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**Customer Involvement in New Service Development: An Examination of Antecedents and Outcomes**

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## Abstract

Customer involvement has been recognized as an important factor for successful service development. Despite its acknowledged importance, a review of the literature suggests that there is little empirical evidence about the effectiveness and outcomes of interacting with customers while developing new services. Similarly, the extant literature shows mixed views about the effect of technological uncertainty on customer involvement, and the effectiveness of customer involvement at different stages of the new service development process.

Against this backdrop, the present study has three objectives: 1) to investigate the effects of customer involvement on operational dimensions (i.e. innovation speed and technical quality) and market dimensions (i.e. competitive superiority and sales performance) of new service performance, 2) to examine the effect of technological novelty and technological turbulence on customer involvement, and 3) to explore the moderating effect of the stage of the development process on the relationships between technological novelty, technological turbulence and customer involvement, and customer involvement and new service performance.

A total of 807 firms with 75 or more employees in a varied set of industries were selected from the Dun & Bradstreet's (2004) listing of Spanish service firms. A questionnaire was mailed to the person in charge of new service development at each company. One hundred and two complete questionnaires were returned. Findings reveal that whereas customer involvement has a positive direct effect on technical quality and innovation speed, it has an indirect effect on competitive superiority and sales performance through both technical quality, and innovation speed. The study also finds a positive effect of technological novelty as well as technological turbulence on customer involvement. Contrary to expectations, the study does not find any moderating effects of the stage of the development process.

This study has several theoretical and managerial implications. In terms of theoretical implications, the study supports the role of technological uncertainty (novelty and turbulence) as an antecedent to customer involvement. It also provides empirical evidence of the impact of customer involvement on several measures of new service performance. In terms of managerial implications, the study offers critical insights on how customer involvement in new service development gets translated into improved new service performance. Customer involvement in new service development will lead to increased market outcomes but the relationship is not direct. Improved market outcomes are achieved through innovation speed, and technical quality. Furthermore, the results reveal that the importance of customer involvement in technologically uncertain contexts and its impact on new service performance are independent of the stage of the development process, suggesting that managers should involve customers throughout the entire development process.

**Customer Involvement in New Service Development: An Examination of Antecedents and Outcomes**

## Introduction

New service development is increasingly becoming a critical aspect of business strategy in both service and non-service industries (Menor et al., 2002). As the economies world over become more service-oriented, firms recognize the need to compete on the basis of new service offerings (Bitnet et al., 2000).

Customer involvement has long been considered important for successful product/service development (Alam, 2006; Cooper, 2001). Despite its acknowledged importance, there has been little empirical work about the effectiveness and outcomes of interacting with customers (Brockhoff, 2003; Campbell and Cooper, 1999). Extant studies on the subject are mainly descriptive and typically evaluate the impact of customer involvement on individual measures of new service performance (e.g., overall performance, sales or market share). The result is a unidimensional and incomplete view of the outcomes of customer involvement. A more robust model would include a broader range of performance criteria reflecting operational and market outcomes of the service development effort (Menor et al., 2002). To the extent that customer involvement is a critical issue for new service development (Matthing et al., 2004; Alam 2006,), there is a pressing need to explore the wider performance benefits associated with engaging customers in the new service development process.

Technology plays a critical role in new service development. For one thing, many service innovations use technological advancements as a means of creating new and improved services (Hipp and Grupp, 2005). For another, the rapid pace of change in technologies is causing constant shifts in the way the services are designed and delivered (Leek et al., 2003). It is argued that customer involvement in the development process could help reduce the uncertainty created by technological changes, and the application of new technologies to the development of new services. Yet, researchers hold ambivalent beliefs about the effect of technological uncertainty on customer involvement in innovation activities (Li and Calantone, 1998). Further empirical investigation is necessary.

In assessing the impact of customer involvement, it is important to consider the stage of the development process where the customer interaction takes place (Alam, 2002). It is argued that customer involvement is more effective the earlier it is conducted in the development process (Alam, 2006; Dahlsten, 2004). However, views are mixed with regards to the relevance of customer involvement in the early stages of the development of projects that incorporate highly innovative technologies. With the exception of a few studies (e.g. Alam 2002; Gruner and Homburg, 2000), there is a shortage of empirical research employing a decompositional approach to examining the significance and performance effects of customer involvement at various stages of the development process.

Against this backdrop, the present study has a three-fold objective: (1) to develop a deeper understanding of the performance implications of customer involvement. Specifically, the study investigates direct and indirect effects of customer involvement on operational and market dimensions of new service performance, (2) to examine the effect of technological uncertainty on customer involvement, and (3) to explore the moderating effect of the stage of the development process on the relationships between technological uncertainty and customer involvement and customer involvement and new service performance.

## Theoretical Framework and Hypotheses

Customer involvement in service innovation refers to the extent to which service producers interact with current (or potential) representative(s) of one or more customers at various stages of the new service development process (Alam, 2006; Matthing et al., 2004). In this study, the term '*customer involvement'* is similar to what other authors have labeled *customer interaction* (Alam, 2006; Gruner and Homburg, 2000), and *customer partnerships* (Campbell and Cooper, 1999), but dissimilar to the phenomenon of *mass customization* (Kaplan and Haenlein, 2006).

Resource dependence theory, in conjunction with the literatures on market orientation and new product development, provides theoretical and empirical background to support the proposition that customer involvement has a positive impact on new service performance. According to the resource dependence theory, information on customer needs and user experiences might be viewed as resources companies depend upon for successfully developing new products. From this perspective, cooperation with customers can be seen as a bridging strategy to secure access to the critical resource of information on customer needs (Gruner and Homburg, 2000; Salomo et al., 2003). One recurring theme in the market orientation and new product literatures is that a strong customer orientation is fundamental to superior new service performance (Athuahene-Gima, 1996; de Brentani, 1995).

New service performance is a multidimensional construct that reflects both operational effectiveness and marketplace competitiveness (Menor et al., 2002). Following Tatikonda and Montoya-Weiss (2001), this study distinguishes between operational outcomes and market outcomes measures of new service performance. Operational outcomes measures focus on project work execution and typically assess the development effort from an internal perspective. Market outcomes measures reflect the market success of the given new service development effort and assess the development effort from an external perspective. For this study, two important operational outcomes are considered: innovation speed and technical quality (Atuahene-Gima, 2003). Innovation speed refers to the pace of activities between idea generation and market launch (Kessler and Bierly, 2002). Technical quality describes the service's conformance to specifications or performance and its reliability (Garvin, 1987). According to Menor et al. (2002), speed and quality are central operational outcomes of a service development effort given the shortening period of advantage common to many new services, the difficulty in aligning service concepts with customer requirements, and that the development processes for services tend to be less formalized. Market outcomes include competitive superiority and sales performance. Competitive superiority is defined in terms of what the customers receive (service outcome) and the company interface that the customers experience (service experience). Sales performance taps the sales, sales growth and market share performance of a new service (de Brentani, 1989). Drawing on the preceding conceptualization of new service performance, Figure 1 posits the following effects: (i) direct effects of customer involvement on innovation speed and technical quality (i.e. operational outcomes), (ii) direct effects of customer involvement on competitive superiority and sales performance (i.e. market outcomes), and (iii) the influence of innovation speed and technical quality on competitive superiority and sales performance.

The current study examines the relationship between new project managers' perceptions of technological uncertainty and their perceptions of interaction with customers. Perceived technological uncertainty refers to an individual's perception that he or she is unable to accurately predict or completely understand some aspects of the technological environment. In new product development efforts, project managers may have perceptions of technological uncertainty regarding the application of new technology to the current development project or regarding impeding changes in that technology (Song and Montoya-Weiss, 2001). Thus, two aspects of perceived technological uncertainty are considered in this study: technological newness or novelty, and technology turbulence. The distinction is important since technological novelty and technological turbulence represent different sources of uncertainty (Chen et al., 2005). Drawing on the preceding discussion, Figure 1 outlines the direct effects of perceived technological novelty and perceived technological turbulence on customer involvement.

From a normative point of view, the new service development process is comprised of multiple, iterative stages. Particularly, scholars have defined two macro stages in the development process: the “fuzzy front-end” and the “execution oriented back-end” (Menor et al., 2002). Here, it is argued that the significance of customer involvement in technologically uncertain contexts and the performance implications of customer involvement might vary with the stage of the development process. Accordingly, Figure 1 posits a potential moderating effect of the stage of the development process on the following relationships: technological novelty-customer involvement, technological turbulence- customer involvement, customer involvement-operational measures of new service performance, and customer involvement-market measures of new service performance. To our knowledge, no study has ever examined these multiple effects in the context of service innovation.

Figure 1. Theoretical framework

*Customer involvement and new service performance*

*The impact of customer involvement on operational outcomes*

A number of scholars have highlighted the significance of customer involvement in improving the technical quality of innovations. From the market orientation literature, Pelham and Wilson (1996) contend that firms emphasizing activities that seek to understand customer needs and satisfy those needs should produce products with lower defect levels. Pelham and Wilson's (1996) study reports a positive relationship between market orientation and the perceived level of relative product quality. Within the literature in new product/service development, Cooper (2001) notes that technical problems often stem from a lack of understanding of the customer requirements. In a similar vein, Voss (1992) reports that failure to understand customer needs will lead to poor service quality. Salomo et al.'s (2003) study shows a positive relationship between customer orientation in development activities and new product's technical performance.

H1a: Customer involvement in new service development has a positive impact on technical quality.

Close interaction with customers during the development process can also reduce development cycle time. Literature on market orientation suggests a potential positive effect of customer involvement on innovation speed. For example, Slater and Narver (1995) contend that the ability to gather information from customers gives companies an advantage in the speed and effectiveness of their response to opportunities and threats. Within the new product development literature, Cooper (2001) asserts that the seeking of continual customer feedback during development validates and confirms the product design, thereby minimizing last-minute changes. Vandenbosch and Clift's (2002) in-depth study of the Galileo project at Nortel Networks finds continual customer involvement and feedback throughout the development process to be an important part of accelerating product development. In a similar vein, Souder et al. (1998) report a positive impact of R&D/customer integration on reduced cycle time.

H1b: Customer involvement in new service development has a positive impact on innovation speed.

*The impact of customer involvement on market outcomes*

The development of superior products requires that customer information be fed into the development process (Cooper, 2001). Literature in new service/product development suggests that interaction with customers can provide a more accurate and complete assessment of users' needs and wants, avoid the development of unacceptable or unimportant features, and improve users' understanding of the new service which, in turn, can lead to the development of a differentiated and superior service (Alam, 2002). Dahlsten (2004) noted how customer involvement in the XC90 project at Volvo cars created improved value for the target customer.

H1c: Customer involvement in new service development has a positive impact on competitive superiority.

Available empirical evidence suggests that customer involvement in service innovation enhances sales performance. Thus, Martin and Horne (1993) reported a positive relationship between customer participation in the development process and the degree of commercial success of service innovations. Gales and Mansour-Cole (1995) found that user involvement is positively related to the successful sale of new technology.

H1d: Customer involvement in new service development has a positive impact on sales performance.

In spite of the existing evidence, customer involvement's influence on market success is a subject of debate. For example, Campbell and Copper (1999) showed no significance differences between customer partnerships and in-house projects on various indicators of market performance. In an attempt to shed some light into this research matter, the present study examines the intervening role of operational outcomes (i.e. innovation speed, technical quality) on the relationship between customer involvement and market outcomes (i.e. competitive superiority and sales performance). As put forward by Tatikonda and Montoya-Weiss (2001), operational outcomes represent key service-intrinsic characteristics that influence market outcomes.

H2a-b: Innovation speed and technical quality mediate the effects of customer involvement on competitive superiority.

H2c-d: Innovation speed and technical quality mediate the effects of customer involvement on sales performance.

*Technological uncertainty and customer involvement*

*The impact of technological novelty on customer involvement*

Technological novelty, a dimension of technological uncertainty, refers to the newness of the technology embodied in the new service. Technological novelty creates inefficiencies in the development process because tasks are less straightforward and are non-routine (Song and Montoya-Weiss, 2001). It is argued that technology novelty is positively related to customer involvement in new service development. When technological newness is high, the new product development manager will struggle to simply understand the technology and its application or to establish standards (Song and Montoya-Weiss, 2001). Lin and Germain (2004) found a positive relationship between the new product's technological content and the extent to which firms heed customers in designing products. Similarly, Gales and Mansour-Cole (1995) reported a positive relationship between technology newness and the frequency of customer involvement.

H3a: The perceived technology novelty has a positive impact on customer involvement in new service development.

*The impact of technological turbulence on customer involvement*

Technological turbulence, the second dimension of technological uncertainty, taps the extent to which technology in an industry is in a state of flux (Jaworski and Kohli, 1993). A review of the literature suggests that researchers hold ambivalent beliefs about the effect of technological turbulence on customer involvement in innovation activities. On the one hand, Narver and Slater (1990) argue that when technology experiences rapid changes, it is imperative for firms to interact with customers because customer needs and preferences can provide direction for a changing product market. On the other hand, Jaworski and Kohli (1993) suggest that, when technology undergoes speedy evolution, the importance of customer information generation might be diminished because customers may know little about the nascent technology, and therefore, close interaction with customers will provide little insight into the emerging markets (Li and Calantone, 1998). Empirical evidence on the potential effect of technological turbulence on customer involvement is also conflicting. Thus, whereas Li et al., (1999) observe that the speed of technology change is positively related with a firm's focus on learning about their customers' needs and preferences for new products, Lin and Germain (2004) report a lack of association between technological turbulence and customer involvement in product development. Given the costs related to changing technologies, the present study argues that conditions of greater technological turbulence should necessitate greater customer involvement. An understanding of customer concerns and future preferences may also help firms demystify future trends (Lin and Germain, 2004).

H3b: The perceived technological turbulence has a positive impact on customer involvement in new service development.

*The moderating effect of the stage of the development process*

*Moderating effect on the technological novelty-customer involvement relationship*

A review of the literature reveals contradictory views on the appropriate role of customers in the early stages of the development of technologically innovative products. While, several scholars note that customers do not represent a useful source of information in the early phases of the development of radical innovations (Veryzer, 1998), others argue that new technology products are best developed through early and in-depth involvement of customers (Neale and Corkindale, 1998). On balance, it is expected that firms developing technologically innovative services would engage customers to a lesser extent in the early stages of the development process. The reasons for this stem in part from the difficulty of conveying to customers a true sense of the potential of radically new services and the limitations necessitated by secrecy concerns (Veryzer, 1998).

H4a: Firms developing technologically innovative services will engage customers to a lesser extent in the earlier stages of the development process.

*Moderating effect on the technological turbulence-customer involvement relationship*

Technological turbulence increases the level of uncertainty associated with the earlier stages of the development process. Early strategic decisions such as whether to commit to an emerging technology or product process can be especially challenging in rapidly changing environments as it is difficult to predict the importance of changes in the environment at the time they occur

(Calantone et al., 1997). Gupta and Wilemon (1990) describe how uncertainties concerning what technologies are appropriate can result in costly delays. Thus, it is expected that companies facing highly turbulence environments would interact with customers to a greater extent in the front-end versus the back-end of the development process. To date, no empirical study has examined this.

H4b: Firms facing technologically turbulent environments will involve customers to a greater extent in the earlier stages of the development process of a new service.

### *Moderating effect on the customer involvement-new service performance relationship*

It is argued that most projects do not fail at the end, they fail at the beginning. Khurana and Rosenthal (1998) contend that the real key to product development success lies in the performance of the front-end activities. Early stages lay down the foundations on which the overall new service development project is built (Cooper, 2001). These stages are more important, more complex and more time consuming than all other stages of new service development process (Alam, 2006). It is because of this complexity and fuzziness that customer involvement is more important in the front-end than the back-end of the innovation process (Dahlsten, 2004; Martin and Horne, 1993).

H5a-d: Customer involvement has a greater positive impact on new service performance (i.e. operational and market outcomes) in the earlier stages of the development process than it has in the later stages of the development process.

## Methodology

### *Sample and data collection*

A total of 807 service firms were drawn from the Dun & Bradstreet (2004) directory of Spanish service firms, which provided a list of 3,228 service companies. Only firms with 75 or more employees were chosen on the basis that large firms are more likely to have established new product development procedures as opposed to smaller firms with more idiosyncratic practices (Alam, 2002). Firms were randomly selected by a sampling procedure that stratified by eight industry groups: utilities, retail trade, transportation and warehousing, information industries, finance, banking and insurance, professional, scientific and technical services, administrative and support services, and health care and social assistance. Table 1 shows the total number of companies in the Dun & Bradstreet listing, the population and the sample for each industry group (stratum). The results of two-sample proportions tests reveal significant differences between the proportion of firms in the sample and the population for the retail trade, and finance and insurance sectors at $p<0.10$. Particularly, firms in the retail trade industry are under-represented in the sample whereas firms in the finance and insurance industry are over-represented. These results are in keeping with findings from the 2003 COTEC Report on Technology and Innovation in Spain which indicates higher (46.4%) and lower (12.9%) percentages of innovative firms in the finance and insurance, and retail trade sectors, respectively, compared to the average percentage of innovative firms for all service sectors (32.8%).

A questionnaire accompanied by a hand signed cover letter and a postage paid return envelope was mailed to the person in charge of new service development at each company. The unit of analysis was the new service project. Respondents were asked to select a new service in whose development potential customers/users had participated.

A total of 102 complete questionnaires were returned which indicates a response rate of 12.6%. Although this response rate is not as high as one might wish, it is consistent with other studies on new product development. To test for nonresponse bias, early with late respondents were compared as suggested by Armstrong and Overton (1977). No significant differences were found in the main constructs examined in this study at $p<0.10$[i]. Table 2 shows the sample characteristics.

Because the sample was drawn from different industries, ANOVA and Tukey's multi-comparison post-hoc tests were conducted to identify differences in the means of the main constructs in relation to the industry. Results reveal no significant differences for any of the main constructs of the study at $p<0.10$. A similar analysis was done to test for differences in the main variables in relation to the type of market served by the new service (i.e. consumer vs. industrial). Results indicate that no significant differences exist at $p<0.05$. Together these results suggest that industry- and market-related biases were not a major problem.

*Measures*

A pool of items was generated for measuring each of the constructs using literature search and interviews with academics and practitioners. Customer involvement was operationalized through four items: frequency of meetings with customers, extent of consultation with customers, representation of customers in the project team and, number of customer involvement tools used (Alam, 2002; Gales and Mansour-Cole, 1995; Gruner and Homburg, 2000). Four stages in the new service development process were identified: idea generation, service design which includes the design of the service concept and service process, service testing, and market launch (Voss, 1992). Customer involvement was measured for each stage. Technological turbulence was measured by two items adopted from Jaworski and Kohli (1993). Three items from Avlonitis et al., (2001)'s service innovativeness scale were used to measure technology novelty. Sales performance and competitive superiority were operationalized with multi-item scales adapted from de Brentani (1989). Innovation speed was measured through three items borrowed from Kessler and Bierly (2002). Technical quality was measured by two items adapted from Gronroos (1984). Overall, items were measured using a five-point Likert-type scale (1= strongly disagree to 5= strongly agree) except for the item ‘number of customer involvement tools used’ measured as the sum of the number of tools applied at each stage. Nine customer involvement tools were listed for each stage: lead user, ethnography, building future scenarios, face-to-face interviews, visits to users’ sites, phone, fax, and e-mail, user observation, focus groups, and weekend retreat (Alam, 2002). Measures and descriptives of all variables are shown in Table 3.

*Unidimensionality, reliability and validity*

Two types of measures were used in this survey: formative multi-item measures and reflective multi-item measures. If a construct was a summary index of observed variables, a formative measurement model was used. In this case, observed variables cover different facets of the construct and cannot be expected to have significant inter-correlations. In contrast, if observed variables were manifestations of underlying constructs, a reflective measurement model was used (Diamantopoulos and Winklhofer, 2001). Based on our understanding and conceptualization of the variable customer involvement, it appears appropriate to use formative measurement approaches for this construct. The reflective multi-item measures used were innovation speed, technical quality, competitive superiority, sales performance, technological turbulence and technological novelty.

The internal consistency, reliability and convergent validity of the reflective scales were investigated by performing a confirmatory factor analysis using AMOS 5.0. The results of the measurement model indicate a good fit to the data ($\chi^2$ = 174.574, DF = 89, p =0.000, Comparative Fit Index (CFI) = 0.96, Normed Fit index (NFI) = 0.98, Root Mean Square Error of Approximation (RMSEA) = 0.09). An inspection of alpha coefficients reveals that all values were equal or greater than 0.71 which indicates good reliability. Composite reliabilities estimates exceeded the standard of 0.6 suggested by Bagozzi et al. (1991), with the exception of innovation speed, which had a composite reliabilility slightly below 0.6. Values of average variance extracted provided satisfactory results. Standardized item loadings for all constructs were greater than 0.5 and significant ($p<.05$), which evidences good convergent validity (Bagozzi et al., 1991). The discriminant validity was assessed across the scales by respecifying the initial measurement model in a series of constrained models in which each intertrait correlation was constrained to unity. In every instance the constrained models showed a worse fit and the difference in $\chi^2$ value between each of the constrained models with the baseline measurement model was found to be significant, thus providing evidence of discriminability. Together the results of the tests suggest that the reflective scales used in this study possess sufficient unidimensionality, reliability and validity (Table 3).

Bollen and Ting (2000) suggest employing the vanishing tetrad test for assessing formative measuring scales. This test provides an empirical assessment of whether a formative or reflective scale specification is appropriate. Tetrads, in this context, refer to the difference between the product of a pair of covariances and the product of another pair among four measurement scale items. In reflective measurement scales, the difference between the covariance products is, by definition, equal to zero. With formative measurement scales this is, by definition, not true unless the individual covariances themselves are zero (Bollen and Ting, 2000). Based on these particulars, five vanishing tetrad tests were performed – one for each of the stages of the development process and another for the overall construct of customer involvement – using the program CTANEST1.mac in SAS. Results from the tests confirm the validity of customer involvement as a formative scale for four of the five tests conducted. The tetrad chi-square value was not significant for the customer involvement construct associated with the launch stage (see tetrad chi-square values in Table 3)[ii].

Before testing the model, scale items were averaged to create a single measure of each construct. In relation to the customer involvement construct, since the constituent items were measured with different scales, the items were standardized and then averaged. An overall measure of customer involvement was created by combining the scale values for each stage of the development process. Table 4 exhibits means, standards deviations and zero-order correlations for the model constructs.

*Model estimation*

Path analysis (AMOS 5.1.) was used to test the model shown in Figure 1[iii]. The choice of path analysis over structural equation modeling was based on the study's small sample size. Path analysis with composite variables can be applied in small samples, yielding correct small-sample standard errors (McDonald, 1996). Model parameters were estimated using the Maximum-Likelihood (ML) method. The assumption of multivariate normality was tested using Mardia's (1970) multivariate kurtosis statistic. The large value of Mardia's statistic signaled the presence of non-normality. In the absence of multivariate normality, Yung and Bentler (1996) recommend using a bootstrap procedure to derive confidence intervals around the parameter estimates. For this purpose, two thousand samples of observations were randomly generated from the original data set with replacement.

To strengthen the accuracy of the estimation results, the model was re-estimated using unweighted least square (UWLS) (AMOS 6.0) and partial least square (PLS-Graph). Table 5 presents the parameter estimates produced by ML, UWLS and PLS for the initial model. The analysis of the comparison of the results indicates that ML, UWLS and PLS provide similar significance levels for hypotheses H1a-H1d and H3b. A small discrepancy was found in p-values in relation to hypothesis H3a. Given that UWLS estimates tend to be less efficient and more sensitive to large differences in the scales of measurement than ML estimates (Wu and Carroll, 1988), it appears that ML should be preferred to UWLS. Following, we report the results based on ML estimates.

**Results based on ML estimates**

*Antecedents and outcomes of customer involvement*

Because of the study's small sample size, a post-hoc power analysis was performed to determine the appropriate alpha-level for the path analysis. Power values were calculated for each dependent variable in the path model using the G*POWER 3 computer software. In all instances, power values for a medium effect size and Type I error ($\alpha$) of 0.05 exceeded Cohen's (1988) recommended criterion of 0.80. Hence, an alpha-value of 0.05 seems appropriate to judge the statistical significance of this analysis.

Hypotheses H1a and H1b posited that customer involvement would have a positive direct effect on technical quality and innovation speed respectively. These predictions are supported ($b=0.26$, $p<0.01$; $b=0.24$, $p<0.05$). Contrary to expectations, results showed a lack of relationship between customer involvement and competitive superiority, and between customer involvement and sales performance. Hypotheses H1c and H1d are rejected.

Hypothesis H3a, which anticipated a positive effect of technological novelty on customer involvement, is marginally accepted ($b=0.21$, $p=0.06$)[iv]. Consistent with hypothesis H3b, technological turbulence is related positively to customer involvement ($b=0.32$, $p<0.01$).

Indirect effects of customer involvement on competitive superiority and sales performance were tested using a bootstrapping procedure. Results show a significant indirect effect of customer involvement on competitive superiority ($b=0.10$, confidence interval [0.02 - 0.19], $p<0.05$). The indirect effect of customer involvement on competitive superiority is actualized through two routes: (1) technical quality, and (2) innovation speed. Hypotheses H2a-b are supported. Results also indicate a significant indirect effect of customer involvement on sales performance ($b=0.10$, confidence interval [0.02 - 0.22], $p<0.05$). This effect is realized through the route of technical quality, which provides support for hypothesis H2d. Hypothesis H2c, which predicted an indirect effect of customer involvement on sales performance through innovation speed is, however, rejected.

In an attempt to improve parsimony, beginning with the least significant path, one by one the nonsignificant paths were removed from the initial model, and the model reestimated. The revised model produced a good fit to the data ($\chi2 = 16.4$, DF= 11, $p =.13$, NFI =.99, CFI = .99, RMSEA = .07).

*Moderating effect of the stage of the process*

Hypotheses H4a-b and H5a-d predicted a moderating effect of the stage of the development process on the relationships between technological turbulence and customer involvement, technological novelty and customer involvement, and customer involvement and each performance measure. To test for this effect, a subgroup analysis was conducted. For the subgroup analysis, path analysis was used to provide parameter estimates for each of the stages of the development process. Table 6 shows the parameter estimates for each stage. To formally test for the equality of the estimates across the four stages of the development process, pairwise comparisons were conducted. Pairwise comparisons were based on the chi-square difference test. Results indicate that chi-square difference values (DF=1) were not significant for any of the thirty six possible pairwise combinations. Based on these findings, it is concluded that the parameter estimates for the relationships between technological turbulence and customer involvement, technological novelty and customer involvement, and customer involvement and each performance measure are equivalent across the stages of the development process. Therefore, hypotheses H4a-b and H5a-d are rejected.

## Discussion

This study offers some important insights in relation to customer involvement's impact on new service performance. In particular, our results show that customer involvement does not predict the market performance of new service projects. No direct relationships were found between customer involvement and the competitive superiority and sales performance of new service projects. However, this is not to say that customer involvement in new service development has no value. Actually, the study shows that rather than having a direct effect on market outcomes (competitive superiority and sales performance), customer involvement has an indirect effect by positively affecting operational outcomes (technical quality and innovation speed). Further, the results appear to suggest that the mediating effect of operational outcomes with respect to market outcomes involve complete mediation rather than partial mediation. Overall, these findings support prior empirical research indicating that there is no compelling reason for customer involvement to have a direct impact on the ultimate success of innovations, beyond its effects on some of the drivers of new product performance (Athuahene-Gima, 1996; Campbell and Cooper, 1999). As shown in this study, customer involvement improves market performance by means of positively affecting the service's technical quality and the speed of the development process. An additional finding is that customer involvement's impact on new service performance is independent of the stage of the development process. This provides support for Cooper's (2001) advice to seek customer input and feedback at every step of the way throughout the entire development process.

As hypothesized, our results show that the greater the newness of the technology embodied in the new service, the greater the degree of customer involvement throughout the development process. Developing technologically innovative services is a process characterized by many questions and usually too few answers. Firms developing services with highly innovative technologies will be more active in the search for customer input and allow users to play a more important role in the development process. Furthermore, our results indicate that customer involvement's importance for technologically innovative services is independent of the stage of the development process. In sum, in this study firms developing technologically innovative services seek to engage and involve customers throughout the entire development process, from beginning to end. In a sense, this result contradicts findings from previous studies on the usability of customer input in the development of technologically innovative products. It has traditionally been argued that customers do not represent a useful source of information in the development of projects incorporating new technologies, especially in the early stages of the development process (Veryzer, 1998). A number of factors explain the departure of our results from the above-mentioned literature. Technologically innovative services can be developed more easily and quickly than technologically innovative products, and involve lesser effective use of patents (de Brentani, 1989). The cumulative effect of these factors is that market competition is likely to be more intensive for technologically innovative services. Increased market competition means that a greater degree of customer involvement would be required for technologically innovative services compared to technologically innovative products (Atuahene-Gima, 1996).

In accordance with the literature review, the results reveal that technological turbulence is positively related to customer involvement. As perceptions of technological turbulence increase, firms are more likely to involve customers in the development process. Given the costs related to changing technologies, customer feedback and customer collaboration are key to assessing technology feasibility and reducing investment risk (Lin and Germain, 2004). With respect to the moderating effect of the stage of the development process, findings indicate that the stage of the development process does not have a significant influence on the impact of technological turbulence on customer involvement. This finding is consistent with Mullins and Sutherland (1998).

## Implications, limitations and future research

This study offers critical insights on how customer involvement in new service development gets translated into improved new service performance. Our results indicate that the real value of customer involvement lies not in its commercial outcomes but in its potential to speed up the development process and improve service's technical quality. Product and marketing managers will do well to appreciate that customer involvement in new service development will lead to increased market outcomes but the relationship is not direct. Improved market outcomes are achieved through innovation speed, and technical quality.

Overall, the study advances research in new service/product development in three important ways. First, the study confirms the role of technological uncertainty (novelty and turbulence) as an antecedent to customer involvement. To date, evidence on the relationship between technological uncertainty and customer involvement has been conflicting. Second, the study proposes and tests a nomological network of relationships between customer involvement and several measures of new service performance. It also provides empirical evidence on the mediating effects of technical quality and innovation speed in the relationship between customer involvement and market outcomes (competitive superiority and sales performance). Third, the study offers further insights on the moderating effect of the stage of the development process. The results reveal that the importance of customer involvement in technologically uncertain contexts and its impact on new service performance are independent of the stage of the development process.

This study has some caveats. First, given the diversity of service sectors involved in the study, our analysis was based on perceptual data. Objective values can only be interpreted within the framework of a particular type of industry. Undoubtedly, perceptual data can be subject to bias, and consequently our findings must be interpreted with caution. Second, a single key informant provided the data in each company for independent and dependent variables. While it is not our intent to minimize the potential effect of response bias, it is believed that this bias was not a major problem in our sample. Thus, the study provided evidence of discriminant validity between the constructs. Moreover, results from the Harman's one-factor test showed that there were seven factors with an eigenvalue greater than 1 and that the first factor only accounted for 26.55% of the total variance explained. Nevertheless, it is important that futures studies validate these findings using multiples data sources. Third, the response rate is relatively low. Still, there are some reasons to believe that the response rate did not jeopardize the representativeness of our sample. Armstrong and Overton's (1977) test provided some indication of the absence of non-response error. The sample included a wide range of services sectors and companies of different sizes. Variances in both dependent and independent variables seem to suggest that specific types of companies were not targeted. Fourth, as shown by Coffman and MacCallum (2005), averaging all the scale items of the same construct prior to conducting the path analysis can lead to significantly biased parameter estimates. Fifth, failure to detect a moderating effect for the stage of the development process could be attributable to the research procedures used in this study and the fact that our sample size is not overly large. McClelland and Judd (1993) have noted that it is difficult to detect interactions in field studies using regression-based procedures and small sample sizes. Therefore, it is perhaps not surprising from a research-methodology point of view that interactions were not observed for the stage of the development process. Finally, the context of the study (Spain) put constraints on the generalizability of the results to other national contexts. However, our use of a country other than the United States does increase our understanding of the role of customer involvement in new service development in other contexts and helps to demonstrate the universality and global importance of the concept. Future research that replicates this study in other national contexts may provide interesting insights.

It would be desirable to examine three extensions of our model. First, future studies could use different measures of operational and market outcomes such as development cost, customer satisfaction or profitability. Second, researchers could examine the direct and moderating effects of various market conditions (i.e. competitive intensity, market potential and market uncertainty). Third, it will be interesting to investigate the performance implications of the type of customer involved at different stages of the development process.

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## Endnotes

[i] Because of the study's low sample size, a series of post-hoc power analyses were completed to determine the p-values for the statistical analyses included in the study. Power calculations were conducted using the G*POWER 3 computer software (Faul et al., 2007) and based on Cohen's (1988) conventional values for medium effect sizes. These power analyses resulted in two different alpha-levels (5% and 10%), which have been used in parallel depending on the statistical power of the associated test.

[ii] Although a nonsignificant tetrad chi-square value was reported for the customer involvement scale associated with the launch stage, a decision was made to keep all the items of this construct. The decision was taken on the basis that one of the study objectives was to compare the path coefficients involving the construct of customer involvement across the four stages of the development process. In this context, it is argued that the items used to measure 'customer involvement' across the four stages of the development process should be the same.

[iii] An alternative model was run in which potential moderating effects of the variable 'type of market served' were added. The alternative model considered potential moderating effects of the variable 'type of market served' on the relationships between technological novelty, technological turbulence and customer involvement, and customer involvement and operational and market outcomes. No effect was found significant at the 0.05 level and only one of the six proposed interaction effects was significant at the 0.10 level. Particularly, a negative interaction effect was found between technological turbulence and type of market served on customer involvement (b= -0.165, p= 0.07) indicating that technological turbulence has a more positive impact on customer involvement for industrial services than consumer services. Interaction effects between technological novelty and type of market served on customer involvement, and between customer involvement and type of market served on each of the constructs of new service performance were not significant. Overall, this model produced a worse fit to the data than the model excluding the effects of the variable 'type of market served'. Therefore, the results are presented without this variable.

[iv] P-value for H3a is marginally higher than the 0.05 required for statistical significance.

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Table 1

Population and sample distribution by industry: Proportion test

| NAICS Code | Dun & Bradstreet directory | Population | | Sample | |
|---|---|---|---|---|---|
| | N | N | % of total | N | % of total |
| 22: Utilities | 196 | 49 | 6.1 | 7 | 7.1 |
| 44-45: Retail trade | 856 | 214 | 26.5* | 9 | 9.2* |
| 48-49: Transport. and warehousing | 372 | 93 | 11.5 | 11 | 10.3 |
| 51: Information industries | 376 | 94 | 11.7 | 14 | 13.3 |
| 52: Finance, insurance | 212 | 53 | 6.6* | 24 | 23.5* |
| 54: Profession., scientific, tech. services | 408 | 102 | 12.6 | 17 | 16.3 |
| 56: Administrative and support services | 520 | 130 | 16.1 | 10 | 10.2 |
| 62: Health care and social assistance | 288 | 72 | 8.9 | 10 | 10.2 |
| TOTAL | 3228 | 807 | | 102 | |

* Significant differences: p <0.10

Table 2

Sample characteristics

| Number of employees | | Sales in Euros (x $10^6$) | | Type of market served | |
|---|---|---|---|---|---|
| | % of companies | | % of companies | | % of companies |
| 75-100 | 9.7% | <=10 | 16.5% | Consumer | 48% |
| 101-200 | 17.4% | 11-30 | 25.9% | Industrial | 52% |
| 201-300 | 18.6% | 31-100 | 20.0% | | |
| 301-500 | 14.2% | 101-300 | 14.1% | | |
| 501-1000 | 18.6% | 301-1500 | 10.6% | | |
| > 1000 | 22.0% | >1500 | 12.9% | | |

Table 3

Construct definition and Measures

| Construct name (Alpha's, Composite reliability, Average Variance Extracted, Tetrad $\chi^2$) | Construct measurement | Mean (S.D.) |
|---|---|---|
| Technological turbulence[1] (r=.62[*], CR=.67, AVE=.61) | The technology in the industry was changing rapidly | 3.3 (1.21) |
| | Technological changes provided big opportunities in the industry | 3.5 (1.15) |
| Technological novelty[1] (α=.78, CR=.64, AVE=.59) | New service is highly innovative | 3.5 (1.19) |
| | New service exploited technology that was totally new to the firm | 3.2 (1.27) |
| | The services was supported by innovative technology | 3.3 (1.23) |
| Customer Involvement (CI) overall[1] (T-$\chi^2$ =8.65, DF = 2, p= 0.01)[3] | The frequency of the meetings with customers was high | 3.1 (1.23) |
| | There were extensive consultation with customers | 2.9 (1.30) |
| | Specific customers were invited to join the project as team members | 2.2 (1.34) |
| | Number of customer involvement tools[2] | 2.2 (1.79) |
| Sales performance[1] (α=.93, CR=.84, AVE=.82) | Exceeded market share objectives | 3.1 (0.82) |
| | Exceeded sales growth objectives | 3.1 (0.89) |
| | Exceed sales objectives | 3.1 (0.90) |
| Competitive superiority[1] (α=.74, CR=.62, AVE=.55) | Give us an important competitive advantage | 3.7 (0.95) |
| | Service experience was superior to competitors | 3.6 (0.99) |
| | Customer solution was superior to competitors | 3.8 (1.00) |
| Technical quality[1] (r=.62, CR=.68, AVE=.63) | This service had fewer problems than what was considered normal | 3.3 (0.92) |
| | Fewer technical problems than our nearest competitors | 3.1 (0.92) |
| Innovation speed[1] (α=.71, CR=.58, AVE=.50) | Developed and launched faster than major competitors | 3.4 (0.96) |
| | Completed in less time than what was considered normal for industry | 3.3 (1.01) |
| | Launched ahead of the original schedule developed | 2.6 (0.97) |

[1] Five-point Likert-type scale (1= strongly disagree to 5 = strongly agree).

[2] Sum of the number of tools applied at each stage.

[3]The tetrad chi-square values for the customer involvement construct at each of the stages of the development process are as follows: CI-Idea generation: T-χ2 =10.49, DF = 2, p= 0.00; CI-Service design: T-χ2 =5.30, DF = 2, p= 0.07; CI-Testing: T-χ2 =4.13, DF = 2, p= 0.10; CI-Market launch: T-χ2 =0.48, DF = 2, p= 0.78.

[*] Correlation coefficient is shown for scale including fewer than 3 items

Table 4.

Means, standard deviations, and zero-order correlations

| | Mean (S.D.) | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Technological novelty | 3.3 (1.02) | | | | | | | | | | |
| 2. Technological turbulence | 3.4 (1.04) | .36** | | | | | | | | | |
| 3. CI – Overall [1] | -- | .33** | .40** | | | | | | | | |
| 4. CI - Idea generation [1] | -- | .20 | .40** | .81** | | | | | | | |
| 5. CI- Service design [1] | -- | .32** | .36** | .85** | .81** | | | | | | |
| 6. CI – Service testing [1] | -- | .41** | .31** | .85** | .55** | .67** | | | | | |
| 7. CI – Commercialization [1] | -- | .24* | .32** | .79** | .44** | .48** | .70** | | | | |
| 8. Innovation speed | 3.1 (.78) | .36** | .07 | .29** | .26* | .22* | .30** | .19 | | | |
| 9. Technical quality | 3.2 (.82) | .24* | .20 | .33** | .31** | .27* | .32** | .21* | .35** | | |
| 10. Competitive superiority | 3.7 (.78) | .43** | .08 | .28** | .12 | .20 | .36** | .23* | .34** | .37** | |
| 11. Sales performance | 3.1 (.73) | .20 | .16 | .19 | .12 | .12 | .17 | .23* | .22* | .37** | .26* |

Significance levels: ** p<.01, * p<.05. [1] Standardized values. CI: Customer involvement

**Table 5. Model estimation. Standardized parameter estimates.**

| | Hypothesized Model | | | Revised Model | |
|---|---|---|---|---|---|
| | ML | PLS | UWLS | ML | |
| **Control relationships** | | | | | |
| Tech. novelty → Sales performance | 0.07 (-0.14, 0.27) | 0.07 | 0.05 (-0.18, 0.30) | | |
| Tech. novelty → Competitive superiority | 0.31 (0.11, 0.47)** | 0.30** | 0.29 (0.05, 0.53)** | 0.28 (0.11, 0.44)** | |
| Tech. novelty → Innovation speed | 0.33 (0.18, 0.47)** | 0.33** | 0.29 (-0.04, 0.47) | 0.29 (0.15, 0.42)** | |
| Tech. novelty → Technical quality | 0.13 (-0.06, 0.31) | 0.13 | 0.11 (-0.25, 0.33) | | |
| Tech. turbulence → Sales performance | 0.06 (-0.16, 0.25) | 0.06 | 0.10 (-0.34, 0.64) | | |
| Tech. turbulence → Comp. superiority | -0.13 (-0.31, 0.08) | -0.13 | -0.10 (-0.64, 0.32) | | |
| Tech. turbulence → Innovation speed | -0.15 (-0.35, 0.07) | -0.15 | -0.26 (-0.84, 0.04) | | |
| Tech. turbulence → Technical quality | 0.05 (-0.20, 0.27) | 0.05 | -0.07 (-0.59, 0.20) | | |
| **Model relationships** | | | | | |
| Customer involvement → Technical quality | 0.26 (0.06, 0.45)** | 0.26* | 0.46 (0.15, 1.00)** | 0.32 (0.14, 0.48)** | H1a supported |
| Customer involvement → Innovation speed | 0.24 (0.05, 0.42)* | 0.24* | 0.47 (0.10, 1.10)* | 0.19 (0.02, 0.36)$^+$ | H1b supported |
| Customer involvement → Competitive superiority | 0.11 (-0.11, 0.30) | 0.11 | 0.04 (-0.66, 0.86) | | H1c rejected |
| Customer involvement → Sales performance | 0.02 (-0.19, 0.22) | 0.02 | -0.08 (-0.97, 0.62) | | H1d rejected |
| Tech. novelty → Customer involvement | 0.21 (0.02, 0.38)+ | 0.21* | 0.20 (-0.02, 0.45) | 0.21 (0.02, 0.38)$^+$ | H3a marginally supported |
| Tech. turbulence → Customer involvement | 0.32 (0.16, 0.46)** | 0.32* | 0.39 (0.19, 0.69)** | 0.32 (0.16, 0.46)** | H3b supported |
| Innovation speed→ Competitive superiority | 0.17 (0.00, 0.35) | 0.17 | 0.21 (-0.01, 0.45) | 0.20 (0.03, 0.39)* | |
| Technical quality → Competitive superiority | 0.22 (0.05, 0.39)* | 0.22* | 0.25 (-0.02, 0.50) | 0.22 (0.05, 0.38)* | |
| Innovation speed → Sales performance | 0.08 (-0.09, 0.29) | 0.08 | 0.15 (-0.16, 0.59) | | |
| Technical quality → Sales performance | 0.30 (0.08, 0.49)* | 0.30** | 0.35 (0.02, 0.63)* | 0.36 (0.17, 0.55)** | |
| $R^2$ of sales performance | 0.20 | 0.15 | 0.17 | 0.20 | |
| $R^2$ of competitive superiority | 0.17 | 0.28 | 0.29 | 0.16 | |
| $R^2$ of innovation speed | 0.12 | 0.17 | 0.29 | 0.10 | |
| $R^2$ of technical quality | 0.14 | 0.12 | 0.23 | 0.13 | |
| $R^2$ of customer involvement | 0.27 | 0.20 | 0.25 | 0.24 | |

Confidence intervals are given in parentheses

Significance levels: ** p<.01, * p<.05, $^+$ p = 0.06

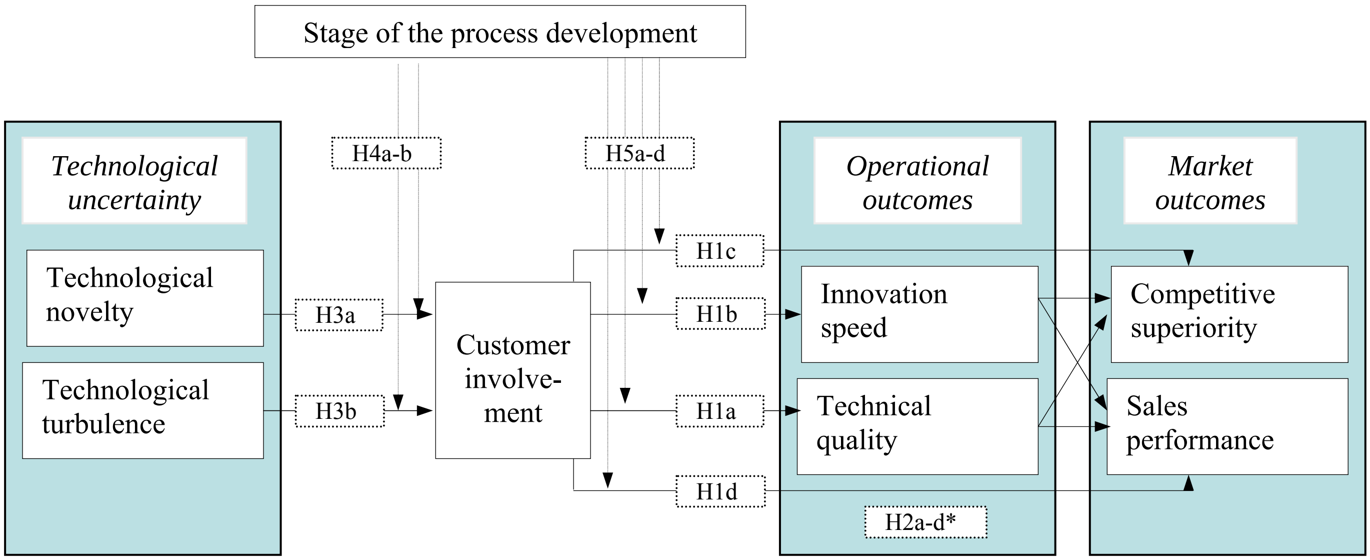
Table 6

Standardized parameters estimates of multi-group analysis

| | Stages of the development process | | | |
|---|---|---|---|---|
| | Idea Generation | Service design | Testing | Launch |
| Tech. Novelty → CI | 0.06 (-0.12, 0.26) | 0.23 (0.05, 0.41) * | 0.19 (0.04, 0.34) * | 0.14 (-0.06, 0.32) |
| Tech. Turbulence → CI | 0.38 (0.21, 0.51)** | 0.28 (0.10, 0.44) ** | 0.35 (0.18, 0.50) ** | 0.27 (0.11, 0.43) ** |
| CI → Innovation speed | 0.19 (0.04, 0.33) * | 0.11 (-0.08, 0.28) | 0.19 (0.00, 0.37) * | 0.11 (-0.09, 0.31) |
| CI → Technical quality | 0.29 (0.14, 0.44) ** | 0.26 (0.08, 0.44) ** | 0.31 (0.13, 0.46) ** | 0.20 (0.01, 0.39) |
| CI→ Competitive perform | -0.07 (-0.24, 0.10) | 0.01 (-0.17, 0.17) | 0.14 (-0.06, 0.33) | 0.09 (-0.08, 0.24) |
| CI → Sales performance | 0.01 (-0.16, 0.17) | 0.03 (-0.14, 0.16) | 0.06 (-0.13, 0.25) | 0.15 (-0.04, 0.34) |

Confidence intervals are given in parentheses. Significance levels: ** p<.01, * p<.05. CI: Customer Involvement

**Figure 1**. Theoretical framework




* Indirect effect of customer involvement on market outcomes via operational outcomes