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Customer Readiness for Product Co-Design – Perspectives from Furniture Customization

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ABSTRACT

This exploratory customer preference study used a simulated customization activity as a means of examining the determinants of customer willingness to participate in the co-configuration process of purchasing customized furniture. Specifically, 56 participants were surveyed in order to determine reasonable thresholds for the basic inconveniences associated with mass customization, including time invested, premiums paid, and lead times accommodated. The study suggests that there is indeed business potential for collaborative furniture customization and that better understanding the linkages that exist between observed customer characteristics and willingness to participate in the co-configuration process will facilitate a superior purchasing experience for buyers of customized furniture.

Keywords: customized furniture, customer participation, co-design, product development

Introduction

Four forms of customization have been described by Gilmore and Pine (1997) and adopted by various researchers: adaptive (customers alter products themselves); transparent (company observes individual customer needs and provides unique products); cosmetic (same standard product is marketed differently to individual customers); and collaborative (company interacts directly with customers in designing and manufacturing the specific product configurations to meet expressed needs). Collaborative customization is a useful tool for profitably capturing innovation in new product development (Franke and Shah 2003, von Hippel 1998). It requires an effective interface between the provider and customer such that customer needs can be expressed and captured accurately for incorporation into a preferred product configuration. In the case of apparel customization, for example, customers may submit body scans and commit to updating personal body information to facilitate the production of customized clothing on demand. This situation illustrates the usefulness of collaborative customization for managing customer relationships in the context of their changing needs over time (Schubert and Koch 2002). Similarly, it is necessary for potential buyers of customized furniture to invest time to clarify needs and explore realistic solutions; manufacturers of customized furniture view the input of customers as a vital prerequisite for successful product customization (Kodzi et al. 2007).

It is reasonable to expect customers to invest time in co-designing products because customized products by their nature cannot be selected from a shelf, so the configuration process is actually initiated by the customer (Pine et al. 1995). A customer, however, may perceive participation in the configuration of customized products as an inconvenience not worth the effort, beyond certain thresholds. Other inconveniences associated with customization include accommodating the lead time between purchase and delivery of the product and paying a premium for the better fit that customization provides (Davis 1987, McKenna 1995, Kotha 1995, Kubiak 1993, Moffat 1990). How might these inconveniences affect customer attitudes in the case of furniture? How would a customer's evaluation of a particular customization offer influence participation in the configuration process?

The primary objective of this study was to explore what factors increase the likelihood that customers will participate in the product co-configuration process to clarify their preferences and obtain the best product fit. What thresholds appear reasonable for the basic customization-related inconveniences were also evaluated. Finally the role of expert guidance in the configuration process was investigated. Will customers try to configure their own furniture or will they express a preference to be guided through technical detailing? How will such a finding affect the business proposition of a customizing company? Given the conceptual benefits of a collaborative customization model, this study evaluated whether or not customers of furniture would indeed participate in the co-configuration process.

Customer Participation

The readiness of customers for mass customized products is influenced by the interaction between perceived inconveniences and expected benefits. In the case of furniture, the process of configuring products to reflect customer preferences may involve substantial time and complexity resulting from inter-related decision-making steps. Furthermore, the added complexity has the potential of increasing the already long manufacturing lead times that have characterized the furniture industry. But, if the customization offer does not require significant trade-offs between the desired product outcome and the associated inconveniences, customers will potentially perceive the offer as representing greater value. We view this minimization of trade-offs primarily as the responsibility of organizations offering customized furniture and the understanding of reasonable thresholds as a precursor to minimizing these trade-offs.

Supposing the inconveniences associated with a customization offer are within reasonable limits, it may also be the case that customers with certain personality and demographic characteristics are more predisposed toward participating in the configuration process required for customization. It is important to identify such characteristics to enable companies to adopt the tactical actions that might be necessary to enhance "take-up rate and depth of market penetration" when new product possibilities and configurations are launched (Kaplan et al. 2007). In this way, companies can better profile customization patrons. For example, customers who are younger and well-educated, and who have relatively higher incomes, can be expected to better understand the challenges of the customization process. This expectation is consistent with the centrality of information technology in mass customization (Strobel 2004, Davis 1987) in the sense that patrons of many customized offerings have been observed to be generally younger and more "tech savvy" than patrons of standard offerings (Corcoran 2005). Dellaert and Stremersch (2005) frame such characteristics in terms of "consumer expertise" and argue that consumer expertise enhances product configuration. In their view, product

complexity negatively affects the configuration experience of “expert customers” much less than those having low product expertise.

These perspectives on customer characteristics appear to imply that customization is somewhat exclusive to customers who are able to navigate the technology maze. The process of evaluating multiple options, however, can also be overwhelming especially if customers do not have stable and well-defined preferences – as may be the case with younger customers. Simonson (2005) indicates that customers often have preferences that are unstable and inadequately developed, supporting his argument with evidence that preferences are usually constructed based on contextual factors (Levin and Gaeth 1988, Huber et al. 1982). In general, we expect that customers with poorly defined preferences (or indeed with other characteristics that make them appear less attractive as market targets) will view ready access to an expert as an incentive to participate in the configuration process. In other words, depending on their expertise and preferences, customers may be influenced by the availability of technical support to participate in the configuration process of a customization offer. Schiffman and Kanuk (2000) portray consumers as thinking problem-solvers seeking to make satisfactory, not perfect decisions. It is reasonable, then, to expect that given a credible intention to customize a product, customers will evaluate available alternatives, refine preferences, and arrive at satisfactory outcomes. The completion of this evaluation can itself be threatened by information overload (Huffman and Kahn 1998). Thus, besides toolkits to simplify the decision-making process in product configuration (Franke and Piller 2004, von Hippel 2001), a customer’s expressed need for the guidance of an expert in the configuration process may be a reflection of a need to externally validate personal preferences within the context of a specific customization offer. This is the essence of collaborative customization (Gilmore and Pine 1997).

In view of the foregoing discussion, Dellaert and Stremersch’s (2005) suggestion that expert consumers constitute a more attractive target segment for customization may be rather limiting. While it is important to determine which market segments are most likely to adopt a customized product offer, it is also important to extend the business proposition by exploring how organizational capabilities might be employed to overcome the limitations experienced by “less desirable-to-target” customers. In cases where customization toolkits are not suitable for a particular segment of the market (von Hippel 2001), this mismatch does not preclude that segment’s interest in customized products. If expert guidance is available as an alternative, we can expect the segment of customers in question to be more willing to participate in the co-configuration process. When consumers purchase furniture, they appear to relate less effectively to virtual products than to physical products. They might use various configuration tools to frame their preferences, but the purchasing dynamics and other “burden of liability” issues are such that many customers will usually complete the furniture configuration process at a physical furniture outlet (Kodzi et al. 2007). Thus, extending the target market to include customers with limited product expertise can have a direct positive impact on the scale of operations. Knowing what proportion of a target furniture market requires the guidance of an expert has useful managerial implications.

To meet our research objectives we draw from a previous study on the degree to which customers are “ready” for mass customization. The study was conducted by Bardakci and Whitelock (2004, 2005) and involved an exploratory analysis of customer readiness in the new car market in two European countries. Their research was premised on the observation that earlier discussions on mass

customization (Pine 1993, Lampel and Mintzberg 1996, Gilmore and Pine 1997, Andersen 1997, Feitzenger and Lee 1997) assume that customers are ready for mass-customization without presenting confirmatory evidence from systematic research. Bardakci and Whitelock (2004, 2005) framed their study by assessing the willingness of customers to accept the inconveniences of investing time in the co-configuration process, paying any associated premiums, and waiting to receive their customized product after placing an order. If customers showed willingness on all three counts, the researchers considered them “ready” for mass customization, although no links between readiness and intention were investigated. Although their study was exploratory in nature, it provides a useful basis for approaching our examination of what factors affect the willingness of customers to participate in the co-configuration process of purchasing customized furniture. From our perspective, time spent in the co-configuration process validates the intention of the customer to explore a customized product solution, while wait time and price premium could potentially minimize customer utility in the customization experience if these are sufficiently high (other utility-minimizing constraints are discussed by Delleart and Stremersch 2005, Franke and Piller 2004, Huffman and Kahn 1998). We view this intention conceptually as an intrinsic customer attribute substantiated by an expressed willingness to participate in the co-configuration process. Thus, we approach our study of customer readiness in terms of firstly establishing the intention of the customer to participate in the co-configuration process and then determining what thresholds of the associated inconveniences will allow the customer to follow through the expressed intention to participate. It is possible that some customers who are willing to invest time in the configuration process will not actually make the purchase, but this willingness is undeniably an important first step in customizing products. By this approach, we contribute to the state of mass customization research by discussing potentially unobserved characteristics that predispose prospective buyers of customized furniture to invest time in the co-configuration process. We also provide managerial decision support in relation to evaluating manufacturing systems against their ability to explore and fulfill customer preferences comprehensively within acceptable thresholds.

Methods

In our study of customer attitudes regarding the process of purchasing customized furniture, the option of using students as subjects for research, as has been the case in other customization studies (Schreier 2006, Höst et al. 2000), was considered. Using students could potentially increase the sample size in such a study. This approach, however, could limit the demographic diversity in our sample compared with a real life situation (Franke and Piller 2004). Thus, we targeted a wide range of visitors who attended an Open Day at a Midwestern University. Participants in the study interacted with a simulated customization project immediately prior to responding to a set of survey questions. Interaction with the customization project was mainly through the process of working with point of sale personnel to configure and order individualized nameplates and cutting boards after observing the entire manufacturing process (Kodzi and Gazo 2009). The sequencing of the customization exposure and the interviews were aimed at increasing the appreciation by respondents of the concept of customization. We assumed that while in real life their responses would not be prompted by such prior exposure, the customization project would help level out potential ambiguities among respondents about customization concepts. In this way, the likelihood of differences in the results that are due to divergent conceptualizations of mass customization could be reduced. On the other hand, the results could also be affected by the fact that the responses from this same sample of respondents may be different without exposure to the customization prompt. It was our position, however, that people faced with the choice of purchasing a customized product usually have a level of awareness of the concept.

Therefore, we chose the customization prompt approach as a means to increase this awareness and mimic reality and also to facilitate a common understanding of the issues at stake in preparation for a series of exit interviews. Participants in the customization project were encouraged to give exit interviewers a few extra minutes for questions after taking delivery of their completed orders. Although our method of selection of respondents for this study does not allow for generalizations, these exit interviews conducted with diverse, freely consenting project participants could provide valuable insights about how customers relate to important elements of the customization process.

The survey instrument had mostly close-ended questions related to office furniture customization. Four of the survey questions were demographic in nature, while seven others were aimed at determining what time investment was reasonable for the custom-configuration and ordering process, what premium was acceptable for a product that achieved the desired customer fit, what wait time was tolerable once the customized order had been placed, and how relevant customers perceived the role of experts in guiding them through detailing orders for customized products. The closed-ended questions were mostly answered either on a five-point Likert scale or by choosing one out of five specific categories. Two open-ended questions addressed features customers might want to change or personalize in office furniture, and what were considered unsatisfactory attributes of their current office furniture. In a pretest, the need to use interval scales for the response categories to reduce the incidence of missing values in some demographic information, was recognized. Lopes and Galletta (2006) also reported a high rate of missing values for perceived sensitive information such as household income. The survey instrument was redesigned to fit onto one letter-sized sheet of paper to shorten the time required for the exit interviews and improve the efficiency of the data collection process.

The question about acceptable price premium was based on the contingent valuation method (Mitchell and Carson 1989) in which respondents indicated how much more they might pay over the standard product price for a customized product that fits their needs. Although this method could potentially overestimate actual levels, it provides a straightforward estimate of how much customers were willing to pay for the new configuration, as observed by Schreier (2006). The questions measuring customer need for expert involvement and customers' rating of their ability to custom-configure their own furniture were both asked as a way of assessing the level of engagement that might be expected between the manufacturer and the customer in a co-design process. The two questions provide complementary views on the same underlying issue – customer capability – and give an indication of response consistency. It was not practical, however, to do the same for all of the questions for the reasons of brevity discussed previously.

In the next section what factors affect the willingness of customers to participate in the configuration process are investigated. Specifically, what associations exist between observed customer characteristics and willingness to invest time in the configuration process for customized furniture using ordinal regression methods are examined. Also responses as to what thresholds appear reasonable for the basic customization-related inconveniences and what the role of expert guidance is in the configuration process are analyzed.

Results

The 56 useable responses obtained from the survey, although a relatively small sample, are comparable to the 58 responses from the United Kingdom and the 37 responses from Turkey analyzed in the Bardakci and Whitelock (2004) study. The data show that 28 percent of respondents were within or below the “moderate household income” range (households earning 50% to 80% of the county median income). The relevant county median annual household income based on census results (2003) was \$39,471. Twenty-two percent of respondents were in the “above moderate income” range (80% to 120% of county median income), while 50 percent of respondents earned above the upper threshold of the moderate income range (these percentages are conservative because they assume only one source of household income, and the sample may be even wealthier than it appears). A third of the respondents spend more office hours at home rather than at work.

Fifty-four percent of the respondents were between 45 and 64 years of age. These are considered to be the peak career years and, therefore, these respondents are expected to exhibit a greater willingness to pay more for products that meet their specifications, all else being equal. Based on this sample description, the results of the survey are expected to be biased toward a willingness to pay higher premiums relative to a sample with a more uniform distribution among age groups and income levels. Twenty-seven percent of the respondents were willing to pay a premium of 20 percent or more for office furniture that provided a good fit for their work needs (**Fig. 1**). But, only a 10 percent premium was perceived as acceptable by the largest proportion (45%) of respondents.

Figure 1. Percentage of respondents perceiving different levels of premium as reasonable for customized office furniture.

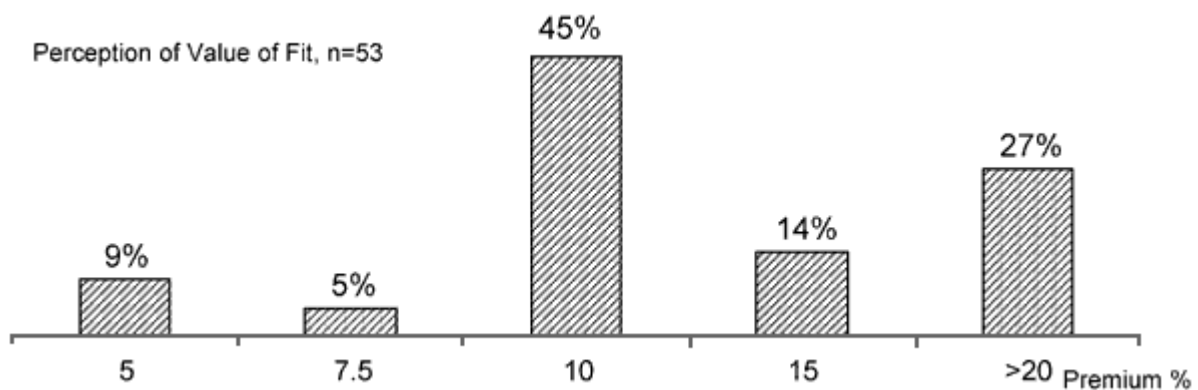
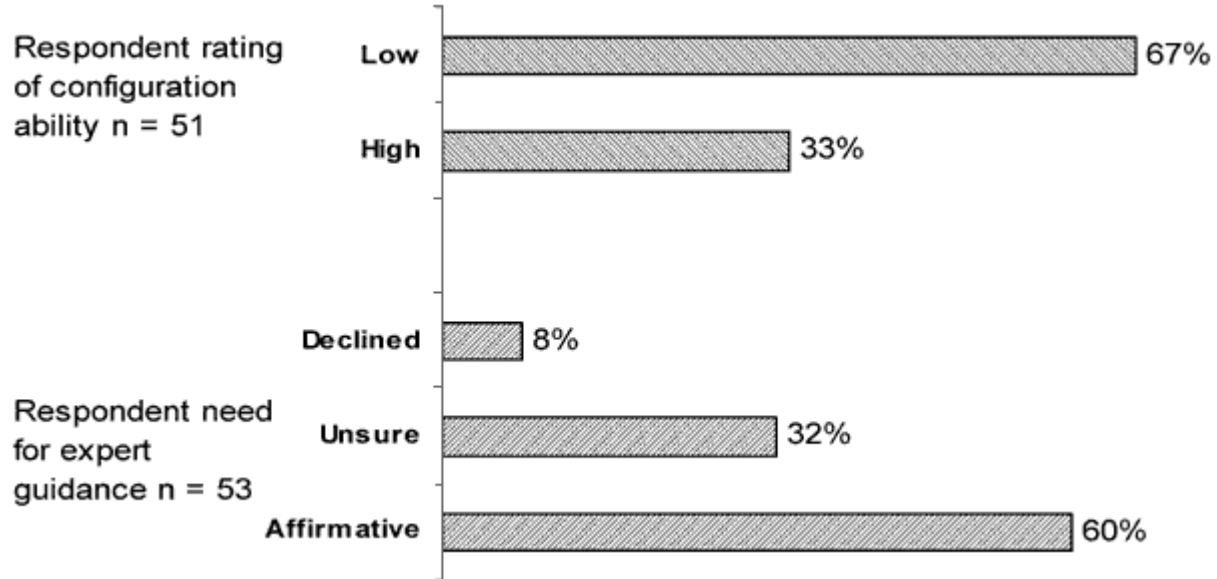


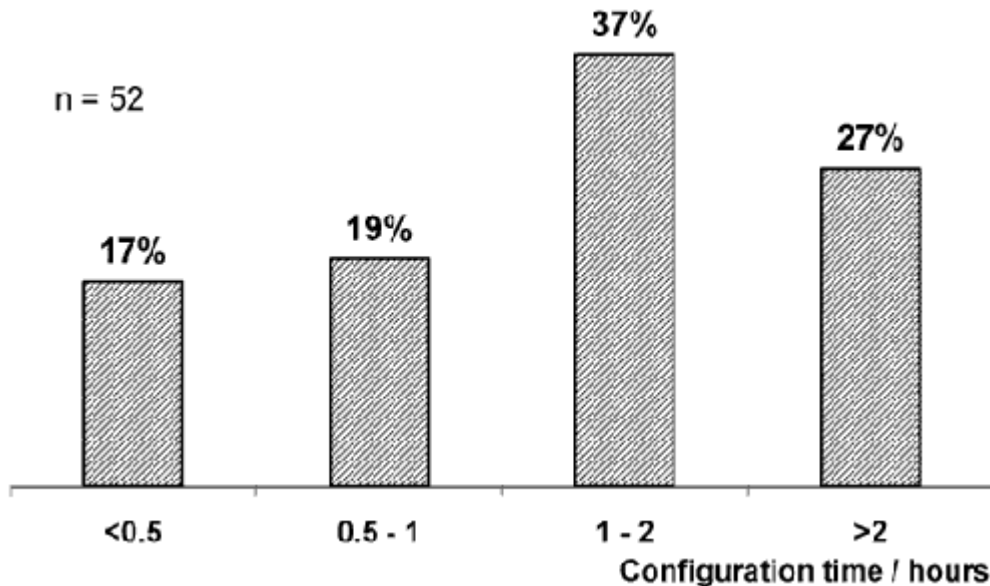
Figure 2 indicates that about two-thirds of respondents rated their ability to personally custom configure their furniture as low. This position on customer competence was corroborated by another related question asked in the reverse form – whether or not respondents would rather have an expert walking them through the order process to explain the implications of their choices. It was expected that a low rating of configuration ability would be indicative of a strong preference for expert guidance in the process of ordering customized office furniture. The results confirmed this expectation.

Figure 2. Assessment of configuration ability and the need for expert guidance at point of sale for customized furniture.



Customers also expect a hassle-free process for configuring and ordering furniture – only a quarter of respondents were ready to invest over 2 hours in customizing their office furniture. Thirty-seven percent of respondents were willing to invest 1 or 2 hours in the co-design process; 36 percent were only willing to spend less than 1 hour (**Fig. 3**). This observation suggests that if the process of custom-configuring furniture is perceived to be cumbersome by potential buyers, they might opt for a standard product. The onus is on manufacturers to provide avenues by which customers can explore options that meet their needs promptly, and without much difficulty.

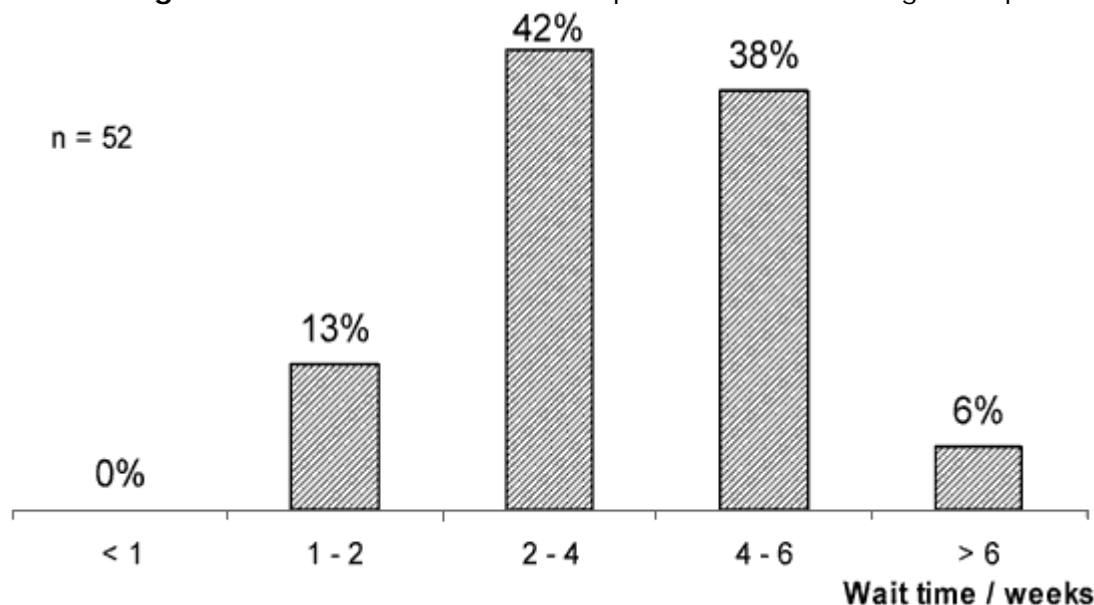
Figure 3. Reasonable configuration time input according to respondents.



Forty-two percent of survey respondents also thought it was reasonable to wait for 2 to 4 weeks for a customized office furniture order to be delivered, while only 6 percent indicated willingness to wait

for over 6 weeks (**Fig. 4**). It is interesting to note that no respondent considered a wait time of less than 1 week to be practical.

Figure 4. Reasonable wait time for placed order according to respondents.



Furthermore, the following statistically significant associations were derived from a correlation analysis of all of the variables:

- i. Respondents who felt less comfortable about customizing their own furniture using IT tools were willing to wait longer for the furniture to be delivered.
- ii. Older respondents had higher incomes and were willing to pay higher premiums to obtain customized furniture. But, they were willing to spend less time in the configuration phase.
- iii. Respondents who were least inclined to seek expert guidance also seemed to think time spent in the configuration process needed to be shorter.

The forgoing results raise two interesting questions. Firstly, are the observed time thresholds sufficient for a manufacturer to comprehensively explore customer preferences and complete a customized furniture order? Perceived customer value can be improved if a manufacturing system operates below the indicated thresholds. The dynamics may vary for different products and market segments but mass customization strategies cannot disregard these expectations while seeking to provide a good fit for customer needs. Secondly, what customer characteristics could providers of customized furniture leverage in attracting potential furniture buyers to invest adequate time in the co-configuration process?

To determine which measured variables most strongly affected the amount of time a customer was willing to invest in configuring their furniture, we ran a series of regression models for predicting “time spent to configure” (T) using all of the other variables. The software employed for analysis was Minitab 15. The best fit for the data in relation to both high adjusted R^2 and low Mallows Cp was obtained with the variables “Wait Time (W), Expert Involvement (E), Annual Income (K), and Age (A)”. The

Anderson-Darling normality test confirmed that our variable had a normal distribution; we then used the probit link function to perform an ordinal regression. The regression output using these five variables is shown in **Table 1**.

Table 1. Ordinal regression of configuration time on wait time, expert involvement, income, and age.

Predictor	Coefficient	Z ^a
Wait time	-0.414	1.91
Expert involvement	0.605	2.02
Income	-0.338	-2.13
Age	0.312	2.40
^a $p < 0.05$; log-likelihood = -52.705; DF = 4; overall model significance; and $p = 0.010$.		

The regression results confirm the previous correlation analysis and suggest the following key insights:

- a. Respondents who were willing to wait for longer times for their finished product to be delivered also appeared to be willing to invest time in customizing their furniture order.
- b. Younger respondents were more likely to spend more time in configuring their furniture order than older respondents.
- c. Respondents with higher incomes were more likely to invest more time in configuring their furniture.
- d. Respondents who would rather opt for guidance to clarify the implications of their choices were more likely to invest time in the configuration process (the question in this case was “Would you rather have an expert walk you through the order process to explain the implications of your choices?” A rating of 1 was assigned to “Yes, very much”, and a 5 for “No, I’ll decide”).

Discussion

The results raise pertinent issues for discussion. For example, the role of age in configuration time and its implication for collaborative customization is a divergence from Bardakci and Whitelock’s (2004) proposition that age group has no effect on respondents’ readiness for mass customization. The fact that older respondents appeared less willing to spend time in the co-configuration phase is insightful. Zipkin (2001) argues that in some cases, the value derived from customized products may not be perceived to warrant intensive exploration of toolkits for the best configuration outcomes.

In view of the data limitations (in terms of sampling method and sample size), we focus more on the general picture presented by the analyses rather than such detail as magnitude of the coefficients. But, we draw attention to the fact that compared with other predictor variables, the expression of a need for technical support from experts, and the willingness of respondents to wait longer times for their finished product to be delivered had the strongest association with willingness to participate in

the product configuration process. This observation has some interesting research and managerial implications. Firstly, the purchase of a customized product could be perceived as a risk by the customer in terms of expected performance in service and potential low resale value because of its customized features. The correspondence between a low rating of configuration ability and a strong preference for expert guidance illustrated in **Figure 2** may support this risk perception. It would make the purchasing decision easier for the customer if they did not have to bear the burden of liability for the product design in the case of furniture. This finding moderates the view by some mass customization proponents that most configurations can be completed via a web-based interface. If mass customization models are heavily dependent on customer competence, then even for highly educated and wealthy respondents who indicated a distinct preference for expert guidance, the business proposition for mass customized furniture is flawed. Customer need for expert guidance to navigate the process of customization should not be viewed as disqualification from the target market, but as an opportunity, in the case of furniture manufacturing. The benefits of this existing customer need in the context of off-shore manufacturing and its implications for local industry competitiveness are obvious. Perhaps local manufacturers can reconsider proactive service capability to take advantage of this business model. Through this collaborative approach, non-expert customers can have a credible expectation of the product performance, while manufacturers have a more informed basis to endorse customer innovation and thus bear the burden of responsibility for product outcomes.

The second managerial implication with respect to longer wait times incorporates an earlier observation that none of the study respondents considered a wait time less than one week to be practical for delivering their customized order. Perceived manufacturing impossibility is an important consideration for the manufacturer. Based on customer perception, the manufacturer can “promise low and deliver high” if customers are more flexible with wait time, and the manufacturer has the capability to deliver much earlier. Supply chain costs can be reduced and scheduling can be improved if the customer is willing to wait within known acceptable thresholds. The observed range of acceptable order lead times raises concerns about an issue that has plagued the furniture industry for many years. Lead times are an important consideration for buyers of furniture. It appears, however, there are some barriers that have traditionally limited the ability of many furniture manufacturers to respond in short lead times to standard orders, not to mention customized ones. Some of these barriers originate from the mindset of manufacturing in large batches to take advantage of economies of scale. Focusing on scale economies is necessary in traditional manufacturing systems because setups and changeovers are time-consuming, and the use of jigs and templates involves significant overhead costs. Yet, to satisfy customers’ need for short lead times, manufacturers must initiate process transformations that eliminate the requirement for long production runs to achieve profitability.

The acceptable price premium measure was perhaps inadequate for capturing the complete picture for willingness to pay premiums. In the context of the ongoing customization project and the Open Day, it was impractical to employ the more rigorous Vickery auctions method (Noussar et al. 2004, Vickery 1961) in determining the acceptable price premium, and this may explain the weak effect of that variable in the model. It is interesting, though, in view of **Figure 1** that over one-quarter of respondents considered a 20 percent premium above a given standard price to be acceptable for customized furniture. Franke and Piller (2004) found patrons of customized watches to be willing to pay more for self-designed products, and interpreted this increased willingness as an assignment of greater product value by the individuals configuring the watches. Franke and Piller (2004) note that

prior everyday life experiences may suggest to customers that individualized products are more expensive or more difficult to make than standard ones. Thus, when customers opt for customized products, they will generally be prepared to pay more than for standard products. In this regard, because persons with higher incomes possess a better ability to pay the expected premiums, they may also be more predisposed to purchasing customized furniture – assuming that the level of premium is perceived to be reasonable for achieving the desired fit. We plan to evaluate these observed thresholds in further study, and we expect neither the acceptable levels nor the extent of customer participation to be the same across all customized product ranges. Providers of different product families need to be aware of what thresholds are considered reasonable for their type of customized product offering.

Limitations

Sample size and its implications for generalizing the results are a major drawback of this study. We would expect to capture other important determinants of customer participation in the co-configuration process using a much larger sample; it may be easier to identify such effects as being attributable to the price premium variable or the configuration capability variable. The exit interview method also limits the range of questions asked and the extent to which interactions between the measured factors can be evaluated. The use of interval scales was a practical way to work with the variables, given the stated constraints.

Other factors influencing consumers' readiness for mass customization, such as personality characteristics and hedonic needs, were also considered beyond the scope of this exploratory analysis. The specific toolkit for the configuration phase and the value that it provides to the participant also influences the amount of time people are willing to invest in the configuration process. We did not account for characteristics of the toolkit *per se* because although the customization prompt was based on nameplates and cutting boards, this interaction was only used as a prompt to elicit responses regarding office furniture. Our current model applies the contingent valuation approach to the evaluation of responses for a hypothetical case. It will certainly be useful to revisit this study with a larger sample of respondents actually involved in the particular customization process they are describing. These concerns will inform further research.

Conclusion

Regardless of the stated limitations, this study provides useful insights to manufacturers of customized products about what thresholds might be acceptable for the inconveniences associated with purchasing customized products, and what manufacturing system improvements may be required to take advantage of a collaborative customization model. We expect these exploratory insights to be upheld and expanded by subsequent research. Assuming that the inconvenience thresholds are defined correctly in industry-specific contexts and implemented through the necessary transformations, our research indicates that regardless of the toolkits available for product configuration, the willingness of customers to participate in the co-design process is affected by some intrinsic characteristics. These customer characteristics appear to affect the predisposition to accept the basic inconveniences associated with mass customization, and are thus vital to the effectiveness of the mass customization paradigm. Correctly modeling the linkages between determinants of customer participation in the co-configuration process will enhance the collaborative form of furniture customization and facilitate a superior purchasing experience for buyers of customized furniture.

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