

Absorbing customer knowledge: how customer involvement enables service design success

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**ABSORBING CUSTOMER KNOWLEDGE:
HOW CUSTOMER INVOLVEMENT ENABLES SERVICE DESIGN SUCCESS**

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Abstract

Customers are a knowledge resource outside of the firm that can be utilized for new service success by involving them in the design process. However existing research on the impact of customer involvement (CI) is inconclusive. Knowledge about customers' needs and on how best to serve these needs (articulated in the service concept) is best obtained from customers themselves. However co-design runs the risk of losing control of the service concept. This research argues that of the processes of external knowledge *acquisition* (via CI), customer knowledge *assimilation* and concept *transformation* form a capability that enables the firm to exploit customer knowledge in the form of a successful new service. Data from a survey of 126 new service projects show that the impact of CI on new service success is fully mediated by customer knowledge assimilation (the deep understanding of customers' latent needs) and concept transformation (the modification of the service concept due to customer insights). However its impact is more nuanced. CI exhibits an "∩"-shaped relationship with transformation, indicating there is a limit to the beneficial effect of CI. Its relationship with assimilation is "U" shaped suggesting a problem with cognitive inertia where initial learnings are ignored. Customer knowledge assimilation directly impacts success, while concept transformation only helps success in the presence of resource slack. An evolving new service design is only beneficial if the firm has the flexibility to adapt to change.

INTRODUCTION

Service design is paramount to service innovation because it brings innovative service ideas to life and has thus been identified as a key research priority (Ostrom et al. 2015). Service design represents a human-centered, reflective learning, iterative approach to the creation of new service offerings. At the heart of service design is the service concept. Also referred to as the value proposition (Skålén et al. 2015) and the customer value constellation (Patrício et al. 2011). The service logic perspective argues that value is not created by the firm, rather value is co-created by the interaction between the service offer (articulated in the service concept) and the customer (Lusch and Nambisan 2015). Therefore information on customer needs and on how best to serve these needs are best obtained from customers themselves. Customers have more knowledge about the problem; service providers have more information about the solution; and design of service concepts should be co-created (Moeller et al. 2013). Ordanini and Parsuraman (2011) argue that the capability to collaborate with customer during service development transforms the customer to an operant resource which increases the firm's innovation capabilities. It is customer involvement (CI) in the innovation process, rather than merely responding to customers, that leads to the design of truly value-adding service innovations (Kumar, et al. 2010; Storey et al. 2015).

However existing research on CI in the design of new offerings is inconsistent. Some research finds that CI improves innovation success (e.g., Cui and Wu 2016; Gustafsson, Kristensson and Witell 2012), whereas others indicate that it has no effect (e.g., Homburg and Kuehn 2014; Menguc, Auh and Yannopoulos 2014). These findings suggest there is a need to develop an understanding of the mechanism through which CI influences the design of successful new services (Hoyer et al. 2010) and of the conditions under which CI is more beneficial (Chang and Tylor 2016; Cui and Wu 2015).

To further understand the role customers' play in service innovation this research adopts the theoretical lens of absorptive capacity (ACAP). ACAP is a firm's process of utilizing external knowledge through the linked capabilities of *acquiring*, *assimilating*, and *transforming* new knowledge to create and exploit commercial outputs (Lane, Koka and Pathak 2006; Zahra and George 2002). Central to the service design process is an ability to make sense of external knowledge, to learn about it, and to adopt new approaches regarding it (Liedtka 2015; Verganti 2008). Consistent with the service logic perspective customers are a resource outside of the firm's boundaries. Research has sometimes demarcated between CI as two resources – a source of information on customer needs and CI as a co-designer generating ideas and solutions in the innovation process (Cui and Wu 2016; Fang 2008; Lusch and Nambisan 2015). CI as co-design provides a resource that supplements in-house capabilities and can help keep development costs down (Carbonell et al., 2009; Gruner and Homburg, 2000). Rather than delineating between the two resources this research views CI as a collaborative competence (Ordanini and Parsuraman 2011). We define CI as the extent to which customers are engaged in the firm's innovation processes (Fang 2008; Kumar et al. 2010). At high levels of engagement CI is seen as the “customer knowledge provision phenomenon whereby customers share their needs- and solution-related inputs in the firm's new product development process” (Chang and Taylor 2016, p48). This positions CI as part of a firm's ACAP process.

Building on ACAP theory's assertion that acquired knowledge needs to be first either assimilated and/or transformed before it can be exploited (Todorova and Durisin 2007), this research proposes that CI is a knowledge acquisition mechanism, which leads to knowledge exploitation in the form of a successful new service, via two mediating capabilities: customer knowledge assimilation and concept transformation.

Assimilation is the extent to which the firm is able to analyse and interpret new knowledge (Jansen, Van Den Bosch and Volberda 2005). The process of formulating and updating mental models is a sensemaking process central to design thinking (Liedtka 2015). In this context customer knowledge assimilation refers to the refinement during development of the perceptual schema the project team holds about its customers, their needs and the ways in which services create value for them (Dougherty 1992).

Transformation is the process by which the character of knowledge is changed (Todorova and Durisin, 2007; Zahra and George 2002) and an important task in the innovation process is to manage the transformation of embedded knowledge (the tacit knowledge possessed by customers and the development team) to embodied knowledge (the codification of this knowledge in the new service offering; Madhavan and Glover 1998). At the heart of service design is the service concept – the articulation of customer needs, how they are to be satisfied, and how this is to be achieved (Edvardsson et al. 2000). We therefore suggest that concept transformation - the extent to which the design of the service offering evolves throughout the development process to reflect new information, insights and interpretations – reflects a key knowledge transformation process that occurs during service design. During development combining knowledge or simply by interpreting the same knowledge in a different manner, facilitates the recognition of new opportunities and alters the way the firm sees its competitive landscape (Zahra and George 2002). Thus the firm transforms the initial design of the service concept to reflect this new reality.

Traditional approaches to service innovation have favoured a structured, systematic, and sequential process with an early fixed concept. A service design driven approach is a less formalized, emergent, reflexive and iterative process (Skålén et al. 2015; Stockstrom and Herstatt 2008; Teixeira et al. 2016). However the service concept is the key driver for all design and planning decisions (Patrício et al. 2011), and the cost of changes later during development stages is exponentially more expensive than at the start of the process (Hull and Storey 2016). Therefore firms are grappling with the dilemma of employing a more linear approach, to bring more certainty to the design process, versus an iterative approach, allowing deviations from the initial plan (Carlgren, Elmquist, and Rauth 2016). This is exacerbated by transferring control over innovation and the service concept to customers (Hoyer et al. 2010). Some practitioners even view CI as ‘more trouble than they are worth’ (Campbell and Cooper 1999, p. 516). As a result there has been calls for more research into the extent to which design concepts should be frozen and into flexibility in development projects (Biazzo 2009).

This study aims to make three principal contributions to theory. First, answering a call for research exploring the mechanism through which CI impacts new service success (Hoyer et al. 2010) this research aims to clarify inconclusive findings regarding the beneficial effects of CI. Although an ability to develop a deep visceral customer understanding has been recognized as central to the practice of innovation (Dougherty 1992), we do not yet know the relative importance of CI for customer knowledge assimilation or the extent to which assimilated customer knowledge helps transform the design of new service offerings during development.

Moreover, answering a recent call for more research into service innovation and service design (Ostrom et al. 2015), this research aims to extend our understanding of CI as a mechanism for co-design. Whilst the service concept is a key element of service design, the benefits and risks of its transformation during the design process are rarely addressed in the literature (Seidel 2007). This is the first time service concept transformation has been studied despite a call for research into different forms of flexibility in innovation projects especially those that enable reactive adaptations to changing knowledge (Kandemir and Acur 2012).

Second, there is a recognized need to study the contingencies or boundary conditions under which knowledge from customers is successfully exploited (Chang and Tylor 2016; Cui and Wu 2015). Wei, Yi and Guo (2013) show that resource flexibility is required to benefit from learning processes for innovation. Resource slack is a buffer of idle resources that enables firms to be flexible (Lee and Grewal 2004) and should therefore aid the effectiveness of customer knowledge assimilation and concept transformation in driving success. Research has not looked at the moderating role of resources in the realization of acquired new customer knowledge.

Third, this study contributes to our understanding of the capability character of ACAP (Zahra and George 2002). Todorova and Durisin (2007) assert that assimilation and transformation are alternative processes through which new knowledge is embraced, altered and integrated to produce change and realize a firm's goals. To date there has been no empirical research into the impact of acquisition on both assimilation and transformation, or into the relative importance of these alternative mechanisms for the exploitation of knowledge. Furthermore this research response to a call to explore the process of ACAP in new contexts (i.e. service design) and at new levels (i.e. the project rather than firm level), using measures that capture each dimension of the process, in a manner appropriate for the specific context/level (Lane, Koka and Pathak 2006).

This paper begins with a discussion of the role of customers in service innovation and goes on to develop a conceptual framework that captures the mechanism through which CI affects success. This model is then tested using data from a survey of new service development projects at European service sector firms.

CUSTOMER INVOLVEMENT in SERVICE INNOVATION

Research findings regarding the effect of CI on the success of new offerings have been inconsistent showing both a positive impact (Gustafsson, Kristensson and Witell 2012; Martin and Horne 1995; Smets, Langerak, and Rijdsdijk 2013), or alternatively no effect (Campbell and Cooper 1999; Menguc, Auh and Yannopoulos 2014; Mishra and Shah 2009). Research even suggests that CI may harm success (Knudsen 2007; Homburg and Kuehnl 2014). Furthermore there is inconsistency as to whether CI benefits an incremental or a radical innovation strategy (Bonner 2010; Menguc, Auh and Yannopoulos 2014). Thus there is a call to develop a more fine-grained understanding of the mechanism through which CI influences innovation performance (Cui and Yu, 2017; Hoyer et al, 2010; Mahr, Lievens and Blazevic 2014).

CI is defined as the extent to which customers are engaged in the firm's innovation processes (Fang 2008; Kumar et al. 2010). This implies that operationalisations of CI should reflect the degree of involvement over the whole of the development process (Hsieh and Hsieh 2015). Whilst Gruner and Homburg (2000) found that CI at the front and back end of the processes impact success, but not the middle stages, other research found no stage effects (Carbonell, Rodríguez-Escudero and Pujari 2009; Martin and Horne 1995). It is argued that knowledge acquisition by actively engaging and conversing with customers should occur throughout the entire development cycle rather than being restricted to opportunity creation (Coviello and Joseph, 2012; Griffin et al., 2009). CI should occur to define the service concept, and later in the process to provide feedback on the design of the service delivery processes (Melton and Hartline 2014).

Research has shown that the extent of CI can increase the amount and quality of information available for firms' innovation efforts (Bonner 2010; Hsieh and Hsieh 2015). By utilising multiple engagement methods firms can elicit greater diversity in information (Callahan and Lasry 2004; Carbonell, Rodríguez-Escudero and Pujari 2009). Stanko and Boner (2013)

demonstrated that through CI companies can better understand their customers. Recently Mahr, Lievens and Blazevic (2014) found that CI is useful for the creation of highly relevant but moderately novel knowledge. However, CI operationalised as an information resource failed to influence the innovativeness or performance of new offerings (Cui and Wu 2016; Fang 2008). This suggests information needs to be transformed in some way before it is of value.

Conventional wisdom is that CI leads to the design of superior offerings. Studies have shown that CI can help produce new offerings that are of higher quality and have greater advantages over existing offerings, and hence are more marketable (Carbonell, Rodríguez-Escudero and Pujari 2009; Melton and Hartline 2010). Furthermore Kristensson, Gustafsson and Archer (2004) show that ordinary users create significantly more original and valuable ideas than advanced users (or professional developers). However Cui and Wu (2016) found that CI specifically geared around generating new product ideas and designs is not linked to performance and research has shown that CI does not appear to develop more innovative offerings (Fang 2008; Ordanini and Parasuraman 2011). It is suggest that listening too closely to the customer can lead incremental and trivial development efforts or over-customized and unfeasible offerings (Alam 2006; Blazevic and Lievens 2008; Campbell and Cooper 1999). This is a specific problem when involving customers with whom the firm already has a close relationship (Bonner and Walker 2004; Stanko and Bonner 2013), whereas CI on a broad base (in terms of the number and diversity of the customers involved) brings new diverse viewpoints and expertise into the development project.

The inconclusive findings of research has triggered the exploration the non-linear effects of CI. Recent research has found that for physical goods CI has a greater impact at higher levels of CI (Milson 2015; Homburg and Kuehnl 2014). However for intangible services, low levels of CI can have a positive impact on success, whilst at high levels it is detrimental (Homburg and Kuehnl 2014). This suggests that the effectiveness of CI may be constrained. The intangible nature of value propositions means customers have difficulty articulating their needs, and that generating customer understanding may be particularly problematic (Mahr, Lievens and Blazevic 2014). Also as value is only created at the at the point of consumption it may be difficult for customers to evaluate service designs before actual utilization (Chang and Taylor 2016). Further research into the non-linear effects of CI is needed to shed light on the limitations of CI for understanding customers and for evolving new service designs.

The inconsistency in existing research findings has also resulted in a call to understand the boundary conditions under which CI will be most beneficial for firms (Mahr, Lievens and Blazevic 2014). Emergent research has started to address this. Cui and Wu (2017) find that if a firm is pursuing an iterative flexible design process involving customers as co-developers is not beneficial but information from customers is more valuable. The firm's technological resources can enhance the benefit from interacting with customers during the development of new offerings but surprisingly can reduce its ability to benefit from ideas generated by customers (Cui and Wu 2016). More formal customer participation strategies or the complexity of development processes do not appear to have an influence (Fang, Palmatier and Evans 2008)

The above discussion indicates that a greater understanding of how CI leads to successful new services could be generated by investigating the extent to which information from CI is assimilated into a deeper understanding of the customer and how knowledge, feedback and ideas from customers is incorporated, or transformed, into the design of the new service concept. Existing results also suggest more research is needed to test the moderating effects of organizational resources on the CI – service innovation performance relationship (Chang and

Taylor 2016), especially resources that enable firms to act on the knowledge or learning generated by CI (Wei, Yi and Guo 2013).

ABSORBING CUSTOMER KNOWLEDGE

The understanding of how a firm absorbs new customer knowledge during service development is limited (Volberda, Foss and Lyles 2010). A firm's acquisition capability is concerned with the breadth and intensity of effort directed at gathering external knowledge (Jansen, Van Den Bosch and Volberda 2005), in this case knowledge of and about customers. Directly involving customers in the service design process has been adopted by firms as an alternative, and perhaps more valuable, means of acquiring new knowledge than feedback from customers via more traditional market research (e.g., Fang, Palmatier and Evans 2008; Mahr, Lievens and Blazevic 2014).

A potential way to shed light on the inconsistencies of existing CI research is to explore the role of assimilation and transformation on a firm's ability to exploit CI. ACAP provides a productive theoretical lens for studying the impact of CI on new service success as it clearly positions the acquisition of new market information, via CI, as only the first step in the process (De Luca and Atuahene-Gima 2007). ACAP comprises a set of organizational capabilities to first to acquire, then assimilate and/or transform external knowledge in ways that enable firms to exploit, or realize, this knowledge in the form of new offerings or processes (Lane, Koka and Pathak 2006; Zahra and George 2002). A firm requires an internal capability to deploy externally acquired customer knowledge by assimilating and/or transforming it during the design of new services (Liedtka 2015; Verganti 2008).

Lewin, Massini and Carine (2011) make a distinction between an external ACAP routine, i.e. knowledge acquisition, and two separate internal routines: knowledge assimilation and knowledge transformation. Assimilation and transformation are alternative, complementary processes through which customer knowledge is embraced, altered and integrated to realise a firm's goals (Todorova and Durisin 2007; Zahra and George 2002). It has been shown that acquisition, assimilation and transformation are theoretically and empirically distinct stages of the ACAP (Backmann, Hoegel and Cordery 2015; Jansen, Van Den Bosch and Volberda 2005).

Assimilating Customer Knowledge

Customer knowledge assimilation, gauges the extent to which the project team is able to analyse and interpret new customer knowledge during development (Jansen, Van Den Bosch and Volberda 2005) thus enriching and/or changing the perceptual schema held about its customers, their needs and the ways in which the new service creates value (Roberts and Grover 2012). It is a learning capability that occurs when new information is combined with existing knowledge and beliefs to derive new meanings (Todorova and Durisin 2007). This represents the conceptual use of information and provides a general enlightenment of the situation (Citrin, Lee and McCullough 2007; Menon and Varadarajan 1992). A deep visceral understanding of information about customers and their latent needs has been recognized as central to the practice of innovation (Dougherty 1992). The process of elaboration and reframing of problems is an essential element of a design oriented approach to innovation (Liedtka 2015; Dunne and Dougherty 2016). Nemanich et al. (2010) show that project teams need to be able to assimilate acquired knowledge before applying that knowledge in the pursuit of commercial exploitations.

Transforming Customer Knowledge: Concept Transformation

When new knowledge is less compatible with existing beliefs knowledge structures need to transform (Todorova and Durisin 2007). A knowledge transformation capability is the ability to recognise the consequences of new external knowledge, the ability to codify, and integrate this knowledge so it can be applied to current operations and strategies (Jansen, Van Den Bosch and Volberda 2005). This reflects the instrumental use of knowledge, where it is applied directly to decision tasks such as problem solving within the design process (Citrin, Lee and McCullough 2007; Menon and Varadarajan 1992). In this instance the embodiment of customers' tacit knowledge in the service concept.

The service concept defines the value that a service allows customers to create, how this is to be achieved and forms the design foundations on which the overall service innovation project is built (Edvardsson et al. 2000; Patrício et al. 2011). It is the representation of the perceptual schema of the collaborative co-design team and is also a tool for sharing knowledge during development (Seidel 2007). Concept transformation is defined as the extent to which the design of the new service offering has evolved during the development process to reflect new information, insights and interpretations.

Service innovation projects face high levels of uncertainty especially at in the initial stages. To manage this uncertainty, firms need to be able to introduce design modifications throughout the process (Biazzo 2009; Witell, Gustafsson and Johnson 2014). During development, firms must maintain a certain degree of flexibility, frequently reviewing and questioning initial plans to react appropriately to shifting conditions. Freezing the design of the new service early in the development process is often infeasible. The majority of design concepts substantially evolve during development (Seidel 2007). However when the design of the service concept is changed existing knowledge and initial investments may be rendered obsolete (Salomo, Weise and Gemünden 2007). Project budget and timelines are adversely affected (Stockstrom and Herstatt 2008). Therefore firms must take care as to the extent of concept transformation.

CONCEPTUAL MODEL

[Figure 1 about here]

The conceptual model of this research is shown in Figure 1. During service design, acquiring new customer knowledge, through CI, is a necessary antecedent to the assimilation of that knowledge and to its embodiment via the transformation of the new service concept. The model reflects the assertion that assimilation and transformation are alternative processes through which new knowledge is embraced, altered and integrated to produce change and realize a firm's goals (Todorova and Durisin 2007). These two processes fully mediate the impact of a customer knowledge acquisition capability, specifically CI, on new service success.

However, a firm's ability to effectively implement change in response to new knowledge will be contingent on the amount of resource flexibility the firm has (Lee and Grewal 2004). Thus we suggest that resource slack will moderate the effect of customer knowledge assimilation and concept transformation on success.

Customer involvement and customer knowledge assimilation

Cui and Wu (2015) argue that customer information can only be applied to the design of new services if it is transferred from the customers and assimilated by the project team. Assimilation is a learning process that occurs when new information is taken-in organized, structured and endowed with relevant meaning (Li and Calantone 1998; Todorova and Durisin

2007). When new information about customers is acquired and interpreted, this enriches and/or amends the project team's shared perceptual schema or a collective 'justified true belief' of its customers, their latent needs and the ways in which services create value for them (Nonaka and Takeuchi 1995). CI increases the opportunity for customer knowledge assimilation. It has been found that CI helps generate insights regarding customer needs, their preferences and their requirements (Bonner 2010).

A deep, tacit understanding of the customer is difficult to obtain from traditional market research reports (Dougherty 1992; Greer and Lei 2012). Latent needs, which customers cannot clearly articulate, or may not even recognize, are difficult to transfer. When customers are actively involved in service design they are more likely to provide the contextual knowledge that is important for understanding their tacit needs and how the customer will ultimately regard and use the service (Cui and Wu 2015; Mahr, Lievens and Blazevic 2014). Customers help the design team understand and interpret customer needs. Dougherty (1992) argues that it is by CI that the design team will develop a real sense of the nuances of customers' needs, the problem that the new service will solve for customers, and see how customers perceive value.

Firms can increase the amount and accuracy of knowledge absorbed by involving a diverse range of customers¹ through a wide variety of CI methods (Backmann, Hoegel and Cordery 2015, Bonner and Walker 2004). This has the potential to reduce ambiguity - the extent to which environmental signals are open to multiple, seemingly accurate interpretations - and aid interpretation (Carson, Wu, and Moore 2012). Furthermore, new and meaningful patterns or interpretations can be created via the combination of new knowledge with pieces of existing information (Blazevic and Lievens 2008). Thus CI creates an enriched and more certain visceral understanding of customers' latent needs:

Hypothesis 1a: Customer involvement has a positive relationship with customer knowledge assimilation.

The above discussion implies that CI will increase customer knowledge assimilation. However, it can be argued that CI's relationship with customer knowledge assimilation may suffer from diminishing returns. At high levels CI has been found to be detrimental to new service success (Homburg and Kuehnl 2014). Beyond a certain point, acquiring additional information from customers reveals relatively few or no new insights.

Problems may also arise if higher degrees of CI results in excessive knowledge heterogeneity, triggering knowledge integration problems. Backmann, Hoegel and Cordery (2015) found that knowledge diversity leads to knowledge assimilation only to a certain degree. Barriers to interpretation and communication arise which negatively affects team processes and outcomes. Antioco, Moenaert and Lindgreen (2008) found inconsistencies among inputs from diverse customers, driven by the frequency of customer contact, resulted in overload and the need to compromise between conflicting information.

Thus we suggest high levels of CI, knowledge diversity increases the likelihood of inconsistencies and conflict between information, and thus creating uncertainty in the teams understanding of customer needs. Therefore an alternative hypothesis to H1a is proposed:

¹ This does not apply to a component manufacturer or customized solution situation where CI is restricted to the specific customer. We thank one of the anonymous reviewers for this clarification.

Hypothesis 1b: Customer involvement has an “∩”-shaped relationship with customer knowledge assimilation.

Customer involvement and concept transformation

Concept transformation reflects the extent to which knowledge is given form and integrated by reshaping the firm’s initial ideas and plans for the design of the new service (Stevens and Dimitriadis 2004). It is recognised that during development firms must react to shifting market knowledge by reviewing and questioning initial expectations (Stockstrom and Herstatt 2008). Previous research has found that information has an instrumental use that is distinct from its conceptual use (Citrin, Lee and McCullough 2007). The instrumental use of information involves recognizing the value of new external knowledge, and applying acquired knowledge directly to a task (Menon and Varadarajan 1992). Thus concept transformation is directly influenced by CI.

It has been found that acquiring new information, through intensive interaction with lead users, can change a firm’s initial plans and push the development team in a new direction (Von Hippel, Thomke, and Sonnak 1999). Feedback from customers can lead to design and feature changes (Carbonell and Rodríguez-Escudero 2015). Customers contribute not only need information but also ideas and solutions to problems during development (Cui and Wu 2015). By supplementing the project team’s ideas with their own customers can often conceive more novel problem solutions (Bonner 2010).

Furthermore by involving customers in the design process, the team is more inclined to view the information as credible. The team is therefore more likely to act on the information (Fang 2008; Menon and Varadarajan 1992). This will help stop operational efficiency considerations overriding the consideration of customer needs (Melton and Hartline 2010) which may curtail concept transformation. Hence:

Hypothesis 2a: Customer involvement has a positive relationship with concept transformation.

As discussed previously the value of additional CI may have its limits. Beyond a certain point CI reveals relatively few or no new benefits, while incurring added costs to the project (Bonner and Walker 2004). When CI yields large volumes of customer inputs, not all inputs will be processed and utilized (Hoyer et al. 2010).

Furthermore because a firm’s cognitive attention is a limited resource, additional information acquired externally can lead to information overload (Zhou and Li 2012) and thus may decrease customer knowledge assimilation. Antioco, Moenaert and Lindgreen (2008) found the amount of learning and the decision to modify a product or service concept during development followed an “∩”-shaped function. They suggest this is the result of information overload, where it is impossible to respond to all suggestions for change, leading to breakdown (of the overloaded system). Thus CI at high levels may complicate the decision-making process and reduce service design changes.

Similarly, the more the new service design deviates from how it was originally conceptualized, the more resistance to change occurs resulting in compromise (Sethi, Iqbal and Sethi 2012). Excessive inputs from customers regarding design changes may lead to the perception that radical design modifications instead of incremental design modifications are needed. This engenders resistance within the project team (Antioco, Moenaert and Lindgreen 2008) and prevents suggestions and improvements from customers from being implemented.

Extensive CI may result in large numbers of suggestions for changes that are deemed trivial, infeasible or too specific to the individual customer (Chang and Taylor 2016; Greer and Lei 2012; Kristensson, Gustafsson and Archer 2004). This may call into the credibility of CI as a knowledge source and the project team are likely to reject the information downplaying its usefulness. Thus, as an alternative to H2a, it is proposed that:

Hypothesis 2b: Customer involvement has an “∩”-shaped relationship with concept transformation.

Customer knowledge assimilation and concept transformation

The conceptual use of information emphasizes the commitment to understanding information before its application to decision-making (Citrin, Lee and McCullough 2007; Menon and Varadarajan 1992). It is argued that the synthesis of customer knowledge alone does not facilitate value creation. Rather, insightful interpretations are needed for the translation of abstract desires into a workable service concept (Greer and Lei 2012). This implies that assimilated customer knowledge needs to be transformed to be of value.

Latent needs may not be fully known to the project team prior to development. During development, the process of assimilation allows for the synthesizing of new and existing knowledge about customers into a constantly evolving perceptual schema, in which unarticulated latent needs are discovered and interpreted (Griffin et al. 2009; Moorman and Miner 1998). Madhavan and Glover (1998) argue that one important task during the innovation process is to manage the transformation of the embedded knowledge of the development team (the cognition and beliefs about customers) to embodied knowledge; the explicit knowledge of customer needs and preferences articulated in the service concept. When the project team reflects on what they have learnt about customer needs and on the feedback from customers, new insights about opportunities or problems will be created and they may recognise that the initial service concept design is incompatible with what was initially known (Magnusson, Matthing and Kristensson 2003). Dunne and Dougherty (2016) show that an iterative process of elaborating and reframing the problem enables the project team to delve deeply into the contextual details of the innovation and results in new conceptualizations of the potential offering.

In addition, one of the benefits of an increased understanding is a sense of self-efficacy, or a belief that a particular course of action can be carried out and an increased propensity to stray from the plan (Moorman and Miner 1998). Thus customer knowledge assimilation will increase the likelihood to act and the extent of concept transformation will increase. Hence:

Hypothesis 3: Customer knowledge assimilation has a positive relationship with concept transformation.

Customer knowledge assimilation and new service success

Generally, a good understanding of the customer and the marketplace is associated with success (e.g. Ordanini and Parsuraman 2011; Storey and Easingwood 1998; Witell, Gustafsson and Johnson 2014). However, if this understanding is limited to expressed needs, this creates no new insights into value-adding opportunities. Rather it is necessary to understand, and to satisfy, the latent needs of customers (Rijsdijk, Langerak and Jan Hultink 2011).

Whilst customer knowledge assimilation impacts the service offering that is created by the firm (via concept transformation), it is also needed to ensure that the new service can be

commercialized effectively. Understanding what generates value for customers and how customers will ultimately regard and use the service (Dougherty 1992), will lead to more effective communication and positioning strategies that aid success (Gruner and Homburg 2000; Melton and Hartline 2010). Customer knowledge assimilation during the commercialization stage may also identify additional uses and benefits (Coviello and Joseph 2012) and enable the co-shaping of customer experiences (Stanko and Bonner 2013). This is particularly important as customers are an integral part of the service delivery system, and in many instances the precise service offering is customized and augmented at the point of delivery (Storey and Easingwood 1998). Therefore:

Hypothesis 4: Customer knowledge assimilation has a positive relationship with new service success.

Concept transformation and new service success

Traditionally an early and well defined service concept is associated with success (Cooper 1979). However external market changes, or indeed internal changes (e.g., technological or operational problems) cannot be fully anticipated through planning and must be accounted for during project execution (Salomo, Weise and Gemünden 2007). Flexibility in design processes – whereby firms discover emerging customer needs, indiscernible prior to the project, and integrate them into their new service concepts – will enhance fit with the market (Alam 2006; Kandemir and Acur 2012). Conversely, if a new service is not adjusted to changing market conditions then it is likely to fail in the market, no matter how well originally conceived. Project inflexibility during development leads to a failure to incorporate new learning into the service concept, adversely affecting performance (Sethi, Iqbal and Sethi 2012). Research has discovered that an iterative development process helps evolve new offerings from their initial concepts, which leads to success (Joshi and Sharma 2004). Therefore:

Hypothesis 5: Concept transformation has a positive relationship with new service success.

Moderating role of resource slack

There is a recognized need to study under what conditions knowledge from customers can be successfully exploited (Chang and Tylor, 2016). ACAP and learning theories suggests that strategic flexibility and organizational resources are required to fully exploit new knowledge (Volberda, Foss and Lyles 2010; Wei, Yi and Guo 2013). Resource flexibility refers to a firm's ability to reallocate and reconfigure its organizational resources to more effectively manage change. Under conditions of uncertainty resource flexibility enables firms to refine its innovation strategies and for quick adjustment of its development activities (Cui and Wu 2015). The design of a new service offering is a complex and causally ambiguous process (Menguc, Auh and Yannopoulos 2014) which requires a flexible approach (Salomo, Weise and Gemünden 2007).

Therefore this research investigates resource slack as a key contingency factor. Resource slack denotes a situation in which organizational resources, in excess of the original allocation, are available to support an activity, in this case the firm's service innovation project (Joshi and Sharma 2004). During development resource slack is a buffer of idle resources that enables firms to be flexible and improvise (Lee and Grewal 2004; Moorman and Miner 1998).

With greater slack the team is better able to implement change to operation and delivery systems, reducing the likelihood of problems during commercialization. This is important as even seemingly minor changes in the service concept can have implications for the design of service

systems and encounters (Storey and Easingwood 1998). Without slack the project team will need to make significant compromises, which may affect the service's ability to compete in the marketplace (Sethi, Iqbal and Sethi 2012). Furthermore structural strain can occur when a firm does not have sufficient resources to effectively implement all potential changes, which can cause conflict during development and reduce the chances of successful project outcomes (Mainemelis 2010). This is exacerbated by transferring control over the service concept to customers as part of a co-design approach to innovation (Hoyer et al. 2010).

Therefore, resource slack will moderate the effect of customer knowledge assimilation and of concept transformation on market performance:

H6a: Resource slack strengthens the relationship between customer knowledge assimilation and new service success.

H6b: Resource slack strengthens the relationship between concept transformation and new service success.

METHOD

Measures

Exploratory interviews were conducted with seven industry innovation experts to ascertain their interpretation of the measures and to ensure content validity. Their feedback helped revise the questionnaire and shape the conceptual model. The final questionnaire was pretested with a holdout sample of senior managers to ensure face validity. The scales are detailed in the Appendix.

Customer knowledge assimilation was based on the research on understanding the latent needs of customers and refined via interviews with managers. Five-items measured the extent to which the project team developed an improved customer understanding (Li and Calantone 1998), learnt what generates customer value (Dougherty 1992; Lievens and Moenaert 2000), discovered additional latent needs (Roberts and Grover 2012; Stanko and Bonner 2013), fine-tuned their intuition of customer needs (Stanko and Bonner 2013), and developed a deeper feeling for how customers use or apply services (Dougherty 1992; Stanko and Bonner 2013).

Concept transformation's measurement was developed from the literature on planning and flexibility in design, and interviews with managers. Specifically this was operationalized by four items that capture the degree to which the final service concept differs from initial expectations (Joshi and Sharma 2004; Sethi, Iqbal and Sethi 2012; Stockstrom and Herstatt 2008), the extent to which new knowledge created during this project is fully integrated into the service (Rijsdijk, Langerak and Jan Hultink 2011), whether ideas from customer were directly incorporated into the new service design (Joshi and Sharma 2004; Stevens and Dimitriadis 2004) and the extent new knowledge challenged the initial understanding of the service concept (Carbonell and Rodríguez-Escudero 2015).

Customer involvement was operationalised with 3-items from Carbonell, Rodríguez-Escudero and Pujari (2009): The extent of engagement, frequency of contact and the number of involvement methods employed. Two additional items were added based on previous research. These were the diversity of customers involved in the project (Bonner and Walker 2004) and involvement over the entire development process (Hsieh and Hsieh 2015). Following Melton and Hartline (2010) the scale captures the breadth and intensity of the knowledge acquisition effort.

Similar measures of CI have been employed in previous research (e.g. Cui and Wu 2016; Homburg and Kuehnl 2014; Ordanini and Parasuraman 2011).

The remaining measures employed scales from previous research, adapted to the service innovation context.

Resource slack was measured by a three-item scale from existing research (De Luca and Atuahene-Gima 2007): The availability of substantial resources to fund projects; the existence of uncommitted resources in addition to those formally budgeted, and the ability to obtain additional resources.

New service success was measured by a four-item scale employed in previous research capturing sales performance, market share, financial performance, and achievement of commercial objectives (De Luca and Atuahene-Gima 2007; Storey and Perks 2015).

Controls: A number of variables that may influence new service success were included in the tested models. *Project newness* is a three-item scale that measures the newness of the project in terms of the company, the industry, as well as the target customers (De Luca and Atuahene-Gima 2007). This controls the extent to which existing knowledge is relevant for the project (Mahr, Lievens and Blazevic 2014). *Market intelligence* reflects the extent traditional market research about customers was available during the project and allows for the relative role of CI in new service success to be assessed. This was measured with four items, comprising extent of new market research studies, customer surveys were conducted specifically for the project, information about customers' purchase behaviour, and database of market research reports (Cooper et al. 1994; Zahay and Griffin 2003). *Environmental uncertainty* was a 2-item scale: the speed of change in customer needs and difficulty in predicting changing customer needs (De Luca and Atuahene-Gima 2007). Dummy variables were included to control for sector and market type. Using data collected on industry sector, firms were grouped according to whether the sector was predominantly technology-based versus more experiential (Storey and Kahn 2010)². As involving customers may be a more challenging task in a business-to-consumer context (Hoyer et al. 2010), the market type served by the new service (i.e., consumer vs. business-to-business) was controlled for. Organizational size was also controlled for via a four category scale.³

Survey

This study collected data following common procedures employed in the innovation literature (e.g. Carbonell, Rodríguez-Escudero and Pujari 2009; Melton and Hartline 2010; Sethi, Iqbal and Sethi 2012). Data was collected from key informants via an online survey of leading international service firms⁴. A list of leading service firms across a range of sectors was obtained from a European research organization. Countries included, but were not restricted to, Austria, Germany, Switzerland, the Netherlands and the United Kingdom. The sample was restricted to those firms with more than 50 employees. Websites and trade directories were consulted to identify appropriate senior executives within these firms. Respondents were not restricted to a

² The former group (N = 70) comprised financial and insurance services, information and communications firms, and energy and utilities; the latter group (N = 56) comprised professional services, travel and tourism, and hospitality firms.

³ Non-significant controls were removed from the final model.

⁴ Informants included representatives of some of the largest global service firms, e.g., Microsoft, Google, Credit Suisse, Lufthansa, Deutsche Post, Virgin, Bertelsmann, British Telecom, Heathrow Airport, Zurich Airport and British Airways.

specific European country as it was important to identify the most relevant informant irrespective of physical location. Key informants were required to hold a senior role in marketing, R&D, service development or market research functions. These areas were selected to identify key informants due to their organizational knowledge, access to relevant information and likely involvement in recent innovation activities. Where possible, direct contact with firms was made to check the identity of the most appropriate informant. Key informants were required to have an organizational tenure of at least two years and have had direct involvement in a recently completed innovation project. In the cases in which such a key informant was not identifiable, the firm was excluded from the sample. The informants were instructed to identify the most recently completed project resulting in a new service that was introduced to the market within the past three years and that had been on the market for at least six months.

To gauge the ability of the informants to report on the variables of interest, interviews of a selection of seven informants were conducted. These interviews verified that the approach taken was able to identify suitably knowledgeable informants (Bonner and Walker 2004). The interviews were used to ascertain key informants' interpretation of the items in the measures, to ensure content validity of each measure and construct equivalence.

Whilst English is the most common language used in European service firms, the research instrument was also made available in German (informants could respond to either the English or German version). This was aimed at maximising the response rate. The research instrument was designed using common business terminology and minimal use of idiomatic statements to help minimise cross-cultural issues. Back translation was used to ensure semantic equivalence (Schaffer and Riordan 2003). In addition, the questionnaire was checked by a professional business language teacher who speaks English and German. Finally, both versions were pre-tested with a small sample of senior managers with leading firms to ensure correct interpretation and face validity. After two follow-ups, a total of 126 usable responses were received, representing a 19% response rate. See Table 1 for sample characteristics.

[Table 1. About here]

ANALYSIS

Sample

To ensure the validity of the sample, the data was explored for sector, informant position and firm size differences between respondents and non-respondents. Differences between early and late respondents for all constructs in the model were examined. No significant differences were identified, suggesting non-response bias was not a significant issue in the data. CI in service design may be context specific. Therefore, mean difference tests were conducted to identify differences based on sector, market type and firm size. No systematic differences were found, suggesting that context-related biases were also not a problem in this sample.

It was important to test for measurement equivalence between the English and German language respondents. A between-groups confirmatory factor analysis was performed. Due to the sample size, the model factors were divided in pairs. A covariance structure analysis was used to directly test the equivalence assumption by placing a series of nested constraints on selected parameters across groups (Schaffer and Riordan 2003). The subsequent results were non-significant, suggesting acceptable metric and factor covariance invariance, hence the English and German samples can be combined. This implies that cross-cultural issues in the pan-European sample are not a significant issue.

Measurement model

Exploratory factor analysis was conducted and all variables loaded on their correct factors, providing evidence of discriminant validity and that the separation of the distinct elements of the ACAP process is valid. Harman's single factor test was used to assess common method bias (CMB). The first factor accounted for less than half of the total variance (24% of 68%) suggesting CMB is not an issue. In addition the latent method factor was employed (Kumar, Heide and Wathne 2011). The structural models estimates with and without the method factor remained virtually unchanged suggesting that CMB does not materially affect the results. Correlations between all latent variables are shown in table 2. The maximum correlation of 0.52 provides further evidence that CMB is within acceptable levels.

[Table 2. About here]

Partial Least Squares (PLS) was used to test both the measurement model and the structural model using SmartPLS 2.0 (Ringle, Wende and Alexander 2005), with a bootstrapping procedure of 500 re-samples to generate t-values (Chin 1998). PLS path analysis was employed as it is more suitable for models that contain complex relationships, a large number of manifest variables and for testing moderating hypotheses (Hair et al. 2014).

Coefficient α and composite reliability were calculated for each construct in the measurement model (see appendix) and indicated acceptable reliability (Chin 1998). No cross-loadings were evident. The average variance extracted (AVE) was always greater than the highest shared variance indicating discriminant validity (Chin 1998; Hair et al. 2014).

Structural model

Two models were tested. A linear effects model, and a model including the quadratic and moderating terms. Interaction terms were developed using an orthogonalizing residual product indicator approach (Henseler and Chin 2010). Product terms are created between all indicators of the two variables. The product terms are then regressed on all the indicators and the residuals used as indicators of the interaction term. This approach limits multicollinearity amongst the interaction terms. Checks revealed that the variance inflation factors of the latent variables in the structural model are less than 2, suggesting that multicollinearity is not an issue (Hair et al. 2014).

To assess the quality of the model, a goodness-of-fit (GOF) measure ($\sqrt{\text{average } R^2 * \text{average AVE}}$) was calculated. Assuming a large effect size for R^2 (0.26) and a cut-off AVE value of 0.70, a comparison GOF value is 0.42 (Tenenhaus et al. 2005). The goodness of fit calculated was 0.44, indicating a good fit. In addition, Q^2 was calculated for new service success (0.12). The positive value indicates that the model has predictive relevance (Tenenhaus et al. 2005).

RESULTS

[Table 3. About here]

Direct effects model

The results of the linear effects model (M1) are shown in Table 3. CI has a strong positive impact on customer knowledge assimilation ($\beta=0.41$) and on concept transformation ($\beta=0.42$), supporting H1a and H2a. Customer knowledge assimilation is positively related to concept

transformation ($\beta=0.20$) confirming H3. This shows that CI influences transformation directly as well as via assimilation.

Customer knowledge assimilation also showed a strong relationship with success ($\beta=0.25$) supporting H4. Surprisingly, concept transformation was not significantly related to success ($\beta=0.09$), failing to support H5. During development modifying the design of the new service to reflect new knowledge does not appear to translate into success in the marketplace.

In the conceptual model, the impact of CI on new service success was expected to be fully mediated by customer knowledge assimilation and concept transformation. An alternative model was tested with a direct path from CI to success. CI was not found to have a direct relationship with success ($\beta=-0.03$). In an unmediated model, excluding customer knowledge assimilation and concept transformation, the relationship between CI and success was significant ($\beta=0.13$; $t=1.69$). The results show that CI's impact on success is fully mediated (Hair et al. 2014).

Quadratic and moderated model

Table 3 also shows the results for the quadratic and moderated model (M2). The quadratic term for CI was found to have a significant relationship with customer knowledge assimilation ($\beta=0.19$). However surprisingly this was positive rather than negative, failing to support H1b. Contrasting this, the effect of the quadratic on concept transformation was significant and negative ($\beta=-0.24$). This supports H2b.

[Figure 2 about here]

To help understand the quadratic effects, the relationships were graphed (see Figure 2). The negative quadratic term for CI on concept transformation demonstrates as the level of CI increases there is diminishing marginal returns from CI. At high levels of CI, the negatives balance the positives, and the effect of further CI on concept transformation is negated. Surprisingly the relationship between CI and customer knowledge assimilation is the opposite. At medium and high levels of CI the positive effects outweigh any negatives. But at low levels of CI, introducing CI does not create any benefits in terms of the understanding the project team has about customers.

[Figure 3 about here]

The non-significant relationship between concept transformation and performance can be explained with the impact of resource slack. The interaction of resource slack and concept transformation has significant effects on success ($\beta=0.23$), supporting H6b. High resource slack enables a positive relationship between concept transformation and success (this is shown in Figure 3). The interaction term between resource slack and customer knowledge assimilation was not significant ($\beta=0.08$) failing to support H6a.

DISCUSSION

Theoretical Implications

This research builds on the assertion that customers are a resource outside of the firm's boundaries and that CI converts customers into a capability which can improve a firm's innovation performance (Chang and Taylor 2016; Mahr, Lievens and Blazevic 2014). In doing so this research makes a number of contributions to theory.

First, this research answers a call to develop a more fine-grained understanding of the mechanism through which CI influences new service success (Hoyer et al. 2010). The research shows that the effect of CI on new service success is fully mediated by the processes of customer knowledge assimilation and concept transformation.

Customer knowledge assimilation and concept transformation have not been specifically operationalized and empirically linked to new service success despite being recognized as central to the practice of innovation in dynamic environments (Dougherty 1992; Kandemir and Acur 2012). The existence of the strong relationship between CI and transformation, as well as the mediated relationship via assimilation supports empirically the assertion that knowledge generated by CI has both a conceptual use - increased understanding - and an instrumental use – transforming the new service concept (Citrin, Lee and McCullough 2007; Menon and Varadarajan 1992). Customers have an important role in the assimilation and transformation of customer knowledge. Both processes are important in the exploitation of customer knowledge.

The results show that the influence of CI is complex, as the inconsistencies of previous research suggest. The negative quadratic term of CI on concept transformation may be indicative of, at high levels of CI, a darker side of involvement where customer participation is dysfunctional. This supports existing research that found that during development the diversity of knowledge can overload the project team making it difficult to effectively use that knowledge (Antioco, Moenaert and Lindgreen 2008; Backmann, Hoegel and Cordery 2015). Extensive CI may invoke greater resistance from the project team towards input from customers if the changes to the service concept are perceived to have operational implications i.e. required changes to the design of service delivery systems.

Surprisingly there is a positive quadratic effect of CI on customer knowledge assimilation. At lows of CI, engaging with customers during the development process has no impact on the understanding the project team has regarding the firm's customers. This may be explained by the theory of cognitive inertia (Zhou and Li 2012). The existing mind-set creates biases in learning processes acting as a perceptual filter hindering the firm's ability to assimilate new knowledge (Coviello and Joseph 2012; Liedtka 2015). The team first has to *unlearn* before it can make use of the new knowledge that customers bring to the project. The findings highlight the difficulty of assimilating tacit need information, especially for intangible services. It is only at moderate or high levels of CI that CI can be seen as a mechanism to overcome cognitive inertia. This complex relationship has so far not been uncovered in previous research.

Customer knowledge assimilation has a strong direct influence on success. Understanding how the customer will ultimately regard and use the service is particularly important in today's experience economy where value is co-created with customers. In addition it is an important antecedent to concept transformation supporting emergent work that shows a design oriented approach, of iteratively elaborating and reframing of the problem, leads to new conceptualizations of the potential offering (Dunne and Dougherty 2016).

Service design is a process that takes knowledge embedded in the customer and iteratively transforms this it into a pragmatic service value offering. This is the first time service concept transformation has been studied despite a calls for more research into the extent to which design concepts should be frozen and into flexibility in development projects (Biazzo 2009; Kandemir and Acur 2012). Surprisingly concept transformation was not found to have a significant effect on success. Customers involved in the design process may be biased towards existing frames of reference. This makes it difficult for them to come up with novel solutions to problems (Liedtka 2015; Verganti 2008). Furthermore, the benefits of adjusting the new service concept to changing

market conditions may be balanced out by the increased costs of development resulting from initial investments being made obsolete. However, the research does not support the opposite view that sticking to the original plan enhances innovation success (Salomo, Weise and Gemünden 2007).

The lack of a positive relationship may be explained by considering the role of resource slack. Under conditions of high resource slack, concept transformation has a positive impact on success. Under conditions of resource constraints, concept transformation can harm performance. If the new service concept changes the organization must have the resources to be able to correctly implement these changes to maximize success. Even seemingly minor changes in the service concept can have dramatic impacts on operations and delivery system requirements. As the quality of interactions between the organization and customers is fundamental for successful value creation (Grönroos and Voima 2013), a service concept that has constantly evolved will require more resources to ensure a high-quality service interaction system is implemented. This research shows that resource slack, as an enabler of flexibility, is a key boundary condition under which knowledge from customers can be successfully exploited. This is the first time that research has demonstrated the moderating role of resources in the realization of acquired new customer knowledge.

A further contribution of this research is the refinement of our understanding of the specific process of absorbing customer knowledge. Whilst the service logic perspective recognises that customers are a knowledge resource outside the firm's boundaries the process of absorbing customer knowledge has so far been neglected by extant research (Lewin, Massini and Carine 2011). The results demonstrate that customers have an important role in the assimilation and transformation of customer knowledge. Customers help the design team understand and interpret customer needs; and help embody this tacit knowledge within the service concept.

Furthermore results show the insufficiency of the simple linear model of the ACAP process. Extant research has neglected and failed to explore the interrelationships of the separate ACAP processes (Lane, Koka and Pathak 2006). Despite being identified theoretically (Todorova and Durisin 2007), previous research has not investigated a possible direct relationship between knowledge acquisition and transformation; or of assimilation and knowledge exploitation (in the form of new service success). The quadratic effects of CI, and the moderating role of resource slack on concept transformation, suggest that the ACAP process is more nuanced than previous research has suggested.

Managerial Implications

Engagement with customers plays a crucial role in delivering innovation success. CI helps identify opportunities, improve the service concept, pinpoint alternative uses and at the same time ensure that service offerings are simple enough to be readily understood by the market. Reliance on market research to understand the customer could be problematic as such an approach may not uncover latent needs. This may be exacerbated if firms outsource market research. The project team will not gain the insights and thoughtful interpretations needed to create successful new services. Rather, knowledge should be generated through iterative probing and immersion in the community of customers. In practice, this could mean that the design team should observe and work with customers rather than employ surveys or online discussion groups.

The extent of CI requires a fine balancing act. CI needs to be more than a token effort or the knowledge generated will be disregarded. Customer needs are difficult to articulate and costly to transfer. At lows of CI most knowledge may 'stick' and not be absorbed. Managers disregard

new information that conflicts with prior patterns of knowledge. Instead the small bits of new knowledge that do transfer from customers may create ambiguity increasing uncertainty. At low levels of CI, CI will not be a mechanism to overcome existing perceptual biases. Learning should be based on different types of information to reduce ambiguity, implying that different customers should be involved via different methods.

However, in integrating customers too closely, there is a danger of creating perceptual blocks that make it harder to assimilate outside information and hence reducing the firm's ability to adapt the new service offering to the wider market's needs. Beyond a certain point, acquiring additional information from customers reveals relatively few or no new benefits, while incurring added costs to the project. This implies that firms must find a middle ground when involving customers and reinforces the messy nature of CI.

Furthermore, a danger of involving customers is that they will come up with too many ways to improve or change the project. Changes throughout the innovation process may result in a new service design completely different from what was initially intended. This can make initial investments obsolete, increase the cost of development and affect profitability. Extensive CI may invoke resistance from the project team towards input from customers if the changes are perceived to have serious operational efficiency considerations.

It may be the case that, by involving enthusiasts and innovative users, firms risk developing service concepts that only appeal to a niche market and may not "take off" in the mainstream market or that frequent interaction with customer may push the organization to make spur-of-the-moment changes which do not add real value. Ideas from customers may be overly conservative (hygiene factors rather than delighters) thereby limiting the benefits of CI. This gives support to the idea that service firms should drive customer needs rather than be driven by customer needs.

If firms do not have spare resources to cope with concept transformation, the quality of the execution of the service innovation may suffer. Managers will need to decide on the degree of concept change by making trade-offs between development constraints (e.g., budgets, schedules) and the likely impact of these changes on success. If the firm is not able to implement all the ideas from customers a considerable strain can be placed on the design team, and on the relationship between the team and the customers.

This has implications for the way firms allocate resources for development. There needs to be clear procedures for evaluating and prioritizing potential concept changes to reduce the scope for conflict. If firms have budgets and resource allocations that are tightly controlled from the outset of individual projects this is a recipe for problems. Rather firms need to move towards a portfolio oriented approach where resources can be swiftly moved between projects.

By actively managing CI, customer knowledge assimilation and concept transformation as an interconnected capability, the firm is better able to create new services that deliver customer value. Firms with well-developed customer involvement capabilities are likely to be more adept at sensing opportunities in the marketplace. Firms with a customer knowledge assimilation capability are able to create a rich and interpretive understanding of its customers, their needs and the ways in which services create value. Hence, they will be more adroit at converting opportunities based on latent customer needs into successful new service concepts. Firms which are deft at concept transformation are more likely to turn service concepts into service offerings that are accepted by the marketplace. However, this will only happen if there are resources available to enact changes during development.

Limitations and Future Research

This research has made an important contribution to our understanding of the role CI plays in service innovation success. A word of caution. CI is not a panacea for new service success. The relative low explanatory power of CI, in line with previous research (Carbonell, Rodríguez-Escudero and Pujari 2009; Cui and Wu, 2017), indicates that CI on its own cannot guarantee success. Indeed whilst CI has been identified as a key success for service innovation it was ranked only 21st out of the 36 success factors (Storey et al. 2015). This study is one of the first to explore the process by which CI is translated into new service success and the boundary conditions of this process. The results highlight the need for further research into how and in what circumstances CI can improve service innovation performance.

More nuanced measures of customer knowledge assimilation and concept transformation would help verify and extend this research. The direct effect of assimilation on success may reflect the value of new knowledge that confirms one is on the right track (Coviello and Joseph 2012). However this was not measured explicitly.

This research explored the co-design of the service concept however service innovation requires the design of service systems and service encounters (Patrício et al. 2011). Exploring the role of CI in the transformation of the design of service systems and service encounters would show where customers can make the greatest impact and may further demonstrate the relative importance of CI for new service success.

Future research could investigate the effects of CI in the early and late stages of innovation projects on customer knowledge assimilation and concept transformation. It is difficult for customers to provide valuable feedback to developers before the service concept reaches a certain degree of maturity (Witell, Gustafsson and Johnson 2014). It may be the case that rich or deep integration of a relatively smaller number of customers early in the process is sufficient to tap into customer needs, which can then be embedded in the service concept, whereas wider CI later in the process will enable firms to evolve the service concept.

This research demonstrated the contingent effect of resource slack and shows the importance of understanding the conditions under which CI leads to successful service innovation. Whilst resource slack is important as it enables flexibility in the face of customer inputs, other internal factors such as formalization of processes, employee capabilities or the degree of customer orientation may also affect the degree to which absorbed customer knowledge is acted upon.

This research takes a mass market view. Exploring the mechanisms by which CI impacts success in a customized service offering situation would clarify the generalizability of the findings. Also longitudinal studies of service design projects over the course of their lives would enable a greater understanding of how knowledge is acquired, assimilated and transformed.

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APPENDIX. ITEMS FOR MEASURING CONSTRUCTS IN THE MODEL

New Service Success (CR = 0.87, α = 0.80, AVE = 0.62, HSV= 0.12) ¹	
The degree of success in terms of the objectives for which it was developed ³	0.84
The degree of success in terms of meeting sales objectives. ⁴	0.84
The degree of success in terms of meeting financial objectives. ⁴	0.79
The degree of success in terms of increasing our market share. ⁴	0.68
Customer Involvement (CR = 0.93, α = 0.90, AVE = 0.73, HSV= 0.25)	
Customers were actively engaged with this project. ²	0.87
Customers were involved at every stage of the project.	0.84
There was a wide variety of customer involvement methods applied in this project.	0.88
A diverse range of customers were involved in this project.	0.76
<i>Frequency of contact between customers and our development team was high.</i>	-
Customer Knowledge Assimilation (CR = 0.90, α = 0.87, AVE = 0.65, HSV= 0.14)	
During this project we developed an improved understanding of our target customers.	0.80
... we fine-tuned our intuition of customer needs.	0.83
... we developed a deeper feeling for how customers use our services.	0.84
... we learnt more about what generates customer value.	0.78
... we discovered additional latent needs of which customers were unaware.	0.79
Concept Transformation (CR = 0.79, α = 0.60, AVE = 0.59, HSV= 0.25)	
The final service was different to our initial expectations due to customer knowledge developed during the project.	0.84
Customer knowledge created during this project was fully integrated in the new service.	0.73
Ideas of customers were directly incorporated into the new service.	0.67
<i>Customer knowledge collected during the project challenged the initial understanding of the service concept.</i> ⁵	-
Resource Slack (CR = 0.90, α = 0.834, AVE = 0.75, HSV= 0.05)	
We have uncommitted resources that can be allocated to our innovation initiatives if needed.	0.79
We have substantial resources available to fund our development initiatives.	0.91
We will have no problems obtaining resources at short notice to support innovation initiatives.	0.90
Environmental Uncertainty (CR = 0.91, α = 0.81, AVE = 0.84, HSV= 0.08)	
In our industry customer needs and preferences change rapidly.	0.93
In our industry it is difficult to predict changes in customer needs and preferences.	0.90
¹ α - Reliability coefficient; CR-Composite reliability; AVE-Average variance extracted; HSV-Highest shared variance.	
² Unless stated all items measured on Likert scale - (1) strongly disagree, (7) strongly agree.	
³ Scale: (1) major failure to (10) major success.	
⁴ Scale: (1) very unsuccessful (7) very successful.	
⁵ Scale item dropped during analysis	

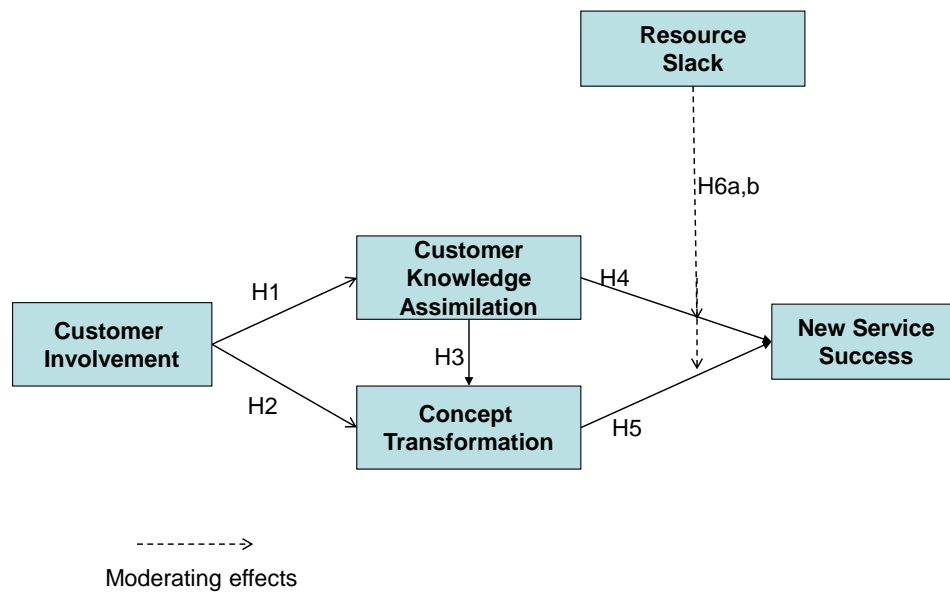


Figure 1. Conceptual model

Functional area:		Sectors:	
Marketing function	34%	Finance and insurance	24%
Innovation/Service development	27%	Information and communications	21%
Operations	19%	Travel/tourism	16%
Business development	14%	Other	38%
Level:		Market:	
Board members	9%	B2B	44%
Directors	26%	B2C	21%
Managers	49%	Both	35%

Table 1. Sample characteristics

	A. Success	B	C	D	E	F
B. Customer Involvement	0.19*	-				
C. Customer Knowledge Assimilation	0.34*	0.38*	-			
D. Concept Transformation	0.19*	0.50*	0.37*	-		
E. Resource Slack	0.22*	0.22*	0.22*	-0.03	-	
F. Environmental Uncertainty	0.29*	0.17+	0.15+	0.07	0.21*	-
Mean	5.6	3.2	5.1	4.0	3.9	4.3
(s.d.)	(1.1)	(1.7)	(1.2)	(1.3)	(1.4)	(1.4)

+significant at 10% level, *significant at 5% level.

Table 2. Latent variable correlations

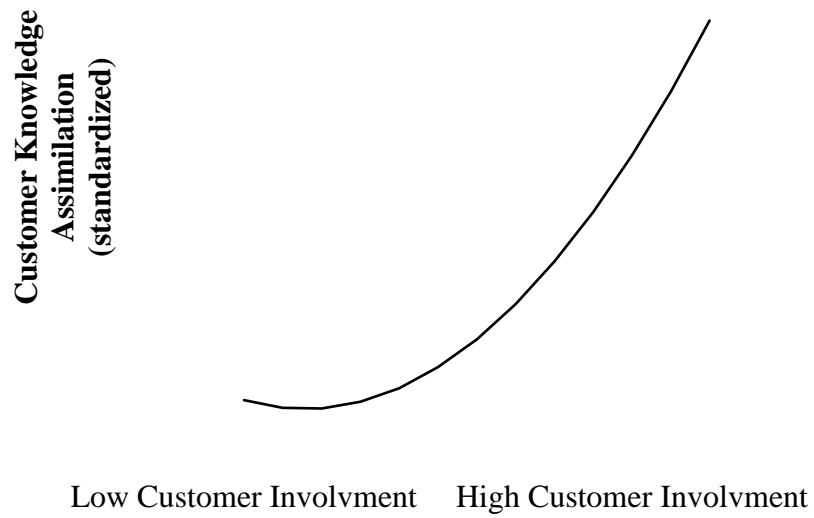
Table 3. PLS results

Path	Model:	<u>M1</u>	<u>M2</u>	
		Path Coef. (t-value)	Path Coef. (t-value)	
Customer Involvement → Customer Knowledge Assimilation		0.41 (5.46)*	0.42 (5.89)*	H1a: Yes
Customer Involvement → Concept Transformation		0.42 (5.45)*	0.42 (5.56)*	H2b: Yes
Customer Knowledge Assimilation → Concept Transformation		0.20 (2.38)*	0.21 (2.62)*	H3: Yes
Customer Knowledge Assimilation → New Service Success		0.25 (2.61)*	0.25 (2.58)*	H4: Yes
Concept Transformation → New Service Success		0.09 (1.22)	0.08 (1.18)	H5: No
Resource Slack → New Service Success		0.12 (1.53)	0.12 (1.57)	
Environmental Uncertainty → New Service Success		0.22 (2.52)*	0.24 (2.89)*	
Customer Involvement ² → Customer Knowledge Assimilation			0.19 (2.42)*	H1b: No
Customer Involvement ² → Concept Transformation			-0.24 (3.45)*	H2b: Yes
Resource Slack x Customer Knowledge Assimilation → New Service Success			0.03 (0.38)	H6a: No
Resource Slack x Concept Transformation → New Service Success			0.23 (2.76)*	H6b: Yes
<u>Variance Explained</u>		<u>R²</u>	<u>R²</u>	<u>F change</u>
Customer Knowledge Assimilation		0.17	0.21	4.6 (0.03)
Concept Transformation		0.29	0.35	11.3 (0.00)
New Service Success		0.19	0.26	5.3 (0.01)

* Path significant at $p < 0.05$ (2-tailed)

Table 3. PLS results

(a) Relationship between customer involvement and customer knowledge assimilation



(b) Relationship between customer involvement and concept transformation

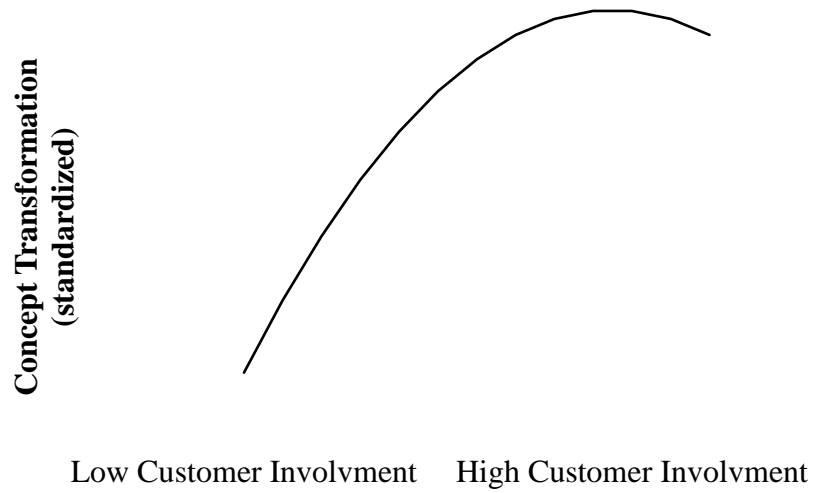


Figure 2. Quadratic effects of customer involvement

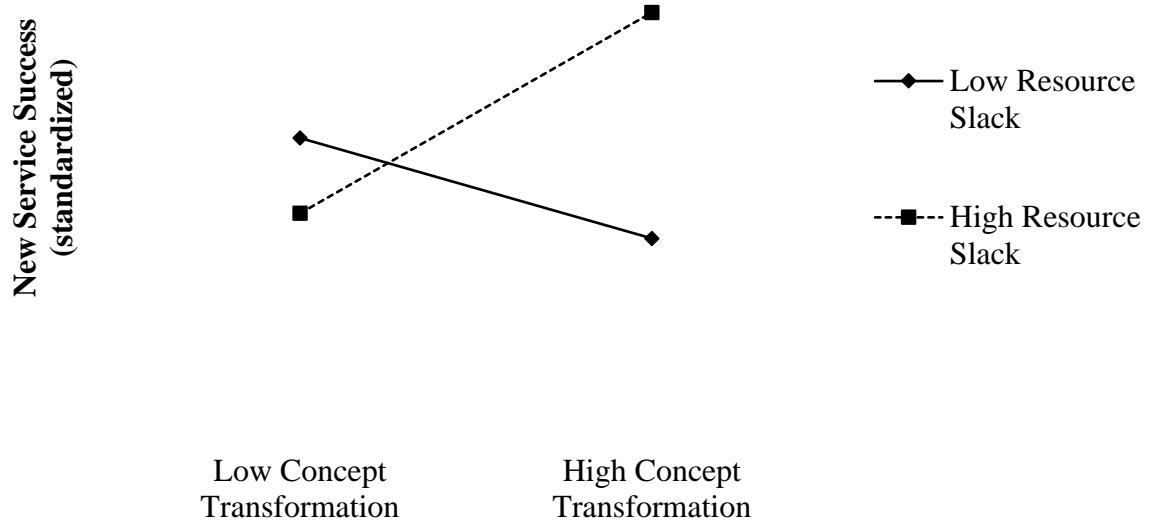


Figure 3. Moderation effect of resource slack