understanding of SIC must consist of all the essential aspects of organisations that facilitate innovation activities (Teece *et al.*, 1997; Lawson and Samson, 2001; Perdomo-Ortiz *et al.*, 2006; Sáenz *et al.*, 2009), the failure to utilise common methods in its investigation has resulted in a variety of fragmented perspectives that propose overlapping or contradictory items (Ngo and O'Cass, 2009; Zhou and Wei, 2010; Nada and Ali, 2015). For instance, some studies have only considered the SIC of a specific type of service firm (Zhou and Wei, 2010; Daugherty *et al.*, 2011; Hogan *et al.*, 2011) and both conceptual and empirical studies propose divergent and unrelated dimensions.

There is some agreement between the three subdimensions empirically substantiated by this research and those advanced in other studies. Specifically, User Involvement capability aligns with the ‘client-focused’ capability proposed by Hogan *et al.* (2011) and the ‘client focus’ capability suggested by Zitkiene *et al.* (2015). With regard to Strategising capability, its inclusion corresponds with other conceptualisations, such as that advanced by Wang and Ahmed (2004) which includes ‘strategic innovativeness’, with that suggested by Nada and Ali (2015), in which there is a ‘strategic capability’, and that by Zitkiene *et al.* (2015) which features a ‘strategy focus’ dimension. Further, the latter conceptualisation also proposes a ‘network focus’ dimension (Zitkiene *et al.*, 2015), which is somewhat similar to Networking capability.

While the present study found empirical support for three of the dimensions of dynamic service innovation capability proposed by Zitkiene *et al.* (2015), the authors also suggested two additional dimensions, ‘knowledge focus’ and ‘technology focus’, with which this research does not agree. While a dimension similar to knowledge focus was initially included in the SIC maturity index, it was not empirically substantiated and consequently removed. The latter, which refers to the ability of an organisation to “utilise internal technologies or adapt external ones” for service innovation (Zitkiene *et al.*, 2015: 274), simply did not feature as an important enabler of an organisation’s ability to develop or improve its services during dimensionalisation of the focal construct. Its inclusion in revisions to SICMI could be of benefit to future research with the purpose of enhancing the measure.

Additionally, the study did not agree with any of the dimensions of SIC proposed by Zhou and Wei (2010), Ngo and O'Cass (2009), and Tuominen and Anttila (2006).

However, it must be noted that none of the empirical studies of SIC utilise a formative approach, where the dimensions are its causes (Diamantopoulos *et al.*, 2008; Bollen and Diamantopoulos, 2015), nor do any of the conceptual studies suggest drivers of this capability.

In sum, this study took a difficult first step towards arriving a single literature-based, unifying conceptualisation and dimensionalisation of SIC. In line with extant research (Fischer *et al.*, 2010; Giannopoulou *et al.*, 2011; Gebauer *et al.*, 2012; Plattfaut *et al.*, 2012; Kindström *et al.*, 2013; Plattfaut *et al.*, 2013; Stryja *et al.*, 2013; Malsbender *et al.*, 2014; Nada and Ali, 2015), it regards SIC as a dynamic capability, a class of capability that describes stable patterns of activity through which an organisation create or modify their resource and capability bases in response to environmental changes (Teece *et al.*, 1997; Zollo and Winter, 2002; Wang and Ahmed, 2007; Eriksson, 2014). It is interesting to note the degree of similarity between the definition of DCs and that developed for SIC in this study[15], where it is conceptualised as a higher-order formative construct caused by its three nonoverlapping subdimensions, (1) User Involvement, (2) Strategising, and (3) Networking capabilities.

8.4 The Relative Importance of Each Subdimension

Among this study's important findings was the identification of three organisational capabilities as predictors of SIC maturity. What is particularly noteworthy here is that, in line with existing literature (Hogan *et al.*, 2011; Nada and Ali, 2015; Zitkiene *et al.*, 2015) and within the framework of the theoretically derived service innovation capability maturity model, described in §4.2.6.5 (Maier *et al.*, 2012), this study proposed that each of the subdimensions should be regarded as being of equal importance to the performance of SIC. However, a criticism of maturity models is that this is not necessarily the case and specific subdimensions are likely "have a stronger relationship with certain areas of performance improvement" (Jørgensen *et al.*, 2006: 335). This was true for the present research as there is some divergence between the conceptual and empirical meaning of SICMI, illustrated by the values for its path

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[15] *Service innovation capability describes a key dynamic capability, embedded in the routines or processes of an organisation, with the potential to repeatedly deploy and reconfigure resources in the continuous creation or improvement of services.*

coefficients. In essence, the estimates obtained for these parameters signify that the three subdimensions are not of equal importance.

The magnitude of the path coefficients between the three indicators and the SIC construct describe the contribution of each subdimension to SIC maturity and reveal that Strategising capability is its strongest determinant or most influential predictor. The magnitude of the path coefficient from Strategising capability to SIC was .413. This was larger than those for Networking capability and User Involvement capability, which were .275 and .214, respectively, indicating that Strategising capability is the subdimension most vital to the enhancement of the SIC of SMEs. Accordingly, these results raise the question as to why Strategising capability is substantially more important to the SIC of SMEs than the other two empirically confirmed subdimensions.

However, aside from Grawe *et al.* (2009), who show that there is empirical support for the impact of three 'strategic orientations' on service innovation capability, no other studies measured the contribution of similar factors. Turning to literature regarding the innovation capability of industrial and manufacturing organisations (Aramburu, *et al*., 2015; Costa *et al*., 2014) for an explanation is instructive here. Drawing from these literatures, this study's perceived significance of Strategising capability can be explained by research from Aramburu *et al.* (2015: 51), who describe an "explicit and organisation-wide shared innovation strategy" as the most important contributing factor to the dimensions of innovation capability in technology-based organisations. Costa *et al.* (2014) report similar findings, concluding that 'product innovation management and strategy' is the most important element of 'product innovation performance' in SMEs.

As both of these findings closely mirror those obtained in this study, they lend additional support to SICMI and highlight the criticality of Strategising capability to managers. From a practical perspective, the importance of this subdimension above the others, means that the managers of SMEs ought to direct their attention to its improvement to achieve the most substantial increases in their SIC performance (Menor and Roth, 2007; Fox and Royle, 2014).

With regard to Networking capability, there is no shortage of studies that view it as vital to service innovation (Mohannak, 2007; Hsueh *et al.*, 2010; Mu and Di Benedetto, 2012; Mustak, 2014; Rusanen *et al.*, 2014). For instance, Panayides (2006) examines the impact of a similar variable, 'relationship orientation', on the innovativeness of logistics service providers, and reports a highly significant figure for this coefficient, .43, which is larger than that for the present study. Comparable to this research, Agarwal and Selen (2009) report a significant path coefficient of .23 in a validation study of the relationship between collaborative innovative capacity, a variable that describes activities relating to the introduction of new services with partners, and another representing new or enhanced services. With regard to SMEs, Zeng *et al.* (2010) find that significant positive relationships exist between three forms of cooperation; amongst organisations, with intermediary institutions, and with research organisations; and innovation performance. The strongest of these relationships is between inter-firm cooperation and innovation performance which has a standardised path coefficient of .70 and is very highly significant (Zeng *et al.*, 2010).

Nevertheless, Networking capability is not regarded by all researchers as an essential driver of innovation capability. Specifically, in a study by Rahman *et al.* (2015) that examines the contribution of various dimensions to the innovation capability of manufacturing SMEs, the authors found that there "has been little research in the way of formal studies to examine the relative importance of such capabilities in the SME sector" and identify 'communication and networking capability' as the dimension which contributes the least to overall innovation capability (Rahman *et al.*, 2015: 553). Rahman *et al.* (2015) acknowledge that, though this finding is inconsistent with some studies (Acs and Audretsch, 1991; Mancinelli and Mazzanti, 2009), it agrees with others, such as Romijn and Albaladejo (2002) who contend that a networking capability is not necessarily conducive to the innovativeness of small firms. Notably, several studies (Barratt, 2004; Heimbürger and Dietrich, 2012; Ford and Mouzas, 2013) point out the demands that that interorganisational collaboration places on organisations, arguing that relationships of this type are "costly and time consuming to build and are very resource intensive to maintain and manage" (Knudsen, 2007: 125). This suggests that smaller firms, whose resources and expertise are severely constrained, may be unable to develop or execute their Networking capability to improve service innovation (Narula, 2004; Zeng *et al.*, 2010). Weighing up both sides of the debate regarding the importance of Networking capability to innovation in smaller businesses, appears to lend additional credibility to this study's findings. Though Networking capability allows organisations to build, manage, and configure their relationships with outside actors, providing access to additional resources and capabilities and enhancing their SIC (Mohannak, 2007; Mu and Di Benedetto, 2012; Mustak, 2014), it is not as important as Strategising capability which allows these organisations to "optimise the use of [their] limited resources" for innovation (Nada *et al.*, 2012: 4). Therefore, the importance with which Networking capability is regarded in the literature, appears to correspond to the magnitude found in this study of the path coefficient between it and the SIC construct, and support its ranking as the second most important SIC driver.

For User Involvement capability, no empirical study could be located which measures the relationship between this subdimension and another identical to SIC. However, Chien and Chen (2010) identify that two dimensions of customer involvement, customer's resources and co-production, have a significant positive effect on new service success. Melton and Hartline (2010) report similar findings which indicate that the involvement of customers in the design, development, and launch of new services, improves the efficiency of service development projects and the sales performance of new services. Likewise, Carbonell *et al.* (2009) acknowledge that customer involvement is important for successful service development and report a significant relationship between it and an operational dimension, innovation speed.

This finding also appears to apply to manufacturing to some extent (Wikström, 1996; Piller, 2004; von Hippel, 2005). Gruner and Homburg (2000) observe that customer interaction during the early and later stages of product development has a significant positive impact on new product success. Similarly, Menguc *et al.* (2014) found some support that customer involvement in design benefits new product performance and Cui and Wu (2016) specify three aspects of customer involvement; where customers are sources of information, co-developers, and innovators; and report path coefficients between the first two and a new product performance variable of .16 and .21, respectively. A study related to the current research project by Hamidi and Gharneh (2017), which examines the relationship between co-creation with customers and the innovation capability of large organisations, reports a path coefficient of .381, a relationship of larger magnitude than the present study.

Despite being regarded by some authors as central to the development of new services (Dadfar *et al.*, 2013; Santos-Vijande *et al.*, 2013; Jin *et al.*, 2014), this study's findings indicate that User Involvement capability is the subdimension that contributes the least to SIC maturity. This result was somewhat unexpected considering that user involvement is regarded as "one of the most important characteristics of [the] production and supply of services" (Cardoso *et al.*, 2016: 117) and is deemed by several studies in the service innovation and service development corpus as fundamental to service innovation success (Magnusson, 2003; Agarwal and Selen, 2009; Perks *et al.*, 2012). However, within the literature, there are many critics of this capability whose research serves as an explanation for the UI subdimension's lower than anticipated importance to SIC maturity.

Specifically, Foss *et al.* (2011) disagree that there is a direct link between customer interaction and innovation, contending that this relationship is mediated by internal practices for acquiring or sharing customer knowledge. Bajaj *et al.* (2004) in a field study with an avionics manufacturer, claim that involving customers does not result in any significant cost savings and can lead to delays in the introduction of new products. In a comparative empirical study of new product development projects involving customers and those undertaken exclusively 'in-house', Campbell and Cooper (1999) find no differences between the success rates of either class of project. Though the authors maintain that "[n]ot all new product development is improved by close cooperation with customers" (Campbell and Cooper, 1999: 507), they concede that there are some benefits to customer involvement and partnering, including access to customers from concentrated markets over a longer period.

Ittner and Larcker (1997) similarly criticise customer involvement, maintaining that an overemphasis on customer feedback during the design stages of NPD means that organisations become reactive rather than proactive. This has a negative effect on the innovation capability of organisations (Lettl, 2007) as it can "stifle disruptive innovations and can lead companies to miss emerging opportunities in the market" (Mohr and Sarin, 2009: 4). Further, much like Networking capability, UI is regarded in the literature 'resource-intensive' and complex (Korhonen and Kaarela, 2015; Geusen *et al.*, 2013; Carbonell *et al.*, 2009), where the awareness of formal methods for involving users, or their application, is low in smaller organisations (Lagrosen, 2005). Accordingly, due to this capability's resource requirements, it is less likely to feature as a prominent driver of SIC for resource constrained SMEs when compared to the other subdimensions (Menguc *et al.*, 2014; Saldanha *et al.*, 2017). Collectively, the implication of the foregoing studies to this research is that they offer a plausible explanation for the lower than anticipated contribution found for UI capability to SIC. Objectively considering all views on the importance of this capability suggests that UI is an important driver of SIC that facilitates co-creation with service users throughout the innovation process and allows organisations to provide solutions in line with their needs (Nicolajsen and Scupola, 2011; Santos-Vijande *et al.*, 2013; Melton and Hartline, 2015). However, the magnitude of its relationship with SIC appears to be accurate as it is of lesser importance to SMEs than Strategising and Networking capabilities.

The reason for disparities in the importance of Networking and UI capabilities to the SIC maturity of SMEs, compared to Strategising capability, appears to be due to the nature of the capabilities themselves. The former two capabilities are 'resource-intensive', respectively requiring resources to build new relationships or modify existing interdependencies with other actors (Ford and Mouzas, 2013) and resources to "plan and implement the method [of user involvement] as well as resources… to analyse and interpret the customer information gained" (Overvik Olsen and Welo, 2011: 147). Contrastingly, Strategising capability appears to be more conducive to SME service innovation as it allows these smaller organisations to prudently and tactically innovate their services in a manner that optimises the use of their limited resources (Wolff and Pett, 2006; Prajogo and McDermott, 2014). Consequently, it is logical that this capability is the most influential predictor of SIC maturity.

8.5 SIC as a Predictor of Service Innovation Performance

To ascertain the validity of SICMI, its nomological network was used. This step confirmed that the study's measure of the service innovation capability construct, behaved as would be anticipated by theory by empirically demonstrating its relationship with a hypothesised outcome variable, service innovation performance (Kariyapperuma, 2013; Hariandja, 2016b).

Substantiating these propositions, Rajapathirana and Hui (2018) found that insurers with higher innovation capabilities are better able to generate successful innovations and Banjongprasert (2017) report a ($\beta = .168$) statistically significant relationship between a construct similar to SIC, 'service innovation readiness', and 'service innovation performance'. However, the present study differs from this finding as the magnitude of the relationship between SIP and SIC was found to be considerably stronger ($\beta = .744$, $p < .001$). This is most likely due to its measurement of clearly specified predictors of an organisation's ability to innovate their services, rather than a vague variable representing their preparedness for innovation (Banjongprasert, 2017). Plattfaut *et al.* (2015), too, examine the relationship between SIC and service innovation performance. The authors conceptualise service innovation capability as consisting of an organisation's sensing, seizing, and transformation abilities, reporting that these factors account for 39.5% of the variance in SIP (Plattfaut *et al.*, 2015). The present study appears to offer a more powerful explanation of SIP and accounts for 15.85%[16] more of the variance for this variable. Similarly, this result also appears to be an implication of measuring SIC using the generic components of dynamic capabilities (Plattfaut *et al.*, 2015), rather than the clearly specified predictors employed by this research.

As there has been limited research regarding this relationship in services literature, it is necessary to turn to that for manufacturing. Here, for Cavusgil *et al.* (2003: 10), an organisation's innovation capability is "critical to achieving a superior innovation performance". Their study regards markets as competitive and product lifecycles as short, necessitating effective capabilities relating to the introduction of new products

[16] 55.4-39.55 = 15.85

that are difficult to imitate by competitors and of high value to buyers (Cavusgil *et al.*, 2003). Yeşil *et al.* (2013: 4) are of a similar view, and contend that innovation capability enhances innovation performance by creating and carrying possible new offerings "through to economic practice". Notably, in this empirical study, the authors found a standardised path coefficient between these two variables of similar magnitude to that in the present research (.673, $p < .001$) (Yeşil *et al.*, 2013). Aspects of innovation capability related to research and development are emphasised by Van Hemert *et al.* (2013) who are of the view that innovation capability increases the likelihood that SMEs will generate an innovation, consequently enhancing their innovation performance. While the authors (Van Hemert *et al.*, 2013) report a slightly weaker relationship between these variables than this study or Yeşil *et al.* (2013) ($\beta = .36$), it is very highly significant.

Ultimately, the study's findings illustrate that there is a large and significant (Kline, 2011) effect by an SME's capability to generate new and significantly improved services on their innovation performance, where the former explains over half of the variance in the latter. The implication of this finding to practitioners is that by improving their SIC maturity, they will also enhance their SIP.

8.6 The Service Innovation Capability Maturity Index

In this section, the advantages of modelling SIC as a formative construct are first considered. Following this, the benefits arising from this study's pioneering exploration of the maturity of service innovation capability are discussed and commentary provided regarding its links with the size of organisations. Finally, the maturity scores obtained by respondents across various demographic groups and the mean scores for individual subdimensions are compared and contrasted with extant literature.

8.6.1 The Merits of Modelling SIC as a Formative Construct

The present study argues that the exclusive utilisation of CTT in the measurement of SIC, rather than employing formative measurement models to operationalise this phenomenon, has resulted in numerous shortcomings in this topic. As discussed in §2.3.1, these options for modelling latent variables differ in their assumptions regarding the relationship between a latent variable and its indicators (Jarvis *et al.*, 2003). With classical test theory, it is assumed that a latent variable causes the scores on its indicators, while the formative approach assumes the opposite, and that the indicators cause the score for the latent variable (Cadogan *et al.*, 2008). The implications of this necessitate that reflective indicators must be internally consistent, while this requirement does not apply to formative indicators (Diamantopoulos and Siguaw, 2006).

The merits of modelling SIC as a formative construct are most evident when considering how this approach overcomes the shortcomings of reflective measurement models (Diamantopoulos and Siguaw, 2006; Coltman *et al.*, 2008). For instance, the assumption of unidimensionality by reflective measurement models, where it is expected that all items are interchangeable and will correlate positively with one another (Bollen and Diamantopoulos, 2015), is not useful for understanding complex, multifaceted phenomena such as service innovation capability where it is likely that there will be trade-offs between these facets (Cadogan *et al.*, 2008). Indeed, when these trade-offs occur, facets of SIC may not correlate or correlate negatively with others, and the reductionist approach, characteristic of CTT, will lead to "the deletion of conceptually necessary items in the pursuit of factorial unidimensionality" (Rossiter, 2002: 308), where important items are eliminated from the measure.

As the default measurement development approach for designers of SIC measures is CTT, meaning that reflective measurement models and scales are employed (Diamantopoulos, 2005), it seems likely that important items have been eliminated for failing to display internal consistency with others (Diamantopoulos, 1999). Consequently, the picture that they provide of SIC will be incomplete due to the elimination of conceptually necessary items exclusively for statistical reasons (Molina-Castillo *et al.*, 2013). On the other hand, when modelled as a formative construct, indicators of SIC can correlate positively, negatively, or not at all, meaning that all important indicators will be retained in the case of trade-offs (MacKenzie *et al.*, 2005). This is a key reason why this study's unique formative representation of SIC is so important. Indeed, the core objective of SICMI is to cover the breadth or entire conceptual meaning of service innovation capability (Diamantopoulos and

Winklhofer, 2001; Rossiter, 2002). The importance of a complete understanding of a construct's dimensions is further supported by Molina-Castillo *et al.* (2013) who suggest that when important dimensions are excluded from measures, the relationships found between a construct and others may be spurious. Consequently, this study, by formatively modelling SIC, facilitates new insights into this construct's multidimensional nature and enhances understanding of its relationships with others.

Another major advantage of modelling and measuring SIC as a formative construct in this study, is the diagnostic potential that this approach offers. As CTT assumes that a latent variable causes the scores on its indicators (Bollen, 1989), these indicators can only be represented by its outcomes (Franke *et al.*, 2008). To illustrate, some examples of items employed in the measurement of SIC are listed below:

- "Compared to our competition, our firm is able to come up with new service offerings" (Grawe *et al.*, 2009: 291).
- "In the unit, we often generate new service ideas" (Tang *et al.*, 2015: 105).
- "Our organisation has the capability to rapidly implement new services" (Thambusamy and Palvia, 2011; Thambusamy, 2019).

While these items may be useful to academics, they are of little value to managers struggling to achieve improvements to their SIC. However, as formative measurement models assume indicators cause the score for a latent variable (Diamantopoulos *et al.*, 2008), these indicators can be modelled as drivers of SIC and shed light on factors that can enhance its performance (Coltman *et al.*, 2008). Therefore, as SIC is modelled and measured in this manner for the present study, new insights are provided that inform its strategic management as the indicators, or drivers of SIC, can easily be made sense of by managers operationally (Cadogan *et al.*, 2008) and SICMI scores can direct their attention and resources to areas that require improvement (Mahr *et al.*, 2014).

8.6.2 Examining the Maturity of SIC

One of the most significant current discussions in the service industry is the requirement to improve the ability of organisations to continuously generate new or improved services (Omar *et al.*, 2016; Li *et al.*, 2017; Wu and Nguyen, 2019). While there is a need for improvements of this type to be managed (Degravel, 2011), including providing organisations with an understanding of their present performance or maturity (Zou *et al.*, 2010), little or no attention has been devoted to what SIC maturity means or how a measure of its performance could be used to manage and support improvements. Therefore, to assist SMEs, this study has provided an understanding of what maturity means in terms of SIC and a measure to diagnose their present performance and support them with enhancing their capability.

This study's understanding of SIC maturity was derived by clustering best practices associated with this capability into progressive levels which describe its optimal improvement path. Through this exercise, an enhanced understanding of SIC's evolution was obtained which provided the basis for a measure of its effectiveness. For Moultrie *et al.* (2007), the application of maturity principles provides far richer insights into examined capabilities than traditional scales. This is because they describe intermediary stages which illustrate "how a firm might progress between each level" and improve objectivity when scoring (Moultrie *et al.*, 2007: 338).

It is interesting to note that prior to this research, these maturity principles (Moultrie *et al.*, 2007) had not been meaningfully applied to SIC and little was known regarding the utilisation of the maturity model framework to support the strategic management of this capability. Favourably, some evidence of this framework's benefits to a related discipline can be gleaned from an examination of its application to the innovation capability of industrial or manufacturing organisations. Notable examples are the ICMM developed by Essmann (2009: 89) which aims to "establish the maturity of an organisation in terms of innovation capability, and to facilitate in establishing a direction and course for improvement"; and the Innovation Capability Maturity Model advanced by Corsi and Neau (2015), the focus of which is to assist managers with improving the ability of their organisation to innovate based on an evaluation.

The analyses reported in §7.3.1.2 are consistent with domain literature (Agarwal and Selen, 2009; Lin, 2013; Nada and Ali, 2015; Plattfaut *et al.*, 2015; Hariandja, 2016b; Banjongprasert, 2017) and show there is linear relationship between SIC and SIP, or in other words, respondent SMEs that achieved a higher level of maturity also reported higher scores for SIP. This association is illustrated in Table 37, which depicts the mean scores for service innovation performance for groups that attained each of the five SIC maturity levels (See Appendix A for details regarding how the overall maturity score for respondents was calculated). For instance, respondents who achieved the first level of SIC maturity, characterised as organisations with a short-term focus; a conservative attitude towards innovation; and ad hoc, reactive, and undisciplined SIC performance; also achieved average SIP scores that were below the mean. Conversely, those who attained the highest possible maturity score, Maturity Level 5, are regarded as epitomising best practice. Their routines and processes relating to service innovation are precisely formalised and continuously improved, allowing them consistently and repeatedly generate service innovations, and, consequently, were associated with scores for SIP that were close to the maximum.

SIC Maturity Score	**N**	**Mean SIP Score**	**Std. Deviation**
Maturity Level 1	59	3.4859	.69363
Maturity Level 2	124	3.7554	.56005
Maturity Level 3	53	3.9434	.60970
Maturity Level 4	40	4.2125	.54952
Maturity Level 5	8	4.4167	.40825
Total	284	3.8175	.63934

Table 37: SIC Maturity Scores and Mean SIP Scores.

8.6.3 Influence of Size on SIC Maturity

There is some agreement in the literature that a relationship exists between the size of an organisation and their innovation performance (Kimberly and Evanisko, 1981; Camisón-Zornoza *et al.*, 2004; Damanpour and Aravind, 2006; Jiménez-Jiménez and Sanz-Valle, 2011). Due to their size specific characteristics (Baregheh *et al.*, 2016), smaller firms are often characterised as resource constrained (Wolff and Pett, 2006), but flexible and nimble, which allows them to innovate through the introduction of new offerings, opening new markets, or reorganising industries (Damanpour and Aravind, 2006). Larger organisations have more resources, greater levels of management expertise, and are more willing to risk investing in an innovation (Goffin and Mitchell, 2010).

For this study, differences in the effectiveness of management activities by larger organisations were evident from results which showed a proportional increase in SIC maturity, relative to size. This was expected as the maturation path of all capabilities, in essence, describe the increasing formalisation with which they are executed (Zhiying, 2003), a feature associated with larger and more complex (Word, 2011; Turner *et al.*, 2012) organisations with "more elaborate formal organisational structures" (Schultz *et al.*, 2013: 437). Indeed, the grouping with the lowest number of employees, 10-19, also had the lowest average SIC maturity scores and that with the highest number of employees, 150-249, the highest average maturity scores.

This explanation is in agreement with related studies. For instance, in a case study exploring the benefits of project management maturity models, Albrecht and Spang (2014) emphasise the association between the standardisation or formalisation of activities and higher levels of maturity. Dijkman *et al.* (2016: 722) support this view, adding that "larger organisations have a more urgent need for better described and more structured processes, because they may otherwise become unmanageable due to their size".

Only one study was located that did not support the relationship between the size of organisations and their innovation performance. This was by Saunila and Ukko (2014), who, using a measure of innovation capability not customised for service firms, suggest that there are no differences between the innovation capability of small firms with between 10-49 employees, and that of medium-sized organisations with between 50-249 employees. However, this study somewhat diverges from others. Perdomo-Ortiz *et al.* (2006) are of the view that there is a slight difference on some dimensions of innovation capability between smaller and larger manufacturers, while Luo and Chanaron (2017) assert that firm size has a significant impact on the innovation capabilities of high-tech SMEs. A study of innovation capabilities by Forsman and Rantanen (2011), reports lower scores for manufacturers with fewer than ten employees than for other size groupings. While this study does report somewhat similar results for service organisations, they were not statistically significant and are not recounted here (Forsman and Rantanen, 2011). Ultimately, its authors concluded that there was "a linear relationship" between the innovation capability dimensions measured and "the size of the enterprise, i.e. the degree of capabilities increases while the size of the manufacturing enterprise increases" (Forsman and Rantanen, 2011: 42).

This view aligns exactly with this study's findings for service SMEs, where the SIC maturity scores were found to be directly proportional to size.

8.6.4 SIC Maturity Scores Across Demographic Groups

Though the normative SIC maturity scores for respondent size groupings are reported in §7.4.1, differences across other demographic variables are not. This is because norms for SIC maturity scores relative to the size of organisations provide a useful summary (Kruger and Johnson, 2010) and can be quickly and easily interpreted by users of the measure and to provide meaning regarding their score (Spector, 1992). In this subsection, differences in average SIC maturity scores across other variables are recorded and discussed.

Table 38[17] ranks the average SIC maturity scores obtained for each of the industries from which responses were obtained. Those with the highest average SIC maturity scores are 'Recruitment, human resources, and employment', 'Health and safety', and 'Real estate', followed closely by ICT. The industries with the lowest average SIC maturity scores are 'Construction', 'Cleaning and industrial cleaning', and 'Sanitation and waste disposal', overlooking the single response obtained from an organisation in the 'Media and entertainment' industry.

[17] Levene's statistic indicates that the homogeneity of variance assumption was violated by these data. Accordingly, the Kruskal-Wallis test (Morgan *et al.*, 2012) was conducted to examine differences in mean SIC maturity scores according to the industry of respondents. No significant differences (p = .079) were found.

	N	Mean	Std. Deviation
Recruitment, human resources, or employment	4	3.2500	.95743
Health and safety	2	3.0000	1.41421
Real estate	6	3.0000	1.26491
Information and communications technology	22	2.7727	.81251
Education or training	14	2.7143	.91387
Business or management consulting	10	2.7000	1.05935
Research and development	3	2.6667	1.15470
Architectural or engineering	35	2.6000	1.09006
Tourism or hospitality	25	2.5600	1.22746
Insurance	4	2.5000	1.00000
Healthcare or social care	12	2.4167	.99620
Agricultural	7	2.2857	.95119
Financial	18	2.2778	1.27443
Sale, hire, or leasing of machinery or equipment	11	2.2727	1.00905
Transport, distribution, or storage	24	2.2083	.93153
Advertising, market research, or public opinion polling	5	2.2000	1.30384
Environmental	8	2.1250	.99103
Design or graphic design	2	2.0000	.00000
Facilities or property management	5	2.0000	.70711
Law	3	2.0000	.00000
Repair or recovery of vehicles or machinery	6	2.0000	1.54919
Retail or wholesale	13	2.0000	1.15470
Security or investigation	11	2.0000	.63246
Sport	1	2.0000	.
Energy	4	1.7500	.95743
Construction	19	1.7368	.93346
Cleaning or industrial cleaning	6	1.6667	.51640
Sanitation and waste disposal	3	1.6667	.57735
Media or entertainment	1	1.0000	.
Total	284	2.3451	1.04693

Table 38: Average SIC Maturity Scores and Industry.

Little has been written regarding comparisons between the innovation capability of service industries. The majority of empirical research is conducted within a single industry, i.e. logistics (Daugherty *et al.*, 2011) or professional services (Hogan *et al.*, 2011), and cannot discuss differences in scores between industries for its scales. Sundbo (2007: 133) is of the view that 'financial services' is the most innovative service industry, attributing this to the fact that it is "well organised, and the firms are generally large". In a study of Norwegian firms, based on several data sources, Langeland and Aslesen (2004) conclude that 'Computers and related activities' is the most innovative service industry, but also point out a positive relationship between the size of organisations and their innovativeness. It is interesting to observe that both of these studies couple the size of an organisation with its industry when commenting on determining factors of innovativeness. In the present study, ‘Information and communications technology’ is among the best performing industries, appearing to support Langeland and Aslesen (2004), while the average for responses in the ‘Financial’ industry is below the mean, contrary to what might have been expected based on Sundbo (2007).

A very general trend among the scores in Table 38 is that industries which could be classified as ‘manual services’ (Sørensen *et al.*, 2013), appear to have the lowest average SIC maturity scores, while those that could be classified as ‘knowledge services’, have the highest scores (Sundbo and Gallouj, 1998). This finding is consistent with the prevailing understanding in services research which regards knowledge services, or KIBS, as the most innovative, and manual services, or “services that treat physical objects” (Sundbo, 1999: 7), as the least innovative (Dahlgaard-Park, 2015).

Rankings for average scores for each of the counties from which responses were obtained are represented in Table 39[18]. There do not appear to be any trends in these data, where, for instance, it might be expected that organisations in more urban areas would have higher average scores (Allgurin, 2017; Aryal *et al.*, 2018). If this were the case, it would be expected that Dublin and Cork, Ireland’s most and second most populated counties, respectively, would rank first and second. The reality though is that the average of the 33 responses from Cork are below the mean and the 118 from Dublin are only marginally above the mean. However, this may be a consequence of so few responses in some of the county categories which comprise the average SIC maturity score.

[18] There were no statistically significant differences between group means as determined by one-way Analysis of Variance (ANOVA) results, $F(21, 262) = 1.369$, $p = .133$.

	N	Mean	Std. Deviation
Offaly	2	3.5000	.70711
Wexford	13	3.0769	1.32045
Louth	2	3.0000	.00000
Sligo	2	3.0000	1.41421
Westmeath	4	3.0000	1.15470
Galway	10	2.9000	1.28668
Donegal	5	2.6000	.54772
Mayo	4	2.5000	1.00000
Kildare	12	2.4167	1.08362
Dublin	118	2.3814	1.10104
Carlow	8	2.3750	.91613
Waterford	14	2.2857	.72627
Cork	33	2.2424	1.03169
Limerick	11	2.0909	.53936
Kilkenny	7	2.0000	.57735
Tipperary	7	2.0000	1.15470
Wicklow	5	2.0000	.70711
Cavan	6	1.8333	1.16905
Meath	5	1.8000	1.30384
Kerry	9	1.7778	.44096
Clare	6	1.6667	.51640
Monaghan	1	1.0000	.
Total	284	2.3451	1.04693

Table 39: Average SIC Maturity Scores and Location.

Average SIC maturity scores for respondents belonging to different organisational age groupings are reported in Table 40[19]. These identify the 75 respondents in the '11-20 years' grouping as having the highest average SIC maturity scores and the 20 respondents in the '3-5 years' grouping as having the lowest average scores.

[19] Levene's statistic indicates that the homogeneity of variance assumption was violated by these data. The Kruskal-Wallis test was conducted to examine differences in mean SIC maturity scores according to the length of time respondents had been in operation. No significant differences (p = .644) were found.

	N	Mean	Std. Deviation
1-2 years	5	2.2000	.83666
3-5 years	20	2.1500	1.03999
6-10 years	31	2.3548	1.05035
11-20 years	75	2.5200	1.13137
More than 20 years	153	2.2876	1.01095
Total	284	2.3451	1.04693

Table 40: Average SIC Maturity Scores and Organisation Age.

Though no studies could be located that investigate the impact of the age of organisations on their innovation capability, Calantone *et al.* (2002), in a study using data from 187 organisations in a variety of manufacturing and service industries, report organisational age as moderating the relationship between learning orientation and firm innovativeness. The authors attribute this to the ability of older organisations to employ knowledge more effectively for innovation (Calantone *et al.*, 2002). However, Vincent *et al.* (2004), in a meta-analysis of 83 studies regarding the determinants and consequences of organisational innovation, detail discrepancies concerning this relationship. The study (Vincent *et al.*, 2004) illustrates that some scholars contend that a positive relationship exists between age and organisational innovation (Sørensen and Stuart, 2000), whereas others dispute this view (Boeker, 1997). It concludes that older organisations may be more rigid and less open to change and ultimately that "age has a negative relationship with product innovation" (Vincent *et al.*, 2004: 17). This study does not entirely agree with this view as the grouping of oldest respondent organisations ranked in the middle based on their SIC maturity scores.

Despite low numbers for some of the organisational age response categories, a general trend appears to be that very young organisations, in operation for five years or fewer, have the lowest average SIC maturity scores. Organisations in the middle, '6-20 years' categories, have the highest average SIC maturity scores, and the oldest, those aged over 20 years, rank between the other groups. While one must be careful interpreting results with so few responses in some groupings, these results appear to be consistent with the literature. This suggests that younger organisations are often unwilling to implement changes that disrupt their present operations and older organisations are less innovative due to rigid and established routines (Vincent *et al.*, 2004).

Accordingly, organisations in the middle of these groups, would be expected to be most innovative and possess the highest levels of SIC maturity.

An examination of the mean SIC maturity scores for respondents in the various turnover categories (See Table 41[20]), reveals an almost linear relationship with turnover, the exception to this pattern being the '€500,000-€999,999' grouping. The result appears to be consistent with Noordin and Mohtar (2013), who contend that an SMEs' innovation capability will result in the transformation of ideas into something new with an economic value that increases their profitability. This notion is further supported by other studies that report a positive relationship between innovation capability or innovativeness and turnover or profitability (Slater *et al.*, 2014; Hariandja, 2016a), including one involving small Irish firms (Roper, 1997). However, Saunila *et al.* (2014), in a study of 302 SMEs, report that the determinants of innovation capability have only a minor effect on profitability.

	N	**Mean**	**Std. Deviation**
<€249,999	12	1.9167	1.08362
€250,000-€499,999	22	2.1818	1.05272
€500,000-€999,999	38	2.3158	.90360
€1 million-€1.99 million	69	2.2319	1.04523
€2 million-€10 million	106	2.3868	1.05624
€11 million-€25 million	30	2.7000	1.11880
€26 million-€50 million	7	2.7143	1.11270
Total	284	2.3451	1.04693

Table 41: Average SIC Maturity Scores and Turnover.

Nevertheless, as these data were obtained through a single cross-sectional survey, it is not possible to definitively conclude that organisations' higher SIC maturity scores will result in a higher annual turnover. Indeed, the result could be explained simply by linking larger turnover figures with larger organisations, described in the previous subsection as the cohort with the highest average SIC maturity scores.

[20] Levene's statistic indicates that the homogeneity of variance assumption was violated by these data. The Kruskal-Wallis test was conducted to examine differences in mean SIC maturity scores according to the annual turnover of respondents. No significant differences ($p = .175$) were found.

An examination of the differences in SIC maturity scores between respondent groupings with various primary customers, depicted in Table 42[21], revealed that the 'Other' category had the highest average SIC maturity scores. This grouping includes organisations whose customers are predominantly government agencies, not-for-profit organisations, or others that are neither classified as a business nor a consumer. Very little has been published regarding the relationship between demographic variables of this type and innovation capability, and no study has advanced any definitive view (Jaakkola and Tuominen, 2008; Menguc and Auh, 2010; Menguc *et al.*, 2014). Further examination of the relationship between this demographic variable and both product and service innovation capability has the potential to yield interesting results and is flagged as a potential avenue for future research in §9.7.

	N	**Mean**	**Std. Deviation**
B2B	159	2.4654	1.00492
B2C	104	2.1346	1.08885
Other	21	2.4762	1.03049
Total	284	2.3451	1.04693

Table 42: Average SIC Maturity Scores and Principal Customers.

The final demographic variable for which average SIC maturity scores are compared across groups, is whether respondent organisations have owners resident in Ireland or abroad. These results are portrayed in Table 43[22]. Though there were significantly fewer responses by SMEs operating in Ireland but with foreign owners, the average of their SIC maturity scores is larger than those reported by domestically owned organisations and is above the mean.

[21] Levene's statistic indicates that the homogeneity of variance assumption was violated by these data. The Kruskal-Wallis test was conducted to examine differences in mean SIC maturity scores according to the primary customers of respondents. Highly significant differences ($p = .009$) were found.
[22] Levene's statistic indicates that the homogeneity of variance assumption was violated by these data. The Kruskal-Wallis test was conducted to examine differences in mean SIC maturity scores according to ownership of respondent organisations. No significant differences ($p = .188$) were found.

	N	Mean	Std. Deviation
Domestically owned	258	2.3217	1.04806
Foreign owned	26	2.5769	1.02657
Total	284	2.3451	1.04693

Table 43: Average SIC Maturity Scores and Ownership.

Jiang *et al.* (2013) explore the implications that different ownership forms have on the ability of Chinese organisations to innovate. They account for some differences between foreign owned firms, referred to as foreign-invested enterprises, and domestically owned organisations, referred to as privately-owned enterprises, as a result of the ability of the former group to invest in research and development, innovation, and attract talented staff (Jiang *et al.*, 2013). This understanding is supported by Dachs and Peters (2014) who contend that foreign-owned organisations possess superior firm-specific assets, including organisational and managerial capabilities, by Falk (2008: 95), who demonstrate that "foreign-owned firms are significantly more innovative than domestic firms", based on approximately 28,000 observations, and numerous other studies on this topic (Balcet and Evangelista, 2005; Frenz and Ietto-Gillies, 2007; Criscuolo *et al.*, 2010; Siedschlag and Zhang, 2014). Ultimately, the results of the present study appear to be in harmony with the prevailing view in the literature regarding the relationship between ownership and innovation capability.

8.6.5 Mean Scores for Individual Subdimensions

The final discussion area in this chapter examines and comments on the mean scores for select subdimensions across groups.

The first demographic variable for which the mean scores for individual subdimensions are reported, is the age of organisations (See Table 44[23]). Of note, the highest average score for any subdimension belongs to the UI capability for the five organisations in operation between 1-2 years. Though this finding was based on a low

[23] Levene's statistic indicates that the homogeneity of variance assumption was violated for each of the subdimensions. The Kruskal-Wallis test was conducted to examine differences in the maturity scores for the subdimensions according to the length of operation by respondent organisations. No significant differences were found for User Involvement (p = .313), Strategising (p = .921), or Networking (p = .691) capabilities.

number of responses, it was in harmony with Chernetska (2017) who recognises that new ventures integrate customers more actively in order to maximise their value. Similarly, Morgan (2015: 10) argues that as organisations become “older they are less reliant on customers as co-innovators”, and reports that their age negatively impacts the relationship between entrepreneurial orientation and customer participation. Comparable results were obtained for the present study, where, with the exception of one category, higher maturity scores for UI capability were achieved by respondents less than or equal to 10 years in age, and the lowest scores by the two categories of organisations aged 11 years or older.

		N	Mean	Std. Deviation
UI	1-2 years	5	3.40	1.140
	3-5 years	20	2.60	1.465
	6-10 years	31	3.10	1.491
	11-20 years	75	3.04	1.390
	More than 20 years	153	2.75	1.270
	Total	284	2.86	1.342
S	1-2 years	5	2.80	.837
	3-5 years	20	3.00	1.257
	6-10 years	31	3.19	1.014
	11-20 years	75	3.21	1.154
	More than 20 years	153	3.14	1.126
	Total	284	3.15	1.122
N	1-2 years	5	2.60	1.140
	3-5 years	20	2.90	1.334
	6-10 years	31	3.10	1.076
	11-20 years	75	3.23	1.146
	More than 20 years	153	3.07	1.212
	Total	284	3.09	1.185

Table 44: Average Subdimension Maturity Scores and Organisation Age.

As discussed in §8.6.3, a proportional increase in SIC maturity was detected, relative to the size of respondent organisations. This finding is an implication of maturity scores for each of the subdimensions that follow a similar trend, illustrated in Table 45[24]. Indeed, the highest scores for User Involvement and Networking capabilities

[24] Levene’s statistic indicates that the homogeneity of variance assumption was violated for each of the subdimensions. The Kruskal-Wallis test was conducted to examine differences in the maturity scores for the subdimensions according to the size of respondent organisations. No significant differences were found for User Involvement (p = .538), Strategising (p = .535), or Networking (p = .188) capabilities.

were both achieved by the category of respondents with most employees, 150-249. Results of this nature for the subdimensions were expected as higher levels of maturity equate to a greater degree of formalisation in their execution, a quality of organisations that are larger and more complex (Word, 2011; Turner *et al.*, 2012).

		N	Mean	Std. Deviation
UI	10-19 employees	127	2.82	1.330
	20-49 employees	84	2.88	1.383
	50-149 employees	60	2.82	1.308
	150-249 employees	13	3.38	1.387
	Total	284	2.86	1.342
S	10-19 employees	127	3.06	1.164
	20-49 employees	84	3.19	1.047
	50-149 employees	60	3.30	1.183
	150-249 employees	13	3.15	.899
	Total	284	3.15	1.122
N	10-19 employees	127	2.94	1.194
	20-49 employees	84	3.20	1.138
	50-149 employees	60	3.17	1.237
	150-249 employees	13	3.54	1.050
	Total	284	3.09	1.185

Table 45: Average Subdimension Maturity Scores and Organisation Size.

The final demographic variable for which the average maturity scores obtained for the subdimensions are reported, is the principal customers of respondents (See Table 46[25]). While many aspects of these results could be explored in greater detail, the decision was made to discuss only those for User Involvement capability. Specifically, it was interesting to observe that respondents whose principal customers are other organisations achieved higher scores than the other categories. The majority of user or customer involvement research has been undertaken in the B2B context (Von Hippel, 1986; Gruner and Homburg, 2000; Bosch-Sijtsema and Bosch, 2015; Lynch *et al.*, 2016), where Magnusson (2009: 579) contends that the involvement of users is more

[25] Levene's statistic indicates that the homogeneity of variance assumption was violated for each of the subdimensions. The Kruskal-Wallis test was conducted to examine differences in the maturity scores for the subdimensions according to the principal customers of respondent organisations. Though no significant differences were found for Strategising capability (p = .121), significant differences were found for Networking (p = .022) and highly significant differences for User Involvement (p = .001) capability.

beneficial due to symmetries between the "technical knowledge of customer[s] and supplier[s]". However, to the author's knowledge, no existing study has contended that B2B or B2C organisations have superior capabilities for involving users in the development of new products or services.

		N	Mean	Std. Deviation
UI	B2B	159	3.13	1.354
	B2C	104	2.48	1.277
	Other	21	2.76	1.136
	Total	284	2.86	1.342
S	B2B	159	3.16	1.073
	B2C	104	3.05	1.194
	Other	21	3.57	1.076
	Total	284	3.15	1.122
N	B2B	159	3.16	1.136
	B2C	104	2.88	1.225
	Other	21	3.57	1.207
	Total	284	3.09	1.185

Table 46: Average Subdimension Maturity Scores and Principal Customers.

8.7 Chapter Conclusion

This chapter provided a comprehensive account of this study's results and findings within the context of its literature base. It commented on the necessity of conceptualising and concretely dimensionalising SIC, the relative importance of the three empirically confirmed subdimensions, the magnitude of the newly developed measure's explanatory power for SIP, and considered the relationship between several demographic variables and overall maturity scores and those for the subdimensions.

The next and final chapter of this dissertation revisits the study's objectives and elaborates on how each was achieved, prior to a summary of the methodological, theoretical, and managerial contributions made by this study. It concludes by outlining the study's limitations and suggesting directions for future research.

Chapter 9: Conclusion

9.1 Introduction

In the preceding chapter, this study's findings were discussed in the context of its literature base. The purpose of this final chapter is to revisit each of the study's objectives and provide a brief overview for how each achieved. Thereafter, the contributions of this study to both research and practice are discussed, with a particular emphasis on its significance to research methodology. Following an overview of the study's limitations, both the chapter and dissertation close with suggestions for future research directions that may be encouraged or assisted by the present work.

9.2 Reiteration of the Study's Objectives

The overarching objective of this study was to *develop and validate a formative measure of service innovation capability maturity*.

Underlying this objective are the following sub-objectives:

A. *To define and conceptualise the service innovation capability construct;*
B. *To develop a framework to support the assessment of service innovation capability maturity and inform improvement initiatives*; and
C. *To construct and empirically validate an index that quantitatively measures service innovation capability maturity in small and medium-sized enterprises.*

Each of the objectives were achieved.

A. The successful achievement of Sub-Objective A addressed a deficiency recognised by Hogan *et al.* (2011: 1266), who contend that the "inconsistent dimensionality and operationalisation" of SIC is an impediment to the development of measures for it. This judgement is supported even by a surface level examination of SIC literature which illustrates the numerous ways the phenomenon has been defined and various features proposed as its dimensions (Zitkiene *et al.*, 2015).

It was conceptualised and operationalised as a formative, higher-order multidimensional latent construct caused by three subdimensions: User Involvement, Strategising, and Networking capabilities. These subdimensions were identified through a structured literature review, followed by a grouping and categorisation exercise. This process reduced 50 candidate subdimensions, identified using the literature, to only four, deemed to be the most important for enabling service innovations in SMEs. Later, this list was reduced further when only the three subdimensions listed above were confirmed empirically. Service innovation capability was defined as *'a key dynamic capability, embedded in the routines or processes of an organisation, with the potential to repeatedly deploy and reconfigure resources in the continuous creation or improvement of services'.*

B. Capability maturity models are a tool that is widely used to support the measurement and systematic management of an organisation's capability performance in a variety of domains (Wendler, 2012). As the purposes of this framework aligned with the second research objective, it was selected for use in the study and the Service Innovation Capability Maturity Model was derived from the literature.

First, this required specification of the number of maturity levels to be included in the model and their characteristics. Based on a composite of 73 maturity models from management and organisation literature, five maturity levels were selected which depicted the typical evolution of organisational capabilities through cumulative and progressive stages. The initial maturity level represented ad hoc, inconsistent, and poor capability performance; while the highest level described disciplined and effective capability execution, or best practice (Corsi and Neau, 2015). Next, the anticipated characteristics of each of the subdimensions at each level of maturity in SMEs were specified through an examination and integration of descriptions of similar and related capabilities at comparable levels of maturity (Maier *et al.*, 2012). Finally, these descriptions were added to a matrix with the maturity levels on one axis and subdimensions on the other. In the cell at their intersection, the characteristics of that subdimension at the corresponding level of maturity was added.

Achieving Sub-Objective B allows users of SICMM to qualitatively evaluate their capability maturity and examine descriptions of higher levels to inform improvement initiatives. Critically, the conceptual maturity model also formed the basis for the development of a quantitative measure that could examine the validity of the proposed subdimensions.

C. To support the construction and empirical validation of an index to measure SIC maturity, a rigorous, best practice procedure consisting of nine phases, some of which had multiple steps, was synthesised and closely adhered to (Churchill, 1979; Hinkin *et al.*, 1997; Diamantopoulos and Winklhofer, 2001; MacKenzie *et al.*, 2011; DeVellis, 2017).

   Initially, SIC was fully conceptualised. This phase built upon Sub-Objective A and closely examined the usage of the term by other authors. SIC was distinguished from a similar phenomenon, new service development (Storey and Kelly, 2001), and support was identified that it had a large (Kline, 2011) and positive effect on service innovation performance (Kariyapperuma, 2013; Plattfaut *et al.*, 2015; Hariandja, 2016b; Banjongprasert, 2017). The property represented by the SIC construct was specified as its maturity and organisations were designated as the entity to which the construct applied. Next, the fundamental attributes or characteristics of SIC were detailed for each level of maturity and the plausibility of formatively representing the empirical relationship between the SIC construct and indicators of its subdimensions was accepted.

   Following this, measurement items were generated. Due to the formative representation of the SIC construct, it was necessary to employ a set of measurement items that fully represented the construct's conceptual meaning (Diamantopoulos and Winklhofer, 2001; MacKenzie *et al.*, 2011). To achieve this, the descriptions of each of the subdimensions at each level of maturity were translated into statements that could be used as measurement items. These were reviewed for content validity by a panel of academics and their suggestions incorporated. The ability of practitioners to comprehend these measurement items was then confirmed by a second review panel.

The successful completion of the previous phase allowed the measurement model to be formally specified (Diamantopoulos and Winklhofer, 2001; MacKenzie *et al.*, 2011). However, in order for the formatively represented SIC construct to be estimated using the AMOS software, certain conditions had to be fulfilled. These included, setting the scale of measurement (MacCallum and Browne, 1993), where the path from SIC to a global reflective item was constrained to one; and the '2+ emitted paths rule' (Bollen and Davis, 2009b), where the global reflective item and a service innovation performance construct were employed as reflectively measured outcomes of the construct. As each of the subdimensions were expected to be interrelated to some degree, the covariances among their indicators were freely estimated (MacKenzie *et al.*, 2005). The measure was then pretested through two studies, one with academics and the other with practitioners, to refine and improve the questionnaire, ensure that there were no issues with the clarity of instructions or missing response options, and determine the expected completion time. Two pilot studies were then used to identify and correct any weaknesses with the specification of the measurement model and to determine the number of invitations required to obtain a minimum of 200 responses by SMEs.

The main study was active for 24 days and collected 824 responses. 304 of these remained following the removal of cases not eligible for the study due to their size or being located outside of the Republic of Ireland. Data were prepared by identifying and removing 20 prediction outliers (Aguinis *et al.*, 2013) and confirming that the remaining response data were approximately normally distributed (Ong and Puteh, 2017), allowing CB-SEM techniques to be utilised to purify and refine the index and assess its validity (Reinartz *et al.*, 2009).

To evaluate the goodness-of-fit of the measurement model, values for recommended statistics, χ^2, χ^2/df, CFI, RMSEA, and SRMR were obtained, all of which were acceptable. An acceptable R^2 value of .549 indicated that the indicators accounted for over half the variance in the construct and path coefficients from three of the indicators to the SIC construct were significant. Excessive multicollinearity was not an issue as none of the VIF values for the indicators exceeded 3.3. Upon consideration of the theoretical and empirical implications of eliminating the indicator with the weak and non-significant path coefficient, it was removed. The revised three-indicator model was then re-estimated. All goodness-of-fit indices remained acceptable and the R^2 value was unchanged.

The acceptability of the psychometric properties of the measurement model allowed the measure to progress to the next phase, where the validity of the structural model was assessed. Validity was suggested through the results of an independent samples t-test that indicated there were significant differences in the mean SIC maturity scores of groups that had standard processes in place for the development of new services and those who did not; through confirmation that SIC had a large (Kline, 2011) and significant effect on service innovation performance; and an examination of discriminant validity, which revealed that SIC was less than perfectly correlated with a measure of NSD performance, suggesting that it tapped a distinct concept. Finally, norms were calculated to aid in the interpretation of scores for the measure.

Following the execution of this rigorous procedure, the validity and legitimacy of SICMI was strongly suggested. Consequently, Sub-Objective C was deemed to have been achieved, meaning the index could be employed confidently by researchers and practitioners seeking to diagnose the SIC maturity of SMEs.

While the value of discrete or singular service innovations is accepted by researchers (Ojasalo, 2009; Randhawa and Scerri, 2015), recognition of the requirement for organisations to consistently and persistently innovate has channelled their attention to a deeper factor. This is the capability that underlies the repeated introduction of new or improved services, SIC (Pöppelbuß *et al.*, 2011; Lillis *et al.*, 2015; Nada and Ali, 2015). In order to overcome challenges related to their size or resource constraints and obtain the organisation enhancing benefits of this capability, it must be effectively managed by SMEs. However, in the absence of a clear conceptualisation of SIC or any tools to support its strategic management, managers are unaware of their organisation's SIC performance or of the dimensions that it is suffering on.

Acknowledging the merits of existing measures of SIC to this expanding topic and in the discovery of relationships with other variables (Grawe *et al.*, 2009; Hogan *et al.*, 2011), they provide little value to practitioners. A key reason for this is their exclusive utilisation of the reflective approach which assumes that a latent construct representing a phenomenon drives the scores for its indicators (Bollen, 1989). Accordingly, any construct measured in this way is represented unidimensionally, as its indicators are merely reflections of it, measured using outcomes (Bollen and Diamantopoulos, 2015).

For practitioners, effective measures of constructs are those that provide a starting point for the management of the phenomenon that they represent (Boyd *et al.*, 2013). Evaluations should afford organisations an understanding of their performance in the focal area, informing them of aspects that demand attention (Juran and Gryna, 1993). Evidently, the above items, effects of SIC, cannot provide practitioners with any insights regarding the management or enhancement of this capability.

Critically, from a conceptual perspective, reflective items are also unsuitable when representing complex multifaceted phenomena. These items are interchangeable, as it is assumed that their scores are driven by the same underlying phenomenon (Jarvis *et al.*, 2003). Consequently, it is expected that there will be a strong correlation among them and any items that fail to display internal consistency with others will be excluded from measures. The exclusive utilisation of the reflective approach and the resultant shortcomings of studies that have attempted to measure and understand SIC in this way, was the motivation for formatively representing SIC.

Indeed, formatively representing SIC offers several advantages. As formative indicators are designated as causes or drivers of the capability they are used to measure, they can be made sense of by managers operationally and controlled. This alerts SMEs to aspects of SIC that can be influenced to increase their overall performance, contributing to management practice. Additionally, during the purification of a formative measure, correlations among items are not required and all conceptually necessary items were retained to produce a complete picture of SIC (Coltman *et al.*, 2008). The merits of the formative approach for generating comprehensive theoretical insights and its foundation for a measure that can be employed as a diagnostic tool by SMEs, justify its selection (Hoehle and Venkatesh, 2015).

An examination of literature on the topic of performance measurement and management for organisational capabilities, revealed the capability maturity model framework to be a popular and effective tool (Ibbs *et al.*, 2004; Wendler, 2012). These models are utilised by organisations to rapidly assess the performance of a capability against defined best practices and to identify areas of strength and weakness that can be used to inform targeted improvements (Essmann and Du Preez, 2009).

To overcome the limitations of existing SIC measures and the inadequate level of detail or granularity that they offer practitioners pursuing improvements, this study's ambition was to construct and validate a formative measure of SIC maturity. The expected outcomes of this research strategy were the provision of an empirically substantiated conceptualisation of SIC and the creation of an original measure that could be employed by SMEs to diagnose their SIC performance and inform decisions related to its improvement which maximise scarce resources.

In summary, the main research objective was successfully achieved as the development and validation of a novel and original formative measure of service innovation capability maturity is detailed throughout this dissertation. Collectively, all chapters have worked towards the fulfilment of this overarching goal, with the cumulative results of conceptual steps and empirical tests strongly indicating that SICMI is a rigorously constructed and legitimate SIC maturity measure.

9.3 Methodological Contribution

The primary methodological contributions of this study are SICMI, a novel and original measure of service innovation capability maturity, and the best practice procedure through which this index was constructed and validated.

9.3.1 New Measure of SIC

SICMI, the instrument at the core of this study, is a unique and pioneering measure that incorporates and extends previous SIC research. It represents SIC as a multidimensional construct caused by three subdimensions and is the first empirical study to assess the performance of this capability through its causes or to measure its maturity. The measure is concise, conceptually sound, has proven psychometric qualities, is easy to complete and score, and can be used across research contexts. Consequently, it contributes to research methods as it can be easily applied to diagnose the maturity of SIC in future studies or as an additional variable in studies of determinants or outcomes of service innovation.

9.3.2 Synthesis and Application of Best Practice Index Construction Procedure

The development and validation of SICMI also contributes to the domain of knowledge regarding index construction. Specifically, the synthesis and execution of best practice steps for the development of measures constitute both a novel systematic procedure and provide an excellent example of its implementation.

The phases and steps in this procedure were derived from an examination of those advanced by expert methodologists and by integrating the disparate best practices from both scale development and index construction literature into a logical, incremental sequence of activities (Churchill, 1979; Gerbing and Anderson, 1988; Hinkin *et al.*, 1997; Diamantopoulos and Winklhofer, 2001; Rossiter, 2002; MacKenzie *et al.*, 2011; DeVellis, 2017). This composite procedure supplements the existing body of literature, providing a robust foundation for future research, and contributes to the growing body of literature guiding the development of formative measures (Diamantopoulos and Winklhofer, 2001) using CB-SEM techniques (MacKenzie *et al.*, 2011). Indeed, the purpose for which this procedure was synthesised, evaluating the validity of a theoretically-derived measure of maturity, mean that it is the ideal methodological approach and offers researchers guidelines for achieving similar objectives (Blommerde and Lynch, 2017).

The application of these procedural steps contributes to knowledge at the methodological level by providing a valuable example for other researchers regarding how they can be executed in practice in the development of a maturity measure. Usually, studies constructing a formative measure will adopt PLS-SEM (Chin, 2010; Heidenreich and Handrich, 2015), an approach that does not permit the estimation of goodness-of-fit statistics and provides less accurate and consistent results for parameter estimates than CB-SEM (Reinartz *et al.*, 2009). This study differs through its adoption of a moderately more complex, yet preferable method, which utilises CB-SEM techniques and the AMOS software. It constitutes one of only a few instances in which this is the case and provides important insights for future researchers that wish to follow this approach (Ong and Puteh, 2017; Ali *et al.*, 2018).

9.4 Contribution to Theory

9.4.1 Contribution to Service Innovation Capability Literature

This project advances research on service innovation capability in several important ways. It describes a robust multidimensional conceptualisation of SIC, constructs and validates the discipline's first measure of maturity, empirically confirms the magnitude of the hypothesised relationship between SIC and service innovation performance, and reveals the importance of Strategising capability to SIC maturity.

A significant theoretical contribution made by this study is its literature-based, unifying conceptualisation of SIC and its representation as a higher-order multidimensional formative construct. SIC is infrequently conceptualised or dimensionalised in the literature and there is little agreement between instances in which it is (Tuominen and Anttila, 2006; Ngo and O'Cass, 2009; Zhou and Wei, 2010). Worryingly, the concept continues to be modelled reflectively (Grawe *et al.*, 2009; Daugherty *et al.*, 2011; Thambusamy and Palvia, 2011; Tang *et al.*, 2015; Tang, 2015), which conceals the essential characteristics of this complex multifaceted phenomenon, restricts its conceptual meaning, and obstructs academic understanding (MacKenzie *et al.*, 2011). This study's pioneering formative representation of SIC facilitates a complete understanding of SIC through its multiple facets and opens a new approach to increasing understanding of this phenomenon.

While service innovation capability research has intensified in recent years (Pöppelbuß *et al.*, 2011; Lillis *et al.*, 2015), its ambiguous nature has been detrimental to its measurement. As a result, the majority of research in this area has remained on a conceptual level (Nada and Ali, 2015; Zitkiene *et al.*, 2015). Of the existing measures, none examine the maturity or performance of this phenomenon or have been designed for small and medium-sized enterprises. Consequently, they provide few insights and do little to advance the domain. This study's development and validation of a measure of SIC maturity represents a significant contribution to this stream of research and can be used as an additional variable in other studies examining the drivers and outcomes of service innovation.

When validating SICMI using its nomological network, a hypothesised relationship between SIC and service innovation performance was utilised. This relationship had been theorised in the literature (Kariyapperuma, 2013; Hariandja, 2016b) and there were two empirical studies that were of relevance (Banjongprasert, 2017; Plattfaut *et al.*, 2015). However, as outlined in §7.3.1.2, neither of these employ clearly specified predictors of an organisation's ability to innovate their services, to measure SIC. As a result, the present study explains 16.05% more of the variance than Plattfaut *et al.* (2015) and its confirmation of a large ($\beta = .744$) (Kline, 2011) and significant (p <

.001) relationship between these two variables marks an important contribution to the body of empirical SIC research.

Of the three subdimensions of SIC supported by this research, Strategising capability emerged as the most critical. Identifying a single dimension of SIC as being of greater importance to its management than others, is an important contribution. No prior study of the predictors of SIC has asserted that any of the dimensions it proposes are more influential than others. It is envisaged that this finding will have a role in directing the focus of new research to the most vital aspects of SIC.

9.4.2 Contribution to Dynamic Capability Literature

Other key theoretical contributions made by this study are those to dynamic capabilities literature.

First, the study strengthens the theory by precisely specifying the dimensions of DSIC. Usually when the dimensions of any dynamic capability are suggested, they are the 'sensing', 'seizing', and 'reconfiguring' capabilities (Pöppelbuß *et al.*, 2011; Plattfaut *et al.*, 2012; Hariandja, 2016b). These items are vague and difficult to study as they are so far removed from an organisation's tangible routines and processes.

Second, it describes the characteristics of a dynamic capability at various levels of maturity or performance, ranging from low to high. Formerly, the possession of a dynamic capability has been predominantly viewed binarily, where it is either possessed by an organisation or it is not, without consideration to its degree of effectiveness (Helfat and Peteraf, 2003; Teece, 2009).

Finally, the study makes an important contribution to the measurement and management of dynamic capabilities by illustrating how the performance of a DC can be assessed and influenced. It achieved this through the formative representation of a dynamic capability, building on the suggestion by Barreto (2010), which positioned the subdimensions of that capability as its causes or predictors which could be leveraged to enhance its performance. This is a valuable approach for understanding and improving dynamic capabilities and can be easily adapted for others, providing the foundation for future empirical studies. Quantitative testing of the DCV prior to this point has been limited, meaning that the DCV has, primarily, remained a theoretical contribution that has been more abstract than useful (Newbert, 2007; Arend and Bromiley, 2009; Giannopoulou *et al.*, 2011; Janssen, 2015).

9.4.3 Contribution to Maturity Model Literature

This study contributes to maturity model literature by extending the framework to service innovation capability for first time and by addressing a criticism regarding the failure to quantitatively test these models.

As the benefits of maturity models for guiding capability performance management have become recognised, there has been a proliferation of them across a variety of domains and contexts (Caffyn, 1997; Kulkarni and Freeze, 2004; Wademan *et al.*, 2007; Röglinger *et al.*, 2012). However, there are few examples of their utilisation in the services context (Burger *et al.*, 2011; Rapaccini *et al.*, 2013; Jin *et al.*, 2014) and none for service innovation capability. The SICMM, presented in this study, enhances the literature by being the first instance in which the maturity model framework has been applied to SIC.

The study, too, addresses a criticism advanced by Mullaly (2006) and Wendler (2012) who lament the lack of testing that occurs with newly developed maturity models. An examination of maturity model literature reveals that the majority are exclusively conceptual (Fisher, 2005; Grimshaw and Mike, 2008; Jin *et al.*, 2014), stimulating the suggestion for solid empirical methods to be utilised to confirm their suitability for supporting organisational improvement initiatives (Mullaly, 2006; Wendler, 2012). The procedure for empirically validating SICMI can serve as an example to other authors seeking to empirically test the validity of their model.

9.5 Implications for Management

This study and the SICMI tool are not of benefit only to scholars, they have important implications for practitioners too.

The first of these implications is that the study is anticipated to stimulate the interest and awareness of practitioners in service innovation capability. This is an area of business research that has been almost entirely neglected until recently (Lillis *et al.*, 2015). By specifying the predictors of this capability and its important link with service innovation performance, practitioners will be alerted to the benefits that they can achieve through improvements to their SIC. Promising evidence of this was obtained during the time that the survey was open. The researcher received positive and enthusiastic feedback via email from several participants that recounted the value of the questionnaire and how it allowed them to focus their thinking about how their business innovates. This both reflected and strengthened the views of the researcher regarding the importance of the study and was encouraging, too, for the future use of SICMI.

Another major implication of this research is that its strong theoretical foundation directs the attention of practitioners to the key drivers of SIC. This allows them to take informed strategic decisions that will ensure their efforts or resources are not wasted by investing in capability development that will not improve their SIC performance. Their focus should be on the three empirically supported capability areas, User Involvement, Strategising, and Networking. The most important of these is Strategising capability which, outside of the maturity model framework, is the strongest predictor of an organisation's SIC performance. Accordingly, the improvement of this capability should be the highest priority for managers of SMEs that are serious about enhancing their SIC performance.

From the outset, SICMI was designed to be a short, straightforward, and useful practical diagnostic tool that addressed the need for quantitative managerial insights into SIC performance. Through an assessment of its maturity, SMEs can obtain their overall score and identify strengths and weaknesses. This quantitative understanding of capability performance facilitates the development of realistic and meaningful objectives and for progress to be tracked or monitored over time, supporting the achievement of substantial improvements to service innovation capability. To provide practitioners with access to this valuable tool, the author's intention is to integrate SICMI into the website of the RIKON research group. This would enable access to the measure on a computer, tablet, or smartphone. Since 2016, this website has been enhanced through the addition of tools and resources to assist practitioners. The addition of SICMI will further support practitioners interested in understanding and enhancing their service innovation capability. Diffusion of this instrument is anticipated to have an important role in improving practice by providing SMEs with access to SIC performance data for the first time.

Quantitatively assessing service innovation capability also allows organisations to benchmark their performance against others without divulging any competitively sensitive information (D. Esterhuizen *et al.*, 2012). Comparisons such as this may be with competitors or collaborators in the same or another industry and can include organisations located in other jurisdictions.

9.6 Research Limitations

In any research study, there are limitations. While efforts were directed toward reducing any weaknesses in this research project and ensuring methodological rigor to the greatest extent possible, there were some deficiencies.

As with many studies that use a quantitative survey methodology, the reporting aspect used in this study involved the perceptions of only a single key informant for each respondent organisation. This can lead to results that are biased. Kumar *et al.* (1993) advise that this can be overcome by collecting responses from more than one key informant but recognise that there may be practical problems with this alternative. (Kumar *et al.*, 1993). After careful consideration, the standard survey methodology was deemed to be the best approach and potential issues with common method bias were safeguarded against to the greatest extent possible through the careful design of the questionnaire (Podsakoff *et al.*, 2003a; MacKenzie and Podsakoff, 2012). Further, results for Harman's one-factor test did not indicate that CMB was an issue with this research.

Another limitation of this study is its minimal validation of SICMI. All analyses were based on a single large sample, raising the possibility that results were affected by the chance characteristics of the dataset, and presenting a challenge to the study's results.

It is suggested by Steenkamp and Baumgartner (1998) and Diamantopoulos and Papadopoulos (2010), that once an original measure has been developed, it should be validated further by confirming its invariance, or the equivalence of scores obtained from its use, across independent samples. While the impact of this limitation was diminished to the greatest possible degree by utilising a normative sample that represented Irish SMEs, future research would be required to gain further evidence of SICMI's generalisability.

Though SICMI was rigorously constructed and validated, the choice to use single-item scales to assess the maturity of each of the subdimensions constitutes an approach that is heatedly debated in the literature (Wanous and Hudy, 2001; Bergkvist and Rossiter, 2009; Fuchs and Diamantopoulos, 2009; Sarstedt and Wilczynski, 2009; Bergkvist, 2016). Indeed, disagreement abounds regarding the reliability, validity, and precision of single-item measures when compared to those with multiple items (Fuchs and Diamantopoulos, 2009; Petrescu, 2013; Fisher *et al.*, 2015). While the selection of measures of this type was made to ensure that the study's focal index would be a valuable and practical tool (Chiesa *et al.*, 1996) for SMEs attempting to assess and improve their SIC performance, readers must be aware that their use is disputed. Consequently, though the validity of these indicators was assessed through the R^2 statistic, the strength and significance of their path coefficients to the SIC construct, and VIF values, it was not possible to statistically test the internal consistency reliability of the individual indicators (MacKenzie *et al.*, 2011). Though all items were carefully constructed based on descriptions in SICMM and their content validated, there is no statistical evidence that they measure the intended subdimension.

As a nonprobability, purposive sampling approach was used to invite the participation of Irish organisations that were likely to be service-based, with between 10 and 249 employees, and an annual turnover not exceeding €50m; on the basis of available database information; it was less favourable than a probability sample, where all members of a population have an equal chance of responding. As a result, the ability to generalise the results to the population of Irish service SMEs may be limited. However, the study's sampling approach was the best option available to the researcher. Probability sampling was impossible as a sampling frame, or complete list of all members of the study's focal population, was not available. Purposive sampling allowed for a sufficient number of responses to be obtained for SEM that were representative of the study's population of interest.

The final limitation relates to the study's sample. It is possible that the representation of responses could be skewed, where those with certain characteristics are overrepresented. For instance, 74.3% of responses were from organisations with fewer than 50 employees. Consequently, the results may generalise more accurately to smaller SMEs. Further, 80.3% of the sample were organisations that were more than ten years old. In this case, the results may not be reflective of younger organisations who may be characterised as more innovative. However, though it is difficult to evaluate the representation of responses without a sampling frame, because a good cross-section of responses were obtained for this study, it is assumed that this potential limitation does not adversely impact results.

Acknowledging these limitations, it is hoped that they can be considered as prompts or clues, directing future research in this area.

9.7 Future Research Directions

This study was a first attempt at measuring the maturity of service innovation capability in SMEs. While there are some limitations to the research, it is perceived that the study provides a novel and original perspective to the measurement and management of this critical capability and it is the hope of the author that other researchers will use this study and its central measure as the foundation for their own research, advancing this discipline further.

One important avenue for future research is to replicate this study with an independent random sample from the same population. This would allow the measure to be cross-validated, or a determination made regarding whether the scores that it produces are invariant, and not dependent simply on the characteristics of the study's sample (Diamantopoulos and Papadopoulos, 2010). Accomplishing this additional step would provide further evidence that supports the validity of SICMI, increasing confidence in the measure's properties.

While SICMI is a good first attempt at understanding service innovation capability, the measure is by no means complete. The use of a formative construct assumes perfect coverage of a latent construct's empirical meaning. Consequently, while the three subdimensions explain 55.6% of the variance in the construct, a level considered acceptable for new measures (MacKenzie *et al.*, 2011), there is much scope for researchers to account for unexplained variance. This can be achieved by revising SICMI, including additional indicators of new subdimensions. For instance, an indicator for a subdimension similar to the 'technology focus' dimension, included by Zitkiene *et al.* (2015) in their conceptualisation of SIC, has the potential to increase the variance explained by the indicators of SIC. Future research could also investigate the subdimensions further, breaking them down or disaggregating them into their component parts. For instance, one suggestion might be to consider the microfoundations of these capabilities (Felin *et al.*, 2012), digging deeper into the exact processes and routines that constitute the three subdimensions.

While the results of this study are interesting, they are limited only to the service innovation capability of for-profit Irish organisations with between 10 and 249 employees and an annual turnover not exceeding €50m. It would be interesting to extend the measure to other contexts, adapting it where necessary, to examine SIC in the public sector, in not-for-profit organisations, in large companies with 250 employees or more, or in micro-firms with fewer than 10 employees. Another exciting context in which to measure SIC maturity would be in organisations that would principally consider themselves to be manufacturers, but have added a service component to their offering and are now hybrids or 'solution providers' (Lightfoot and Gebauer, 2011).

As this study's data were collected from Irish SMEs, its findings may not apply to other regions. Consequently, it would be interesting to administer the instrument in countries other than the Republic of Ireland, replicating this study to confirm the invariance of scores for the measure or undertaking a comparative analysis to examine whether cultural differences influence SIC performance. In addition to a comparative analysis between regions, a comparative analysis between industries would be another interesting avenue for research. This could compare, for instance, the SIC maturity of organisations considered to be ‘high-tech’ against that of ‘low-tech’ organisations, identifying if there are any differences.

An examination of the average SIC maturity scores for respondent organisations, grouped by their primary customers, appeared to indicate that ‘Other’ and ‘B2B’ were the best performing categories. Subsequent research could explore this finding in greater detail and study the relationship between types of organisations, based on their primary customers, and their product or service innovation capability. Although cross-sectional research can collect interesting results, it provides only a snapshot of an organisation’s SIC performance at a single moment in time. Therefore, to obtain richer insights, a longitudinal design could be used to examine the evolution of SIC maturity in SMEs over time. Further, the norms established for scores on SICMI are expected to change over time. It would be beneficial to return to this measure after a predetermined period of time, for instance five years, to update these norms and ensure that it remains a valid instrument.

In §3.2.1.3, it was explained that, while there is a bidirectional relationship between DSIC and its subdimensions, only the influence of the subdimensions on DSIC was considered in this study. The purpose of this decision was to limit the scope of this investigation, which aimed only to describe the performance of the focal phenomenon through its subdimensions. This intentional curtailment now presents an exciting opportunity for future research, where the effect of DSIC on its subdimensions can be addressed. It is possible that this could be examined by having formative and reflective measures of SIC operating in parallel or through a qualitative approach that identifies changes in the subdimensions that appear to be caused directly by SIC.

Compared to larger SMEs, smaller SMEs will have fewer resources. As a result, their Networking capability may be of greater importance to their SIC than it is for larger organisations. Future research could examine whether there are differences in the importance of the subdimensions to organisations of various sizes. Extending this suggestion, another avenue for research is to examine whether any of the subdimensions are of greater importance in specific industries.

This study measures the ability of organisations to develop or improve their services. This includes both radical and incremental innovations. It would be interesting for further research to isolate these classes of new services, examining them separately to determine whether any of the subdimensions are more important for innovations of a particular type. Further, to provide additional insights regarding the extended SIC concept, future research could explore antecedents, mediators, moderators, and consequences of this formative latent variable that were not addressed by this research.

A fertile area for further research is the utilisation of the procedure detailed in this dissertation, in combination with one of the many maturity models detailed in the literature that remain exclusively conceptual (Wendler, 2012; Jin *et al.*, 2014). Adhering to the procedures' nine prescribed phases could guide the conversion of descriptions of maturity levels in these models into measurement items and the empirical verification of their legitimacy.

Finally, the researcher is aware of several areas in which post hoc analysis can be undertaken using the data collected during the study's main survey. Specifically, the influence of barriers to service innovation on SIC maturity and SIP can be investigated, identifying those of the greatest significance to each. A construct was measured too that examined the perceived competitiveness of the respondent's industry. Interesting insights may be obtained by examining if there is any relationship between SIC maturity and perceived industry competitiveness.

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Appendix A – Determining the Overall SIC Maturity Score

As described in §4.2.5, the overall SIC maturity score is determined by its indicators (Blommerde, 2016). The maturity levels are cumulative and progressive and higher levels build upon the requirements of lower levels (Maier *et al.*, 2012). Accordingly, for SIC to attain a level of maturity, the requirements for that maturity level must be met by each of its subdimensions (Salvaterra, 2008; Chovanová *et al.*, 2019). As a result, the overall SIC maturity score is the same as that achieved by the subdimension with the lowest score. To illustrate, if an organisation achieves Maturity Level 3 for User Involvement, Maturity Level 4 for Strategising, and Maturity Level 5 for Networking capability, as Maturity Level 3 is the only level of maturity that has been achieved by *all* subdimensions, formative indicators of SIC, the overall maturity score for SIC is 3.

The overall SIC maturity scores in Table 34 were calculated by taking the minimum value of the maturity scores for each of the subdimensions for each respondent. In SPSS, a respondent's SIC maturity score was computed as new variable by using the minimum numeric expression for the three variables representing the maturity scores achieved by the subdimensions.

Appendix B – Scale Items for Additional Constructs

Service Innovation Performance (Chen *et al.*, 2011)	
	In recent years, our company has...
SIP1	Developed brand new services.
SIP2	Improved existing services and promoted the services.
SIP3	Repackaged existing services and promoted the services.
SIP4	Extended existing service lines and promoted the services.
SIP5	Introduced new services that competitors do not offer in the market.
SIP6	Tried to reduce the risks of failure of new service development.

NSD Performance (Yang *et al.*, 2016)	
	Please indicate the extent to which you agree with the following statements.
NSD1	The speed of our new service development projects is very fast.
NSD2	Our organisation's new service development programme has been very successful at meeting customer' requirements.
NSD3	Our organisation's new service development programme has been very successful at meeting profit objectives.
NSD4	The performance of our organisation's new service development programme is better than that or our competitors.
NSD5	Our organisation's new service development programme leads to future opportunities.

Organisational Performance (Li and Atuahene-Gima, 2001)	
	In comparison to your principal competitors, rate your firm's performance over the last three years on:
OP1	Return on investment.
OP2	Return on sales.
OP3	Profit growth.

OP4	Return on assets.
OP5	Overall efficiency of operations.
OP6	Sales growth.
OP7	Market share growth.
OP8	Cash flow from market operations.
OP9	Firms' overall reputation.

Industry Competitiveness (Asare *et al.*, 2013)	
	Please mark your level of agreement with the statements below.
COMP1	Competition in our business is cut throat.
COMP2	We are in a business with very aggressive competitors.
COMP3	Price competition in this business is severe.
COMP4	Companies are very aggressively making efforts to capture market share.

Appendix C – Pilot 1 Questionnaire

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Service Innovation Capability Survey

GENERAL INSTRUCTIONS

What is the purpose of this study?

The purpose of this study is to determine the potential possessed by small and medium-sized enterprises (SMEs) to innovate their services.

Who should complete the questionnaire?

The questionnaire should be completed by a member of management or employee with sufficient knowledge of an organisation's capabilities and performance.

Why should I participate?

Your opinion will help to increase understanding of how Irish SMEs innovate their services and provide valuable input into a tool to improve their ability to do so. It will also assist the researcher in the completion of a doctorate.

What are the questions about?

The initial questions relate to the capabilities of user involvement, knowledge management, strategising, and networking and the extent to which they are possessed by your organisation. The objective of the following questions is to obtain an understanding of items that you perceive as barriers to service innovation and your organisation's performance. The final questions have the purpose of gaining some background on your company. There are no correct or incorrect answers and it is hoped that you will find the questionnaire stimulating and interesting.

How long will it take?

The survey will take approximately 10 minutes to complete.

Who will read or see my answers?

I assure you that this will be a strictly confidential survey. Collected data will be stored securely and individual responses will not be made available to any third party. Only the doctoral researcher and research supervisor can see your answers.

Who should I contact?

If you have any questions, please contact Mr. Tadhg Blommerde at 051-302413 or 085-2867979, or by

I would like to thank you in advance for your time and effort.

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Service Innovation Capability Survey

Confirmation of Industry

* 1. Is your organisation a service business?

- ◯ Yes
- ◯ No

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Service Innovation Capability Survey

User Involvement Capability

*** 2. The purpose of this question is to assess the extent to which your organisation possesses a 'user involvement capability'. A user involvement capability describes the ability of an organisation to involve its users, or customers, in different stages of their new service development processes. From the options below, please select that which most accurately describes your organisation.**

- ◯ In our organisation, user participation in the development of services is infrequent and ad hoc. In fact, unless a user approaches us, we assume we can develop the services that they want.
- ◯ We study and observe users with the aim of defining their requirements for new or improved services. Usually, there is no direct contact and we tend to use internal channels like sales reports, feedback, and customer complaints to improve our understanding of their demands.
- ◯ In our organisation, users are loosely involved in the early phases of developing new services. We view them as 'experts' and information about their specific needs, wishes, and requirements are of great value to us. Surveys or similar techniques are our preferred mechanism for gathering their opinions or insights.
- ◯ Users have a direct, personal, and active role at each stage of our service development processes. While this role is extensive, it is not fully collaborative. We monitor and track their involvement throughout, from early development, through to the verification and testing of new services or service improvements.
- ◯ Users play an intrinsic, collaborative role in all phases of our new service development processes. They are treated as knowledgeable innovation partners and our relationship does not dissolve once a project is completed, but instead extends to multiple projects. Because of their value, we make an effort to continuously increase and enhance their input and cooperation at all stages of service development.

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Service Innovation Capability Survey

Knowledge
Management Capability

* **3. The purpose of this question is to assess the extent to which your organisation possesses a 'knowledge management capability'. This capability describes activities that enable an organisation to effectively manage and deploy knowledge to develop or improve services. From the options below, please select that which most accurately describes your organisation.**

- ◯ We do not formally manage communication or knowledge in our organisation and any activities that occur in these areas do so in an ad hoc and unsystematic way.
- ◯ We have some basic processes in place for capturing or utilising knowledge, but they are not always adhered to by staff who are generally guided by their individual experiences, observations, and intuition.
- ◯ Our organisation have the basic framework and tools in place to support the systematic gathering, documentation, and communication of knowledge. Employee roles in these activities have been specified, but knowledge sharing chiefly occurs between individuals within groups.
- ◯ In our organisation, there are standard processes in place for capturing and sharing knowledge. Metrics are used to ascertain the performance of these processes and to provide feedback. Knowledge sharing and learning is not organisation wide, but is presently limited to certain departments or organisational functions.
- ◯ There is a culture in our organisation in which the widespread, automatic sharing of knowledge and open communication occur. We consider ourselves to be a learning organisation and use our experiences to continually improve how we manage knowledge for service development or improvement.

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Service Innovation Capability Survey

Strategising Capability

*** 4. The purpose of this question is to assess the extent to which your organisation possesses a 'strategising capability'. This describes the ability of an organisation to define their goals and objectives, identify focus areas, and allocate their resources when deciding which services to develop or improve. From the options below, please select that which most accurately describes your organisation.**

- ◯ Our organisation have no formal strategies for service development or improvement. Services are developed in an ad hoc way that does not involve staff.
- ◯ There is some strategic planning in our organisation for the development or improvement of services, but this generally only occurs as a reaction to a specific, urgent problem. It is conducted inconsistently, with erratic employee input, and its focus is primarily on budgeting and costs.
- ◯ We have formal and comprehensive strategic planning processes in place. Generally, we use forecasting tools which allow us to keep pace with competitors or address niche markets. Our strategy for service development or improvement is communicated and understood.
- ◯ During strategy development, we strive to identify future success factors, frequently engage with employees, and monitor the activities undertaken to confirm that our internal standards and methods have been adhered to. The aim of developing or improving services is to outperform similar competitors.
- ◯ In our organisation, standardised processes that integrate the contribution of employees at all levels are in place for deciding which services to develop or improve. We make changes or adjustments to these processes when we believe we can enhance their effectiveness. The resulting strategies are widely communicated and aim to create new markets by doing what competitors cannot.

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Service Innovation Capability Survey

Networking Capability

*** 5. The purpose of this question is to assess the extent to which your organisation possesses a 'networking capability'. This describes the ability of an organisation to effectively manage their relationships and utilise ties with external parties, select beneficial partners, and proactively build systems of contacts for the purpose of enhancing services. From the options below, please select that which most accurately describes your organisation.**

- ◯ Aside from discrete instances arranged by individuals, our organisation does not create or maintain any relationships with external parties for the purpose of enhancing our services. We do not consider the potential impact that changes to our services may have on supply chain actors and have a conservative attitude towards opening our boundaries for knowledge sharing or cooperation.
- ◯ We are beginning to understand the value and importance of involving external parties in innovation and are becoming receptive to opening our organisation's boundaries for knowledge sharing and cooperation.
- ◯ In our organisation, defined practices are in place that govern our interactions and partnerships with other organisations. Usually, only significant external stakeholders are permitted to have an input into service development processes. Some knowledge is shared across the boundaries of our organisation and informal discussions, relationships, and associations with stakeholders are encouraged.
- ◯ When possible, all external stakeholders interested in, or impacted by, our service development activities are integrated into the process. However, this is not achievable on every occasion. Despite not actively searching for compatible organisations, we periodically initiate beneficial alliances or collaborations relating to service development and use performance metrics to monitor and control this interorganisational cooperation.
- ◯ We have established processes in place for building and managing relationships with our external stakeholders. We learn from our successes and continuously improve these processes. All of our external stakeholders are involved with service development activities and collaborations allow us access to their skills and knowledge. We actively identify new external parties with whom we can create beneficial relationships and maintain and maximise those with highly skilled parties such as research groups and consultants.

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Service Innovation Capability Survey

Service Innovation Barriers and Organisational Performance

Next, we need to learn about issues that you consider obstacles to service innovation and the performance of your organisation in recent years.

6. Please select the items below which you believe are barriers to service innovation in your organisation.

- [ ] Financial costs (lack of funding).
- [ ] Economic risks.
- [ ] Lack of time (immersed in more immediate operational concerns).
- [ ] Inadequate staff.
- [ ] Inadequate staff skills or expertise.
- [ ] Lack of resources.
- [ ] Difficulty attracting skilled or innovative workers.
- [ ] The structure of the organisation.
- [ ] Organisational culture (lack of integration or sharing).
- [ ] Government legislation or regulations.
- [ ] Lengthy decision-making processes.
- [ ] Innovation strategy (absence of, or bad strategic fit).
- [ ] Poor communication.
- [ ] Concerns about protecting innovations.
- [ ] Issues related to establishing or managing value networks.
- [ ] Effects of the formality of innovation processes.
- [ ] Issues evoked by competition.
- [ ] Changes in market demands or requirements.
- [ ] Customer's ability to afford service.
- [ ] Customer's ability to use service.
- [ ] Low customer or market demand (interest) for innovation.
- [ ] Poor leadership.
- [ ] Insufficient market information.

Other (please specify)

* **7. Relative to your principal competitors, rate your firm performance over the last three years on:**

	Considerably worse	Worse	Almost the same	Better	Considerably better
Return on investment	○	○	○	○	○
Return on sales	○	○	○	○	○
Profit growth	○	○	○	○	○
Return on assets	○	○	○	○	○
Overall efficiency of operations	○	○	○	○	○
Sales growth	○	○	○	○	○
Market share growth	○	○	○	○	○
Cash flow from market operations	○	○	○	○	○
Firms overall reputation	○	○	○	○	○

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Service Innovation Capability Survey

Background

Finally, we need to collect some information about your organisation to improve our understanding.

*** 8. How long has your organisation been in operation?**

- ◯ Less than one year
- ◯ 1-2 years
- ◯ 3-5 years
- ◯ 6-10 years
- ◯ 11-20 years
- ◯ More than 20 years

*** 9. How many employees does your organisation have?**

- ◯ 5 employees or fewer
- ◯ 6-9 employees
- ◯ 10-19 employees
- ◯ 20-49 employees
- ◯ 50-149 employees
- ◯ 150-249 employees
- ◯ 250+ employees

10. Which of the following best describes your position in the organisation?

- ◯ CEO/Owner
- ◯ Managing Director
- ◯ Part of management
- ◯ Employee (non-management)

*** 11. Which of the following best describes your organisation?**

- ◯ B2B. Our services are predominantly sold to other businesses.
- ◯ B2C. Our services are predominantly sold to consumers.
- ◯ Our services are predominantly sold to government agencies, not-for-profit organisations, or others neither classified as a business or consumer.

*** 12. Which of the following best describes the principal industry of your organisation?**

- ◯ Non-technological services, including Accounting; Advertising, marketing, market research, or public relations; Architectural or engineering; Catering; Cleaning or industrial cleaning; Construction; Consulting; Education or training; Energy; Environmental; Equipment hire; Financial or insurance; Healthcare; Legal; Recruitment or human resources; Tourism; Training; and Transport or distribution.
- ◯ Information and communication technology-related services, including Computer services, maintenance, or repair; Data processing, management, or analysis; Hardware consultancy or supply; Printing; Software consultancy or supply; and Website design or hosting.

*** 13. What was the turnover for your company in 2016?**

- ◯ <€249,999
- ◯ €250,000-€499,999
- ◯ €500,000-€999,999
- ◯ €1 million-€1.99 million
- ◯ €2 million-€10 million
- ◯ €11 million-€25 million
- ◯ €26 million-€50 million
- ◯ >€50 million

*** 14. Your organisation is...**

- ◯ Domestically owned
- ◯ Foreign owned

15. Where is your organisation or branch located?

* 16. Do you have a standard process in place for the development of new services?

- Yes
- No

* 17. Please mark your level of agreement with the statements below.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Competition in our business is cut throat.					
We are in a business with very aggressive competitors.					
Price competition in this business is severe.					
Companies are very aggressively making efforts to capture market share.					

18. If you would you like to receive a report of this study's findings, please enter your email address below.

* 19. Using numbers 1-5, with 1 representing poor and 5 excellent, how would you rate your organisation's overall ability to innovate its services?

- 1
- 2
- 3
- 4
- 5

Service Innovation Capability Survey

Thank You For Your Participation.

Thank you once again for your participation. Please click the submit button to finish this survey or use 'Prev' to navigate to previous pages if you wish to check or revise your answers prior to their submission.

Appendix D – Final Version of Questionnaire

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Service Innovation Capability Survey

General Instructions

What is the purpose of this study?

The purpose of this study is to determine the potential possessed by small and medium-sized enterprises (SMEs) to innovate their services.

Who should complete the questionnaire?

The questionnaire should be completed by a member of management or employee with sufficient knowledge of an organisation's capabilities and performance.

Why should I participate?

Your opinion will help to increase understanding of how SMEs innovate their services and provide valuable input into a tool to improve their ability to do so. It will also assist the researcher in the completion of a doctorate.

What are the questions about?

The initial questions relate to the capabilities of user involvement, knowledge management, strategising, and networking and the extent to which they are possessed by your organisation. The objective of the following questions are to obtain an understanding of items that you perceive as barriers to service innovation, understand your organisation's service innovation performance, and the organisation's performance generally. The final questions have the purpose of gaining some background on your company. There are no correct or incorrect answers and it is hoped that you will find the questionnaire stimulating and interesting.

How long will it take?

The survey will take approximately 10 minutes to complete.

Who will read or see my answers?

I assure you that this will be a strictly confidential survey. Collected data will be stored securely and individual responses will not be made available to any third party. Only the doctoral researcher and research supervisor can see your answers.

Who should I contact?

If you have any questions, please contact Mr. Tadhg Blommerde at 051-302413 or 085-2867979, or by email at tblommerde@wit.ie.

I would like to thank you in advance for your time and effort.

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Service Innovation Capability Survey

Confirmation of Industry

* 1. Is your organisation a service business?

- Yes
- No

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Service Innovation Capability Survey

User Involvement Capability

* **2. The purpose of this question is to assess the extent to which your organisation possesses a 'user involvement capability'. A user involvement capability describes the ability of an organisation to involve its users, or customers, in different stages of new service development.**

Five statements are presented below that describe the characteristics of an organisation when this capability is possessed to different degrees. They are ordered low to high. Please select the option which most accurately describes your organisation.

- **1. Initial:** In our organisation, user participation in the development of services is infrequent and ad hoc. In fact, unless a user approaches us, we assume we can develop the services that they want.
- **2. Managed:** We study and observe users with the aim of defining their requirements for new or improved services. Usually, there is no direct contact and we tend to use internal channels like sales reports, feedback, and customer complaints to improve our understanding of their demands.
- **3. Defined:** In our organisation, users are loosely involved in the early phases of developing new services. We view them as 'experts' and information about their specific needs, wishes, and requirements are of great value to us. Surveys or similar techniques are our preferred mechanism for gathering their opinions or insights.
- **4. Measured:** Users have a direct, personal, and active role at each stage of our service development processes. While this role is extensive, it is not fully collaborative. We monitor and track their involvement throughout, from early development, through to the verification and testing of new services or service improvements.
- **5. Optimising:** Users play an intrinsic, collaborative role in all phases of our new service development processes. They are treated as knowledgeable innovation partners and our relationship does not dissolve once a project is completed, but instead extends to multiple projects. Because of their value, we make an effort to continuously increase and enhance their input and cooperation at all stages of service development.

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Service Innovation Capability Survey

Knowledge Management Capability

*** 3. The purpose of this question is to assess the extent to which your organisation possesses a 'knowledge management capability'. This capability describes activities that enable an organisation to effectively manage and deploy knowledge to develop or improve services.**

Five statements are presented below that describe the characteristics of an organisation when this capability is possessed to different degrees. They are ordered low to high. Please select the option which most accurately describes your organisation.

- ◯ **1. Initial:** We do not formally manage communication or knowledge in our organisation and any activities that occur in these areas do so in an ad hoc and unsystematic way.
- ◯ **2. Managed:** We have some basic processes in place for capturing or utilising knowledge, but they are not always adhered to by staff who are generally guided by their individual experiences, observations, and intuition.
- ◯ **3. Defined:** Our organisation have the basic framework and tools in place to support the systematic gathering, documentation, and communication of knowledge. Employee roles in these activities have been specified, but knowledge sharing chiefly occurs between individuals within groups.
- ◯ **4. Measured:** In our organisation, there are standard processes in place for capturing and sharing knowledge. Metrics are used to ascertain the performance of these processes and to provide feedback. Knowledge sharing and learning is not organisation wide, but is presently limited to certain departments or organisational functions.
- ◯ **5. Optimising:** There is a culture in our organisation in which the widespread, automatic sharing of knowledge and open communication occur. We consider ourselves to be a learning organisation and use our experiences to continually improve how we manage knowledge for service development or improvement.

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Service Innovation Capability Survey

Strategising Capability

* **4. The purpose of this question is to assess the extent to which your organisation possesses a 'strategising capability'. This describes the ability of an organisation to define their goals and objectives, identify focus areas, and allocate their resources when deciding which services to develop or improve.**

Five statements are presented below that describe the characteristics of an organisation when this capability is possessed to different degrees. They are ordered low to high. Please select the option which most accurately describes your organisation.

- **1. Initial:** Our organisation have no formal strategies for service development or improvement. Services are developed in an ad hoc way that does not involve staff.
- **2. Managed:** There is some strategic planning in our organisation for the development or improvement of services, but this generally only occurs as a reaction to a specific, urgent problem. It is conducted inconsistently, with erratic employee input, and its focus is primarily on budgeting and costs.
- **3. Defined:** We have formal and comprehensive strategic planning processes in place. Generally, we use forecasting tools which allow us to keep pace with competitors or address niche markets. Our strategy for service development or improvement is communicated and understood.
- **4. Measured:** During strategy development, we strive to identify future success factors, frequently engage with employees, and monitor the activities undertaken to confirm that our internal standards and methods have been adhered to. The aim of developing or improving services is to outperform similar competitors.
- **5. Optimising:** In our organisation, standardised processes that integrate the contribution of employees at all levels are in place for deciding which services to develop or improve. We make changes or adjustments to these processes when we believe we can enhance their effectiveness. The resulting strategies are widely communicated and aim to create new markets by doing what competitors cannot.

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Service Innovation Capability Survey

Networking Capability

*** 5. The purpose of this question is to assess the extent to which your organisation possesses a 'networking capability'. This describes the ability of an organisation to effectively manage their relationships and utilise ties with external parties, select beneficial partners, and proactively build systems of contacts for the purpose of enhancing services.**

Five statements are presented below that describe the characteristics of an organisation when this capability is possessed to different degrees. They are ordered low to high. Please select the option which most accurately describes your organisation.

- **1. Initial:** Aside from discrete instances arranged by individuals, our organisation does not create or maintain any relationships with external parties for the purpose of enhancing our services. We do not consider the potential impact that changes to our services may have on supply chain actors and have a conservative attitude towards opening our boundaries for knowledge sharing or cooperation.
- **2. Managed:** We are beginning to understand the value and importance of involving external parties in innovation and are becoming receptive to opening our organisation's boundaries for knowledge sharing and cooperation.
- **3. Defined:** In our organisation, defined practices are in place that govern our interactions and partnerships with other organisations. Usually, only significant external stakeholders are permitted to have an input into service development processes. Some knowledge is shared across the boundaries of our organisation and informal discussions, relationships, and associations with stakeholders are encouraged.
- **4. Measured:** When possible, all external stakeholders interested in, or impacted by, our service development activities are integrated into the process. However, this is not achievable on every occasion. Despite not actively searching for compatible organisations, we periodically initiate beneficial alliances or collaborations relating to service development and use performance metrics to monitor and control this interorganisational cooperation.
- **5. Optimising:** We have established processes in place for building and managing relationships with our external stakeholders. We learn from our successes and continuously improve these processes. All of our external stakeholders are involved in service development activities and collaborations allow us access to their skills and knowledge. We actively identify new external parties with whom we can create beneficial relationships and maintain and maximise those with highly skilled parties such as research groups and consultants.

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Service Innovation Capability Survey

Service Innovation Barriers, Service Innovation Performance, and Organisational Performance

Next, we need to learn about issues that you consider obstacles to service innovation, your service innovation performance, and the performance of your organisation.

6. Please select the items below which you believe are barriers to service innovation in your organisation.

- ☐ Financial costs (lack of funding)
- ☐ Economic risks
- ☐ Lack of time (immersed in more immediate operational concerns)
- ☐ Inadequate staff
- ☐ Inadequate staff skills or expertise
- ☐ Lack of resources
- ☐ Difficulty attracting skilled or innovative workers
- ☐ The structure of the organisation
- ☐ Organisational culture (lack of integration or sharing)
- ☐ Government legislation or regulations
- ☐ Lengthy decision-making processes
- ☐ Innovation strategy (absence of, or bad strategic fit)
- ☐ Poor communication
- ☐ Concerns about protecting innovations
- ☐ Issues related to establishing or managing value networks
- ☐ Effects of the formality of innovation processes
- ☐ Issues evoked by competition
- ☐ Changes in market demands or requirements
- ☐ Customer's ability to afford service
- ☐ Customer's ability to use service
- ☐ Low customer or market demand (interest) for innovation
- ☐ Poor leadership
- ☐ Insufficient market information

Other (please specify)

* **7. In recent years, our company has...**

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Developed brand new services	○	○	○	○	○
Improved existing services and promoted the services	○	○	○	○	○
Repackaged existing services and promoted the services	○	○	○	○	○
Extended existing service lines and promoted the services	○	○	○	○	○
Introduced new services that competitors do not offer in the market	○	○	○	○	○
Tried to reduce the risks of failure of new service development	○	○	○	○	○

* **8. Using numbers 1-5, with 1 representing poor and 5 excellent, how would you rate your organisation's overall service innovation performance?**

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5

* 9. Please indicate the extent to which you agree with the following statements.

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
The speed of our new service development projects is very fast	○	○	○	○	○
Our organisation's new service development programme has been very successful at meeting customer' requirements	○	○	○	○	○
Our organisation's new service development programme has been very successful at meeting profit objectives	○	○	○	○	○
The performance of our organisation's new service development programme is better than that or our competitors	○	○	○	○	○
Our organisation's new service development programme leads to future opportunities	○	○	○	○	○

* 10. In comparison to your principal competitors, rate your firm's performance over the last three years on:

	Considerably worse	Worse	Almost the same	Better	Considerably better
Return on investment	○	○	○	○	○
Return on sales	○	○	○	○	○
Profit growth	○	○	○	○	○
Return on assets	○	○	○	○	○
Overall efficiency of operations	○	○	○	○	○
Sales growth	○	○	○	○	○
Market share growth	○	○	○	○	○
Cash flow from market operations	○	○	○	○	○
Firms' overall reputation	○	○	○	○	○

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Service Innovation Capability Survey

Background

Finally, we need to collect some information about your organisation to improve our understanding.

*** 11. How long has your organisation been in operation?**

- ◯ Less than one year
- ◯ 1-2 years
- ◯ 3-5 years
- ◯ 6-10 years
- ◯ 11-20 years
- ◯ More than 20 years

*** 12. How many employees does your organisation have?**

- ◯ 5 employees or fewer
- ◯ 6-9 employees
- ◯ 10-19 employees
- ◯ 20-49 employees
- ◯ 50-149 employees
- ◯ 150-249 employees
- ◯ 250+ employees

13. Which of the following best describes your position in the organisation?

- ◯ CEO/Owner
- ◯ Managing Director
- ◯ Part of management
- ◯ Employee (non-management)

*** 14. Which of the following best describes your organisation?**

- ◯ B2B. Our services are predominantly sold to other businesses.
- ◯ B2C. Our services are predominantly sold to consumers.
- ◯ Our services are predominantly sold to government agencies, not-for-profit organisations, or others neither classified as a business or consumer.

* **15. Which of the following categories best describe the principal activities of your organisation?**

- Advertising, market research, or public opinion polling
- Agricultural
- Architectural or engineering
- Business or management consulting
- Construction
- Cleaning or industrial cleaning
- Design or graphic design
- Education or training
- Energy
- Environmental
- Facilities or property management
- Fashion
- Financial
- Health and safety
- Healthcare or social care
- Information and communications technology
- Insurance
- Law
- Media or entertainment
- Real estate
- Recruitment, human resources, or employment
- Repair or recovery of vehicles or machinery
- Research and development
- Retail or wholesale
- Sale, hire, or leasing of machinery or equipment
- Sanitation and waste disposal
- Security or investigation
- Sport
- Tourism or hospitality
- Transport, distribution, or storage
- Other (please specify)

* **16. What was the turnover for your company in 2016?**

- <€249,999
- €250,000-€499,999
- €500,000-€999,999
- €1 million-€1.99 million
- €2 million-€10 million
- €11 million-€25 million
- €26 million-€50 million
- >€50 million

* 17. Your organisation is...

- Domestically owned
- Foreign owned

* 18. Where is your organisation or branch located?

* 19. Do you have a standard process in place for the development of new services?

- Yes
- No

* 20. Please mark your level of agreement with the statements below.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Competition in our business is cut throat					
We are in a business with very aggressive competitors					
Price competition in this business is severe					
Companies are very aggressively making efforts to capture market share					

* 21. Using numbers 1-5, with 1 representing poor and 5 excellent, how would you rate your organisation's overall ability to innovate its services?

- 1
- 2
- 3
- 4
- 5

22. If you would you like to receive a report of this study's findings, please enter your email address below.

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Service Innovation Capability Survey

Thank You For Your Participation.

Thank you once again for your participation. Please click the submit button to finish this survey or use 'Prev' to navigate to previous pages if you wish to check or revise your answers prior to their submission.

Appendix E – Survey Invitation Email and Reminders

E1: Survey Invitation Email

Title: Service Innovation Capability Survey

To Whom It May Concern,

I am appealing to your organisation for help.

My name is Tadhg Blommerde and I am a doctoral student at Waterford Institute of Technology where I am studying the ability of SMEs to innovate their services. In order for me to complete my PhD, I need your assistance in completing a short online questionnaire, linked in this email. This can be accessed by selecting 'Begin Survey' below.

I am aware that surveys can be time consuming, but would like to assure you that this questionnaire has been carefully designed and tested to ensure it can be completed quickly. It has 21 questions and should take approximately 10 minutes. To ensure that I can use your response, it is important that the questionnaire is completed in its entirety and submitted correctly on the final page. Your cooperation and response is vital to my analysis.

This study is the first of its kind, anywhere; and its results should have significant implications for the development of service innovations by all companies. Specifically, its purpose is to understand where resources ought to be directed to improve their 'service innovation capability'.

It was felt that you would be in the best position to either complete the questionnaire or delegate the responsibility to an appropriate other. In return for doing so, I will send a report on the study's full findings to an email address of your choosing. I believe you will find the results to be of value to your business.

Please be assured that all collected information will be treated with the utmost confidentiality and stored securely, in line with the stringent requirements for best practice research at the institute. I would be most happy to answer any questions you might have and can be reached at 051-302413/ 085-2867979/ tblommerde@wit.ie.

In anticipation of your response, I thank you for your assistance.

Yours sincerely,

Tadhg Blommerde

E2: Reminder 1 – Non-Respondents

Title: Reminder: Service Innovation Capability Survey

To Whom It May Concern,

Two days ago, I sent you a questionnaire regarding my service innovation capability research. I am aware that I am requesting a task that adds to your already busy working day, but to complete my PhD within the permitted time your response is truly needed. Select 'Begin Survey' below to access the questionnaire.

I acknowledge that the completion of surveys can be time consuming, but a great effort has been made to ensure quick and easy answering (approximately 10 minutes). I would be grateful to receive your response at as soon a time as it is convenient to you and in return for your participation, promise to send a report on the study's findings to an email address of your choosing. I believe that this report will be of value to your business.

Once again, I wish to assure you of the survey's strict confidentiality and thank you for your assistance. Please do not hesitate to contact me if you require clarification on any question or other matter related to the survey. I will be very happy to help you in any way possible. If you do not wish to be involved in the survey, click 'Unsubscribe' at the bottom of this email or contact me directly to be removed from the mailing list. I can be reached at 051-302413 or 085-2867979, or by email: tblommerde@wit.ie.

Yours sincerely,

Tadhg Blommerde

E3: Reminder 1 – Partial Respondents

Title: Reminder: Service Innovation Capability Survey

To Whom It May Concern,

Two days ago, I sent you a questionnaire regarding my service innovation capability research. The software I am using indicates that you partially completed this questionnaire, but did not submit it. I am aware that I am requesting a task that adds to your already busy working day, but to complete my PhD within the permitted time your submitted response is truly needed. Select 'Begin Survey' below to continue answering the questionnaire.

I acknowledge that the completion of surveys can be time consuming, but a great effort has been made to ensure quick and easy answering (approximately 10 minutes). I would be grateful to receive your response at as soon a time as it is convenient to you and in return for your participation, promise to send a report on the study's findings to an email address of your choosing. I believe that this report will be of value to your business.

Once again, I wish to assure you of the survey's strict confidentiality and thank you for your assistance. Please do not hesitate to contact me if you require clarification on any question or other matter related to the survey. I will be very happy to help you in any way possible. If you do not wish to be involved in the survey, click 'Unsubscribe' at the bottom of this email or contact me directly to be removed from the mailing list. I can be reached at 051-302413 or 085-2867979, or by email: tblommerde@wit.ie.

Yours sincerely,

Tadhg Blommerde

E4: Reminder 2 – Non-Respondents

Title: Please can you assist me?

To Whom It May Concern,

Last week, I sent a survey (service innovation capability) to you in connection with my PhD research. I understand that you are busy, but would truly appreciate your support in the completion of this survey. Your response will ensure I have sufficient data to draw valid conclusions and successfully finish my doctorate.

It is my sincere belief that the findings of this undertaking will make a substantial contribution to understanding service innovation in small and medium-sized enterprises and therefore should be of value to your firm. In return for your participation, I promise to send a report on the study's findings to an email address of your choosing. Please select 'Begin Survey' to access the questionnaire.

If you have any concerns or require assistance understanding the questions before proceeding, I would be happy help. I can be contacted at 051-302413, 085-2867979, or by email: tblommerde@wit.ie.

Finally, I would like to once again assure you of the strict confidentiality of this survey and that all data will be stored securely. Under no circumstances will your response be used in any way that identifies your organisation and will be kept private; accessible only to the researcher and research supervisor. At all times, the best practice guidelines and regulations for research at Waterford Institute of Technology will be strictly adhered to. In anticipation of your response, I send many thanks.

Sincerely yours

Tadhg Blommerde

E5: Reminder 2 – Partial Respondents

Title: Please can you assist me?

To Whom It May Concern,

Last week, I sent a survey (service innovation capability) to you in connection with my PhD research. The software that I am using indicates that you partially completed this survey, but did not submit your answers. I understand that you are busy, but would truly appreciate your support in the completion of this survey. Your response will ensure I have sufficient data to draw valid conclusions and successfully finish my doctorate.

It is my sincere belief that the findings of this undertaking will make a substantial contribution to understanding service innovation in small and medium-sized enterprises and therefore should be of value to your firm. In return for your participation, I promise to send a report on the study's findings to an email address of your choosing. Please select 'Begin Survey' to continue answering the questionnaire.

If you have any concerns or require assistance understanding the questions before proceeding, I would be happy help. I can be contacted at 051-302413, 085-2867979, or by email: tblommerde@wit.ie.

Finally, I would like to once again assure you of the strict confidentiality of this survey and that all data will be stored securely. Under no circumstances will your response be used in any way that identifies your organisation and will be kept private; accessible only to the researcher and research supervisor. At all times, the best practice guidelines and regulations for research at Waterford Institute of Technology will be strictly adhered to. In anticipation of your response, I send many thanks.

Sincerely yours

Tadhg Blommerde

E6: Reminder 3 – Non-Respondents

Title: Reminder: Service Innovation Capability Survey

To Whom It May Concern,

Two weeks ago, I sent you a survey relating to my PhD research, but to date have not received your response. Because a large number of completed questionnaires are essential to the success of this study, your input is truly needed. I sincerely believe that the findings of this enquiry will substantially contribute to the existing understanding of service innovation in small and medium-sized enterprises and therefore should be of value to your firm. In return for your participation, I promise to send a report on the study's findings to an email address of your choosing. Please select 'Begin Survey' to access the questionnaire, it has been carefully designed to be completed in approximately 10 minutes.

If you have any questions or there are any matters that you wish to clarify prior to undertaking the survey, I would be pleased to help. I can be contacted at 051-302413, 085-2867979, or by email: tblommerde@wit.ie.

Finally, I would like to reassure you of the survey's strict confidentiality. All best practice guidelines and regulations for research at Waterford Institute of Technology will be strictly adhered to. Data will be stored securely and your response will not be used in any way that that can identify your organisation. In anticipation of your response, I send many thanks.

Sincerely yours

Tadhg Blommerde

E7: Reminder 3 – Partial Respondents

Title: Reminder: Service Innovation Capability Survey

To Whom It May Concern,

Two weeks ago, I sent you a survey relating to my PhD research, but to date your response has not been submitted. The software I am using indicates that you partially completed the questionnaire, but did not finish it in its entirety. Because a large number of completed and submitted responses are essential to the success of this study, your help is truly needed. Consequently, I appeal to you to select ‘Begin Survey’ below to continue completing the questionnaire, ensuring that you submit your answers on the final page.

I sincerely believe that the findings of this enquiry will substantially contribute to the existing understanding of service innovation in small and medium-sized enterprises and therefore should be of value to your firm. In return for your participation, I promise to send a report on the study’s findings to an email address of your choosing.

If you have any questions or there are any matters that you wish to clarify prior to undertaking the survey, I would be pleased to help. I can be contacted at 051-302413, 085-2867979, or by email: tblommerde@wit.ie.

Finally, I would like to reassure you of the survey’s strict confidentiality. All best practice guidelines and regulations for research at Waterford Institute of Technology will be strictly adhered to. Data will be stored securely and your response will not be used in any way that that can identify your organisation. In anticipation of your response, I send many thanks.

Sincerely yours

Tadhg Blommerde

E8: Final Reminder – Non-Respondents

Title: Reminder: Service Innovation Capability Survey

To Whom It May Concern,

Three weeks ago, I sent a survey to you in connection with my PhD research. To date I have not received your response. The requirement of a high response rate to the success of this study is the reason that I now appeal to you again. Please select ‘Begin Survey’ below to access the questionnaire.

In addition to assisting me with the completion of a doctorate, it is my sincere view that this research will benefit your organisation and those like it by enhancing understanding of service innovation capability in small and medium-sized enterprises. It is the first research of its kind and your response is vital to my analysis. In return for your participation, I promise to send a report on the study’s findings to an email address of your choosing.

Again, I would like to assure you that all collected information will stored securely and treated with the utmost confidentiality, in line with the stringent requirements for best practice research at Waterford Institute of Technology. I would be happy to clarify any concerns or answer any questions you might have and can be reached at 051-302413/085-2867979 or emailed at tblommerde@wit.ie, if you wish to contact me.

In anticipation of your response, I send many thanks.

Yours sincerely,

Tadhg Blommerde

E9: Final Reminder – Partial Respondents

Title: Reminder: Service Innovation Capability Survey

To Whom It May Concern,

Three weeks ago, I sent a survey to you in connection with my PhD research. The software that I used to do so indicates that you partially completed this survey, but did not submit your answers. As a result, your response has not been recorded. The requirement of a high response rate to the success of this study is the reason that I now appeal to you again. Please select 'Begin Survey' below to continue answering the questionnaire.

In addition to assisting me with the completion of a doctorate, it is my sincere view that this research will benefit your organisation and those like it by enhancing understanding of service innovation capability in small and medium-sized enterprises. It is the first research of its kind and your response is vital to my analysis. In return for your participation, I promise to send a report on the study's findings to an email address of your choosing.

Again, I would like to assure you that all collected information will stored securely and treated with the utmost confidentiality, in line with the stringent requirements for best practice research at Waterford Institute of Technology. I would be happy to clarify any concerns or answer any questions you might have and can be reached at 051-302413/085-2867979 or emailed at tblommerde@wit.ie, if you wish to contact me.

In anticipation of your response, I send many thanks.

Yours sincerely,

Tadhg Blommerde

E10: Text of Survey Invitation Email and Reminders, Illustrating Implied Messages

Survey Invitation Email	***Reminder 1 – Non-Respondents***	***Reminder 1 – Partial Respondents***
To Whom It May Concern, I am appealing to your organisation for help. My name is Tadhg Blommerde and I am a doctoral student at Waterford Institute of Technology where I am studying the ability of SMEs to innovate their services. (Statement that the research is doctoral level, coupled with specification of the third level institution, provide the impression that the study is legitimate and important) In order for me to complete my PhD, I need your assistance in completing a short online questionnaire, linked in this email. (Indicates the receiver's response is important. Online questionnaire communicates professionalism) This can be accessed by selecting 'Begin Survey' below. I am aware that surveys can be time consuming, but would like to assure you that this questionnaire has been carefully designed and tested to ensure it can be completed quickly. It has 21 questions and should take approximately 10 minutes. (Acknowledges that the researcher is aware of the demands that the receiver's job places upon them, but has taken steps to minimise any disruption to their work) To ensure that I can use your response, it is important that the questionnaire is completed in its entirety and submitted correctly on the final page. Your cooperation and response is vital to my analysis. This study is the first of its kind, anywhere; and its results should have significant implications for the development of service innovations by all companies. (Designed to persuade the receiver that their response to the questionnaire is important and will contribute to research that benefits their organisation in addition to having a greater social importance) Specifically, its purpose is to understand where resources ought to be directed to improve their 'service innovation capability'. It was felt that you would be in the best position to either complete the questionnaire or delegate the responsibility to an appropriate other. (Designed to suggest the receiver's position or importance is the reason they have been contacted) In return for doing so, I will send a report on the study's full findings to an email address of your choosing. I believe you will find the results to be of value to your business. Please be assured that all collected information will be treated with the utmost confidentiality and stored securely, in line with the stringent requirements for best practice research at the institute. (Confirms confidentiality and eliminates the fear that responses will be used for purposes other than those described) I would be most happy to answer any questions you might have and can be reached at 051-302413/ 085-2867979/ tblommerde@wit.ie. (Illustrates that the researcher is willing to answer any questions or address any concerns) In anticipation of your response, I thank you for your assistance. Yours sincerely, Tadhg Blommerde	To Whom It May Concern, Two days ago, I sent you a questionnaire regarding my service innovation capability research. (Designed to refresh the receiver's memory) I am aware that I am requesting a task that adds to your already busy working day, but to complete my PhD within the permitted time your response is truly needed. (This sentence has a more insistent tone than the introductory email and strongly appeals for a response) Select 'Begin Survey' below to access the questionnaire. I acknowledge that the completion of surveys can be time consuming, but a great effort has been made to ensure quick and easy answering (approximately 10 minutes). (Reiterates the researcher's awareness of the work demands of receivers and that action has been taken to minimise disruption) I would be grateful to receive your response at as soon a time as it is convenient to you and in return for your participation, promise to send a report on the study's findings to an email address of your choosing. I believe that this report will be of value to your business. Once again, I wish to assure you of the survey's strict confidentiality and thank you for your assistance. (Reiterates the confidentiality of responses) Please do not hesitate to contact me if you require clarification on any question or other matter related to the survey. I will be very happy to help you in any way possible. If you do not wish to be involved in the survey, click 'Unsubscribe' at the bottom of this email or contact me directly to be removed from the mailing list. I can be reached at 051-302413 or 085-2867979, or by email: tblommerde@wit.ie. (Repeats that the researcher is available to answer any questions or address any concerns) Yours sincerely, Tadhg Blommerde	To Whom It May Concern, Two days ago, I sent you a questionnaire regarding my service innovation capability research. (Designed to refresh the receiver's memory) The software I am using indicates that you partially completed this questionnaire, but did not submit it. I am aware that I am requesting a task that adds to your already busy working day, but to complete my PhD within the permitted time your submitted response is truly needed. (This sentence has a more insistent tone than the introductory email and strongly appeals for a response) Select 'Begin Survey' below to continue answering the questionnaire. (Indicates that partial respondents will not have to begin answering the questionnaire again, but can resume from where they stopped) I acknowledge that the completion of surveys can be time consuming, but a great effort has been made to ensure quick and easy answering (approximately 10 minutes). (Reiterates the researcher's awareness of the work demands of receivers and that action has been taken to minimise disruption) I would be grateful to receive your response at as soon a time as it is convenient to you and in return for your participation, promise to send a report on the study's findings to an email address of your choosing. I believe that this report will be of value to your business. Once again, I wish to assure you of the survey's strict confidentiality and thank you for your assistance. (Reiterates the confidentiality of responses) Please do not hesitate to contact me if you require clarification on any question or other matter related to the survey. I will be very happy to help you in any way possible. If you do not wish to be involved in the survey, click 'Unsubscribe' at the bottom of this email or contact me directly to be removed from the mailing list. I can be reached at 051-302413 or 085-2867979, or by email: tblommerde@wit.ie. (Repeats that the researcher is available to answer any questions or address any concerns) Yours sincerely, Tadhg Blommerde

Reminder 2 – Non-respondents	***Reminder 2 – Partial Respondents***	***Reminder 3 – Non-respondents***
To Whom It May Concern, Last week, I sent a survey (service innovation capability) to you in connection with my PhD research. (Prompts the receiver to recall previous emails) I understand that you are busy, but would truly appreciate your support in the completion of this survey. Your response will ensure I have sufficient data to draw valid conclusions and successfully finish my doctorate. (A more personal tone, expressing the importance of responses to the researcher) It is my sincere belief that the findings of this undertaking will make a substantial contribution to understanding service innovation in small and medium-sized enterprises and therefore should be of value to your firm. In return for your participation, I promise to send a report on the study's findings to an email address of your choosing. (Reiterates that there is an incentive for participation in the study) Please select 'Begin Survey' to access the questionnaire. If you have any concerns or require assistance understanding the questions before proceeding, I would be happy help. I can be contacted at 051-302413, 085-2867979, or by email: tblommerde@wit.ie. Finally, I would like to once again assure you of the strict confidentiality of this survey and that all data will be stored securely. Under no circumstances will your response be used in any way that identifies your organisation and will be kept private; accessible only to the researcher and research supervisor. (The confidentiality of the survey is stressed and further details given with regard to who can access collected data) At all times, the best practice guidelines and regulations for research at Waterford Institute of Technology will be strictly adhered to. In anticipation of your response, I send many thanks. Sincerely yours Tadhg Blommerde	To Whom It May Concern, Last week, I sent a survey (service innovation capability) to you in connection with my PhD research. (Prompts the receiver to recall previous emails) The software that I am using indicates that you partially completed this survey, but did not submit your answers. I understand that you are busy, but would truly appreciate your support in the completion of this survey. Your response will ensure I have sufficient data to draw valid conclusions and successfully finish my doctorate. (A more personal tone, expressing the importance of responses to the researcher) It is my sincere belief that the findings of this undertaking will make a substantial contribution to understanding service innovation in small and medium-sized enterprises and therefore should be of value to your firm. In return for your participation, I promise to send a report on the study's findings to an email address of your choosing. (Reiterates that there is an incentive for participation in the study) Please select 'Begin Survey' to continue answering the questionnaire. If you have any concerns or require assistance understanding the questions before proceeding, I would be happy help. I can be contacted at 051-302413, 085-2867979, or by email: tblommerde@wit.ie. Finally, I would like to once again assure you of the strict confidentiality of this survey and that all data will be stored securely. Under no circumstances will your response be used in any way that identifies your organisation and will be kept private; accessible only to the researcher and research supervisor. (The confidentiality of the survey is stressed and further details given with regard to who can access collected data) At all times, the best practice guidelines and regulations for research at Waterford Institute of Technology will be strictly adhered to. In anticipation of your response, I send many thanks. Sincerely yours Tadhg Blommerde	To Whom It May Concern, Two weeks ago, I sent you a survey relating to my PhD research, but to date have not received your response. Because a large number of completed questionnaires are essential to the success of this study, your input is truly needed. I sincerely believe that the findings of this enquiry will substantially contribute to the existing understanding of service innovation in small and medium-sized enterprises and therefore should be of value to your firm. (A more insistent tone with the purpose of nudging the receiver to commence the questionnaire) In return for your participation, I promise to send a report on the study's findings to an email address of your choosing. Please select 'Begin Survey' to access the questionnaire, it has been carefully designed to be completed in approximately 10 minutes. (Repeats the assertion that steps have been taken to minimise any disruption to the receiver's work) If you have any questions or there are any matters that you wish to clarify prior to undertaking the survey, I would be pleased to help. I can be contacted at 051-302413, 085-2867979, or by email: tblommerde@wit.ie. Finally, I would like to reassure you of the survey's strict confidentiality. All best practice guidelines and regulations for research at Waterford Institute of Technology will be strictly adhered to. Data will be stored securely and your response will not be used in any way that that can identify your organisation. (Confirms confidentiality and attempts to eliminate any fears receivers may have with regard to their data) In anticipation of your response, I send many thanks. Sincerely yours Tadhg Blommerde

Reminder 3 – Partial Respondents	*Final Reminder – Non-respondents*	*Final Reminder – Partial Respondents*
To Whom It May Concern, Two weeks ago, I sent you a survey relating to my PhD research, but to date your response has not been submitted. The software I am using indicates that you partially completed the questionnaire, but did not finish it in its entirety. Because a large number of completed and submitted responses are essential to the success of this study, your help is truly needed. (A more insistent tone with the purpose of nudging the receiver to commence the questionnaire) Consequently, I appeal to you to select 'Begin Survey' below to continue completing the questionnaire, ensuring that you submit your answers on the final page. (Indicates that the receiver does not have to begin the questionnaire again, but can resume from their last answer. Additional instructions are given to ensure that the response will be recorded) I sincerely believe that the findings of this enquiry will substantially contribute to the existing understanding of service innovation in small and medium-sized enterprises and therefore should be of value to your firm. (Emphasises the social good and benefits that a response may have in enhancing the receiver's business) In return for your participation, I promise to send a report on the study's findings to an email address of your choosing. If you have any questions or there are any matters that you wish to clarify prior to undertaking the survey, I would be pleased to help. I can be contacted at 051-302413, 085-2867979, or by email: tblommerde@wit.ie. Finally, I would like to reassure you of the survey's strict confidentiality. All best practice guidelines and regulations for research at Waterford Institute of Technology will be strictly adhered to. Data will be stored securely and your response will not be used in any way that that can identify your organisation. (Confirms confidentiality and attempts to eliminate any fears receivers may have with regard to their data) In anticipation of your response, I send many thanks. Sincerely yours Tadhg Blommerde	To Whom It May Concern, Three weeks ago, I sent a survey to you in connection with my PhD research. (Designed to evoke the memory of previous correspondence) To date I have not received your response. The requirement of a high response rate to the success of this study is the reason that I now appeal to you again. Please select 'Begin Survey' below to access the questionnaire. (Explains why the receiver's response is important and directs them toward opening the questionnaire) In addition to assisting me with the completion of a doctorate, it is my sincere view that this research will benefit your organisation and those like it by enhancing understanding of service innovation capability in small and medium-sized enterprises. (Emphasises both the importance of the research personally and its importance socially. Their response is critical for multiple reasons) It is the first research of its kind and your response is vital to my analysis. In return for your participation, I promise to send a report on the study's findings to an email address of your choosing. Again, I would like to assure you that all collected information will stored securely and treated with the utmost confidentiality, in line with the stringent requirements for best practice research at Waterford Institute of Technology. (Affirms that collected data will only be used for the purposes outlined) I would be happy to clarify any concerns or answer any questions you might have and can be reached at 051-302413/085-2867979 or emailed at tblommerde@wit.ie, if you wish to contact me. (Conveys the researcher's availability to answer questions or address concerns) In anticipation of your response, I send many thanks. Yours sincerely, Tadhg Blommerde	To Whom It May Concern, Three weeks ago, I sent a survey to you in connection with my PhD research. (Designed to evoke the memory of previous correspondence) The software that I used to do so indicates that you partially completed this survey, but did not submit your answers. As a result, your response has not been recorded. The requirement of a high response rate to the success of this study is the reason that I now appeal to you again. Please select 'Begin Survey' below to continue answering the questionnaire. (Explains why the receiver's response is important and directs them toward opening the questionnaire) In addition to assisting me with the completion of a doctorate, it is my sincere view that this research will benefit your organisation and those like it by enhancing understanding of service innovation capability in small and medium-sized enterprises. (Emphasises both the importance of the research personally and its importance socially. Their response is critical for multiple reasons) It is the first research of its kind and your response is vital to my analysis. In return for your participation, I promise to send a report on the study's findings to an email address of your choosing. Again, I would like to assure you that all collected information will stored securely and treated with the utmost confidentiality, in line with the stringent requirements for best practice research at Waterford Institute of Technology. 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