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AVOIDING THE VARIETY PARADOX THROUGH PRODUCT CONFIGURATORS

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Abstract. Product configurators can help firms avoid the risk that offering more product variety in an attempt to increase sales, paradoxically results in a loss of sales. Few studies, however, have focused on the characteristics configurators should have so as to avoid this paradox. Furthermore, empirical investigation on the effectiveness of the recommendations made by these studies has been hindered by the lack of psychometrically sound measures. This paper conceptualizes, develops and validates five capabilities that product configurators should deploy to avoid the variety paradox: namely, focused navigation, flexible navigation, easy comparison, benefit-cost communication, user-friendly product-space description capabilities.

Key Words: Mass Customization, Product configuration, Software capabilities

1. INTRODUCTION

A trend toward an increase in product variety and customization has been observed worldwide in many diverse industries [1-3]. The promise of increased product variety and customization is that by offering customers exactly what they want, or at least something closer to their ideal product solutions, companies will be able to charge higher prices and/or to gain higher market shares [4, 5], thereby increasing revenues.

There is a risk, however, that a strategy of product proliferation and customization backfires, leading to lower rather than greater revenues, as increasingly suggested in literature [5-11]. Potential customers, for example, may feel so confused and overwhelmed by the number of product configurations offered by a company that they choose not to make a choice at all [6] and the company loses potential sales. Firms offering product variety and customization may therefore experience what has been termed the "product variety paradox" [12]: offering more product variety and customization in an attempt to increase sales paradoxically results in a loss of sales.

An important role in alleviating the risk of experiencing this paradox can be played by sales configurators [12-14]. A sales configurator is a subtype of software-based expert systems (or knowledge-based systems) with a focus on the translation of each customer's idiosyncratic needs into complete and valid sales specifications of the product solution that best fits those needs within a company's product offer [15, 16]. The fundamental functions of a sales configurator include

presenting a company's product space, meant as the set of product solutions that a firm offers [17], and guiding customers in the generation or selection of a product variant within that space, thus preventing inconsistent or unfeasible product characteristics from being defined [14, 18]. Additional functionalities of a sales configurator may include providing real-time information on price and/or delivery terms of a product variant, making quotations [19, 20] and recommending a product solution that can be further altered [13]. Sales configurators may be standalone applications or modules of other applications, known as product configurators, which support not only translation of customer needs into sales specifications, but also translation of sales specifications into the product data necessary to build the product variant requested by the customer, such as bill of materials, production sequence, etc. [21].

Many studies on sales configurators and, more generally, on product configurators have investigated technical or application development issues, such as the modeling of configuration knowledge or the algorithms to make configurators faster and more accurate [e.g., 22, 23-28]. Many other studies have provided detailed accounts of the introduction and use of a configurator in a single company, focusing mainly on implementation challenges and operational performance outcomes from the company perspective [e.g., 19, 20, 29, 30-32]. In this vein, large-scale hypothesis-testing studies on the effects of product configurator use on a firm's operational performance have recently appeared as well [33, 34].

Instead, less attention has been given in literature to which characteristics of sales configurators reduce the effort involved in the specification process and drive users' satisfaction with this process [14], thereby alleviating the risk that companies experience the product variety paradox [12]. In particular, the empirical study of how sales configurators should be designed to ease the customer decision process and to increase configuration processrelated value for the customer is still in its infancy [14, 35]. To help narrow this research gap, the present paper conceptualizes, develops and validates five sales configurator capabilities that are expected to motivate and facilitate further empirical investigation in the field.

1. BACKGROUND

Prior research suggests several mechanisms that explain why a company's strategy of product

proliferation and customization might prove detrimental, rather than beneficial to the company's revenues [11]. In particular, four inter-related mechanisms link product variety and customization to the difficulty experienced by potential customers in configuring the product solutions that best fit their needs within a company's product space. The experience of difficulty accompanying a potential customer's decision process may become an input to his/her evaluation of the decision outcome itself [9, 11, 36, 37]. Consequently, greater decision difficulty for potential customers may translate into lower satisfaction with the configured products and, eventually, into reduced willingness to make a purchase [9, 11].

A first explanation for the product variety paradox relies on choice complexity, defined as the amount of information processing necessary to make a decision [9]. As product variety and customization increase, so too does choice complexity, since more alternatives have to be processed in order for a potential customer to make a decision based on rational optimization. The amount of information processing is a widely acknowledged source of decision difficulty [38]. If potential customers are provided with "too much" information at a given time, such that it exceeds their processing limits, information overload occurs [39]. Information overload, in turn, may lead potential customers to choose from competing brands that do not require such cognitive effort [5] thus reducing the company's revenues.

A related explanation for the product variety paradox relies on anticipation of post-decisional regret, which is a cognitively determined negative emotion that individuals experience when realizing or imagining that their present situation would have been better, had they acted differently [40]. When choice complexity becomes excessive, potential customers may become unable to invest the requisite time and effort in seeking the best option for them based on rational optimization and may turn from compensatory decision strategies, which process all of the available information, to noncompensatory heuristics, which reduce information processing demands by ignoring potentially relevant information [38, 41, 42]. Furthermore, potential customers may have uncertain preferences because of poorly developed preferences or poor insight into their preferences [42-44], so that their wants at the time of choice can have low correlations with their likes at the time of consumption [8]. When potential customers are unable to engage in rational optimization and/or have uncertain preferences, they may anticipate the possibility of post-decisional regret due to poor fit between the selected product configuration and the customer's preferences [7, 8, 45]. If this is the case, potential customers take into account this possibility into their decision processes, seeking to avoid or minimize postdecisional regret [8, 45]. The goal of minimizing postdecisional regret makes potential customers' decision processes more difficult [7] and may lead them to delay their purchase decisions [7, 45] or to prefer a standard product to a customized one [8].

A third related explanation for the product variety paradox relies on responsibility felt by potential customers for making a good decision. As product variety and customization increase, potential customers feel more responsible for their choices, given the greater opportunity of finding the very best option for them [7, 11]. These enhanced feelings of responsibility promote anticipated regret, as subjectively important decisions, for which individuals feel more responsible, will result in more intense post-decisional regret when things go awry [40, 45]. By amplifying anticipated regret and the resulting decision difficulty, responsibility for making a good decision magnifies the negative impact of choice complexity on customers' willingness to make a purchase.

Finally, a fourth mechanism relating product variety and customization to decision difficulty relies on conflict between product attributes that are linked to highly valued goals for potential customers [5, 9, 38, 46]. To increase product variety and customization, companies need to broaden the range of product attributes on which they allow their potential customers to make a choice [47]. As the number of product-differentiation attributes increases, so too does the likelihood that potential customers have to make trade-offs among attractive attributes. This happens because offering all the possible combinations of all the different levels of all the productdifferentiation attributes may be economically unfeasible, owing to insufficient manufacturing process flexibility and limited product modularity [48]. Explicit trade-offs among attractive attributes not only increase the cognitive effort required of potential customers to process all of the available information [5], but also cause potential customers to experience negative emotions such as anticipated regret [5]. This happens because trade-off resolution involves consideration of potential unwanted consequences and threatens one's reputation of selfesteem as a decision maker [49]. The negative emotions associated with between-attribute trade-offs are another mechanism that links increased product variety and customization to greater subjective experience of choice task difficulty [9] and decreased satisfaction with the chosen product [11], thus explaining the product variety paradox.

2. CONSTRUCT DEVELOPMENT

In the following subsections, we propose five sales configurator capabilities that help companies avoid the product variety paradox by hindering operation of at least one of the mechanisms outlined in the previous section.

3.1. Focused navigation capability

We define focused navigation capability as the ability to quickly focus a potential customer's search on a product space subset that contains the product configuration that best matches his/her idiosyncratic needs. A fundamental way of improving focused navigation capability is to allow potential customers to sequence their choices concerning the value of each product-differentiation attribute from the least uncertain choice to the most uncertain one [12]. This is because, according to the attribute being considered, a customer's preferences may be more or less uncertain [43] and preference uncertainty is an antecedent of anticipated regret [8, 50]. If the early choices a potential customer is required to make are those for which his/her preferences are best developed, then he/she is enabled to narrow down search more quickly, as anticipated regret associated with those choices is lower. Noteworthy, a prerequisite for this way of structuring the customercompany interaction is the by-attribute presentation of the company's product space, meaning that the customer is asked which value he/she prefers for each productdifferentiation attribute instead of being required to choose from among a set of fully-specified product configurations, as happens with the by-alternative presentation [6]. Another option to enhance focused navigation capability is to provide one or more starting points, where a starting point is defined as an initial product configuration that is close to the customer's ideal solution and that may be further altered [13]. Starting points can be recommended with little or no effort on the customer's part, based on his/her past purchases and/or customer input concerning simple demographics, intended product usage and his/her best developed preferences [26, 51]. Noteworthy, this solution requires complementing the by-attribute presentation of the product space with the by-alternative presentation. The same applies to another way of improving focused navigation capability, that is to allow a potential customer to completely exclude certain product solutions from consideration if he/she does not wish for them [52].

Focused navigation capability helps avoid the product variety paradox by reducing choice complexity and by mitigating anticipated regret. A sales configurator with this capability does not force potential customers to go through and evaluate a number of product options that they regard as certainly inappropriate for themselves. Therefore, this capability reduces the amount of information processing necessary to make a decision without potential customers experiencing anticipated regret [8, 40, 45, 50]. Furthermore, by quickly reducing the size of the search problem, this capability enables potential customers to invest more time and effort in exploring the product options for which their preferences are less certain. Potential customers can learn more about both these options and the value they would derive from them, especially when focused navigation capability is complemented with the capabilities discussed in the subsequent sections. In addition, potential customers can rely on more time-consuming, compensatory decision strategies that enable rational resolution of betweenattribute conflicts [42], if any. As a consequence, once a potential customer has selected his/her most preferred product configuration, he/she is more confident that the chosen solution is the one that best fits his/her needs within the company's product space. Reduced uncertainty on the superior fit of the selected product configuration with the customer's preferences, in turn, translates into less anticipated regret [45].

3.2. Benefit-cost communication capability

We define benefit-cost communication capability as the ability to effectively communicate the consequences of the available choice options both in terms of what the customer gets (benefits) and in terms of what the customer gives (monetary and nonmonetary costs). A fundamental way of improving benefit-cost communication capability is to explain what potential needs a given choice option contributes to fulfill and to what extent it does so [12]. This explanation is especially important when choice options involve design parameters of the product, such as specifications of product components, because potential customers are often unable

to relate design parameters to satisfaction of user needs [13]. According to the product attribute being considered, this explanation may be more effectively provided by means of different media, including texts, photos, animations or other simulations of the real product on a computer [53]. Besides the benefits, it is also important to communicate monetary and nonmonetary costs of each option, for example by displaying the prices of the individual product components from among which potential customers can choose or by warning potential customers that certain options imply longer delivery lead-times [12].

Benefit-cost communication capability helps avoid the product variety paradox by mitigating anticipated regret. During the sales configuration process, potential customers seek to anticipate the value they will perceive from consumption of the product being configured [54]. Perceived product value is defined as the customer's "overall assessment of the utility of a product based on perceptions of what is received and what is given" [55: 14]. By delivering clear pre-purchase feedback on the effects of the available choice options, a sales configurator with high benefit-cost communication capability fosters potential customers' learning about the value they would derive from these options [56, 57]. This learning process makes a potential customer more confident that the product configuration he/she has selected is the one that best fits his/her needs within the company's product space. Reduced uncertainty on the superior fit of the chosen product configuration with the customer's preferences, in turn, translates into less anticipated regret [45], thus lowering choice task difficulty [7].

At the same time, however, higher benefit-cost communication capability may lead to greater choice complexity, with negative effects on decision difficulty. For instance, individual pricing of the available choice options may make cost-benefit trade-offs more salient and, hence, may increase information processing demands [58]. To fully realize the potential advantages of benefit-cost communication capability, therefore, this capability needs to be complemented with the focused navigation one, which lowers choice complexity by quickly reducing the size of the search problem for potential customers. As a result, the learning process enabled by benefit-cost communication capability focuses only on those choice options for which potential customers' preferences are less certain and, thus, the possible negative effects of this capability on choice complexity are mitigated.

3.3. Flexible navigation capability

We define flexible navigation capability as the ability to minimize the effort required of a potential customer to modify a product configuration that he/she has previously created or is currently creating. A fundamental way of improving flexible navigation capability is to allow sales configurator users to change the choice made at any previous step of the configuration process without having to start it over again [13]. Furthermore, after changing the choice made at a given step, potential customers should not be required to go through all the subsequent steps up to the current one. Instead, they should be asked to revise only those choices, if any, that are no longer valid because of the change they have just made [59]. Another option to enhance flexible navigation capability is to allow potential customers engaged in configuring their products to bookmark their work [13]. Bookmarks enable potential customers who are exploring alternative product configurations to immediately recover a previous configuration in the case that they decide to reject the newly-created one.

Flexible navigation capability helps avoid the product variety paradox by mitigating anticipated regret. A sales configurator with this capability enables potential customers to quickly make and undo changes to previously created product configurations. Consequently, the number of product solutions a potential customer can explore in the time span he/she is willing to devote to the sales configuration task is larger. Stated otherwise, potential customers can conduct more trial-and-error tests to evaluate the effects of initial choices made and to improve upon them. Trial-and-error experimentation promotes potential customers' learning about the value they would derive from consumption of the product being configured [56, 57], especially when flexible navigation capability is complemented with the benefit-cost communication one as well as those discussed in the subsequent sections. This learning process makes potential customers more confident that the product configuration they have selected is the one that best fits their needs within the company's product space. Reduced uncertainty on the superior fit of the chosen product configuration with the customer's preferences, in turn, translates into less anticipated regret [45].

3.4. Easy comparison capability

We define easy comparison capability as the ability to minimize the effort required of a potential customer to compare previously created product configurations. A fundamental way of improving easy comparison capability is to allow potential customers to save a product configuration they have just created and, then, to compare previously saved configurations side-by-side in the same screen [13]. The advantages of providing an overview of previous configurations can be enhanced by highlighting commonalities and differences among them, especially if the sales configuration process involves many choices. In this manner, a potential customer can immediately understand, for example, which configuration choices have caused the price or weight difference between two configurations he/she is comparing. Another solution to enhance easy comparison capability is to rank-order previously created configurations in terms of fit to the customer's preferences or profile [43]. This can be accomplished with little or no effort on the customer's part, based on his/her past purchases and/or customer input concerning simple demographics, intended product usage and his/her best developed preferences [26, 51].

Easy comparison capability helps avoid the product variety paradox by reducing choice complexity and by mitigating anticipated regret. A sales configurator with this capability fosters potential customers' learning about the value they would derive from consumption of the product being configured. This happens because, in assessing the value of a particular product solution, customers tend to rely on comparisons with other alternatives that are currently available or that have been encountered in the past [43, 60]. In particular, the possibility of easily comparing complete product configurations is of greatest assistance when global performance characteristics, which arise from the physical properties of most if not all of the product components [48], are important to potential customers. In brief, easy comparison capability gives potential customers evaluating practice at alternative configurations and provides anchors for the evaluative process [6]. Consequently, potential customers improve their confidence that the configuration they have eventually selected is the one that best fits their needs within the company's product space. In turn, reduced uncertainty on the superior fit of the chosen product configuration with the customer's preferences translates into less anticipated regret [45]. A sales configurator with high easy comparison capability also alleviates choice complexity, by reducing information processing necessary to make comparisons. Potential customers do not need to rely on their limited working memory to recover configurations they have previously created. Moreover, potential customers do not need to rely on their limited computational abilities to decompose the configurations they want to compare to find out similarities and differences among them.

3.5. User-friendly product-space description capability

We define user-friendly product-space description capability as the ability to adapt the product space description to the needs and abilities of different potential customers, as well as to different contexts of use. One way of improving user-friendly product-space description capability is to employ content adaptation techniques [cf. 61] to provide optional detailed information pertaining to the available choice options. In this manner, potential customers with higher involvement for the product, who are more interested in acquiring product information [62], are allowed to learn more about the choice options for which their preferences are less developed. Conversely, customers with lower involvement, who feel less responsible for making a good decision [45], are not forced to process product information they are not interested in. In this respect, a promising approach is to design multimedia-based interfaces that enable potential customers to retrieve rich information and explanations about specific product parts/features while looking at an illustration of the product and without breaking the continuity of their product evaluation processes [63]. Another option to enhance user-friendly product-space description capability is to adapt information content presented to potential customers according to their prior knowledge about the product [13, 52]. Particularly, novice customers should be allowed to use a needs-based interface, where the available choice options involve desired product performance and functions, while expert customers should be enabled to employ a parameterbased interface, where the available choice options include design parameters such as specifications of product components [12, 64]. User-friendly productspace description capability can also be improved by presenting the same information content by means of different media, so as to streamline human-computer interaction based on potential customers' characteristics, such as cognitive abilities, age, motivation, cultural background, etc. [65, 66].

User-friendly product-space description capability helps avoid the product variety paradox by reducing choice complexity and by mitigating anticipated regret. A sales configurator deploying this capability provides potential customers with the information content they value most according to their individual characteristics or usage contexts and does not bother users with communications they do not need [52]. In addition, a sales configurator with this capability augments or switches modalities of presentation of the same information content in such a way that each individual user's information processing is enhanced [67]. By tailoring both information content and information format, this capability reduces information overload and eases the customer decision process [68-70]. In particular, this capability allows for aligning the way in which the product space is presented to a potential customer with the way in which he/she is able or willing to express his/her requirements [56, 57]. As potential customers interact with a sales configurator in their customary language, they become able to assess the fit of the configured product with their needs more easily and in less time [71]. This means that, once a potential customer has selected his/her most preferred product configuration, he/she is more confident that the chosen solution is the one that best fits his/her needs within the company's product space. Reduced uncertainty on the superior fit of the selected product configuration with the customer's preferences, in turn, translates into less anticipated regret [45].

3. MEASURES DEVELOPMENT AND VALIDATION

The items for the five sales configurator capabilities were generated based upon the relevant literature and extensive interviews with practitioners involved with the development and use of sales configurators. All the items were measured by means of a 7-point Likert scale. Additionally, we used only positive statements, as negatively worded questions with an agree-disagree response format are often cognitively complex [72] and may be a source of method bias [73].

The original set of items was vetted through three steps in order to remove potential for measurement error from the new scales. First, the items were reviewed by a group of six people with different experiences and perceptions relative to sales configuration, who were questioned about the appropriateness and completeness of the instrument. Second, to replicate as closely as possible data collection procedures to be used in our large-scale study, we pretested the instrument with 20 engineering students from our university, who were asked to comment on any problems encountered while responding, such as interpretation difficulties, faulty instructions, typos, item redundancies, etc.. Based on the feedback from the focus group and field pretesting, redundant and ambiguous items were either modified or eliminated. Finally, the resulting instrument was evaluated through a Q-sort procedure for establishing tentative indications of construct validity and reliability [74, 75]. Each of ten practitioners who are experienced in developing or using sales configurators was given a questionnaire containing short descriptions of the proposed capabilities, together with a randomized list of the items. Subsequently, these

expert judges were asked to assign each item to one or none of the defined capabilities. All the items were placed in the target construct by at least 75% of the judges and, therefore, were retained for our large-scale study [54]. The final instrument consisted of 17 items and is reported in Appendix A.

Each of the proposed sales configurator capabilities indicates a fundamental benefit potential customers should experience and perceive during the sales configuration process if the product variety paradox is to be avoided, regardless of how such benefits are delivered. This is consistent with the capability perspective of routines, which tends to treat routines as a "black box" and is mainly interested in the purpose or motivation for routines [76]. Notice that sales configurators embody rules and procedures to generate or select the product variant that best fits each customer's idiosyncratic needs within a company's product space and, as such, are repositories of organizational procedural knowledge: namely, they are software-embedded routines [77].

Accordingly, to measure the proposed sales configurator capabilities, we needed to collect data on sales configurations experiences made by potential customers using sales configurators. Specifically, data for our large-scale study were gathered on a sample of 630 sales configuration experiences made by 63 engineering students at the authors' university (age range: 24-27; 29% females) using Web-based sales configurators for consumer goods relevant to the participants. As a result, our data are biased in favor of young, male, and fairly adept persons who are familiar with the Internet. At the same time, however, young people adept at using Internet also represent the majority of business-to-consumer sales configurator users [35, 78]. Each participant was asked to configure a product according to his/her individual preferences on 10 different, pre-assigned, Web-based sales configurators and to fill out a questionnaire for each of these configuration experiences. We decided to control for possible effects of participants' characteristics before the psychometric properties of assessing our measurement scales. Consequently, consistent with prior studies [79], we regressed our 17 indicators on 63 dummies representing the participants in our study and used the standardized residuals from this linear, ordinary least square regression model as our data in all the subsequent analyses.

Subsequently, CFA was employed to assess unidimensionality, convergent validity, discriminant validity, and reliability of our measurement scales. We used a variance-covariance matrix of the 17 indicators to input data, maximum likelihood method to estimate the model, and LISREL 8.80 to conduct the analysis.

Unidimensionality and convergent validity were assessed by estimating an a priori measurement model, where the empirical indicators were restricted to load on the latent factor they were intended to measure. The model showed a good fit to the data: RMSEA (90% CI)= 0.047 (0.040; 0.054), χ 2/df (df) = 2.39 (109), CFI=0.991, NFI=0.984. Furthermore, inspection of the standardized factor loadings indicated that each was in its anticipated direction (i.e., positive correspondences between latent constructs and their posited indicators), was greater than 0.50, and was statistically significant at p<0.001. Altogether, these results suggested that every item was significantly associated with one and only one latent

factor and that, for each scale, all items in the scale were convergent [80-83].

Discriminant validity was tested using [84] procedure. For each latent construct, the square root of the average variance extracted (AVE) exceeded the correlation with each of the other latent variables, thereby suggesting that our measurement scales represent distinct latent variables [84].

Reliability was assessed using both AVE and the Werts, Linn, and Joreskog (WLJ) composite reliability method [85]. All the WLJ composite reliability values were greater than 0.70 and all the AVE scores exceeded 0.50, indicating that a large amount of the variance is captured by each latent construct rather than due to measurement error [84, 86].

Finally, we examined the predictive validity of our constructs by investigating whether they exhibit relationships with other constructs in accordance with theory [87]. Our proposed sales configurator capabilities are posited to help firms avoid the risk that offering more product variety and customization to increase sales, paradoxically results in a loss of sales. Accordingly, these capabilities are hypothesized to positively influence both choice satisfaction and purchase intention. In the same way as Valenzuela et al. [9], we measured choice satisfaction as follows: "How satisfied or dissatisfied are you with the product that you have customized? (sevenpoint scale: very dissatisfied/very satisfied). Following Schlosser et al. [88], we measured purchase intention by means of three items, each rating the same statement ("If I needed this type of product, I do think I would buy the product that I have just configured") on a different seven-("Unlikely/likely" (-3 point scale to +3),"Impossible/possible" (-3 to +3), "Improbable/probable" (-3 to +3), respectively). This measure of purchase intention proved to be both reliable and valid (WLJ composite reliability: 0.972; AVE= 0.920; square root of AVE exceeded the correlation with each of the other latent variables). The structural model testing the hypotheses that the proposed sales configurator capabilities positively influence both choice satisfaction and purchase intention, showed a good fit to the data: RMSEA (90% CI) = 0.0432 (0.0372; 0.0493), χ^2/df (df) = 2.18 (169), CFI=0.993, NFI=0.987. All the path coefficients are positive and statistically significant, indicating that each of the five sales configurator capabilities has a significant positive effect on both choice satisfaction and purchase intention and thus establishing the predictive validity of our constructs.

4. CONCLUSION

prior research concerning Drawing upon sales configurators and the customer decision process, the present paper conceptualizes five capabilities that sales configurators should deploy in order to help avoid the product variety paradox: namely, focused navigation, flexible navigation, easy comparison, benefit-cost and communication, user-friendly product-space description capabilities. Overall, these capabilities support personalization of the sales configuration experience according to each individual user's characteristics and context of usage. Benefit-cost communication capability combined with user-friendly description capability product-space supports personalization on the content and presentation levels [cf. 89], while focused navigation, flexible navigation, and

easy comparison capabilities support personalization on the interaction level [cf. 89]. Personalization of the sales configuration experience is essential to build successful sales configurators, which improve fit between selected product configuration and customer needs while limiting search effort [cf. 89, 90]. The ultimate goal would be to simulate the adaptive and heuristic behavior that makes salespeople effective and aids in improving both the shopping experience and the final product choice [91, 92].

Another contribution of this study is the development and validation of an instrument to measure the proposed set of capabilities. The instrument was rigorously tested for content validity, unidimensionality, convergent validity, discriminant validity, predictive validity, and reliability. In particular, we found that each of the proposed capabilities significantly predicts both choice satisfaction and purchase intention, in accord with the theoretical argument that these capabilities help avoid the product variety paradox. Admittedly, our large-scale validation study involved hypothetical rather than real purchase experiences, only focused on sales configurators for consumer goods, and used students as subjects for research. Therefore, future studies should strengthen the proposed instrument through a series of further refinements and tests across different populations and settings, including truly representative samples of potential customers, sales configurators for industrial goods, etc.. Though conscious that development of a measurement instrument is an ongoing process [93], we believe our instrument will be a useful diagnostic and benchmarking tool for companies seeking to assess and/or improve their sales configurators. Further, we believe the instrument developed in this paper will be of use to researchers not only as a basis for refinement and extension, but also directly. Future studies could develop and test hypotheses linking the proposed capabilities to the various dimensions of the value of customization that have been discussed in literature [35, 54, 78, 94, 95]. In particular, further research is needed to empirically investigate complementarities among the proposed capabilities, meaning that the effects of one capability on the customer perceived value of customization is reinforced by another capability, as our paper suggests.

5. APPENDIX A

Benefit-cost communication capability: (1) Thanks to this system, I understood how the various choice options influence the value that this product has for me. (2)Thanks to this system, I realized the advantages and drawbacks of each of the options I had to choose from. (3) This system made me exactly understand what value the product I was configuring had for me.

Easy comparison capability: (1) The system enables easy comparison of product configurations previously created by the user. (2) The system lets you easily understand what previously created configurations have in common. (3) The system enables side-by-side comparison of the details of previously saved configurations. (4) The systems lets you easily understand the differences between previously created configurations.

<u>User-friendly product-space description capability</u>: (1) The system gives an adequate presentation of the choice options for when you are in a hurry, as well as when you have enough time to go into the details. (2) The product features are adequately presented for the user who just wants to find out about them, as well as for the user who wants to go into specific details. (3) The choice options are adequately presented for both the expert and inexpert user of the product.

Flexible navigation capability: (1)The system enables you to change some of the choices you have previously made during the configuration process without having to start it over again. (2) With this system, it takes very little effort to modify the choices you have previously made during the configuration process. (3) Once you have completed the configuration process, this system enables you to quickly change any choice made during that process.

Focused navigation capability: (1) The system made me immediately understand which way to go to find what I needed. (2) The system enabled me to quickly eliminate from further consideration everything that was not interesting to me at all. (3) The system immediately led me to what was more interesting to me. (4) This system quickly leads the user to those solutions that best meet his/her requirements.

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