How product intelligence and brand affect consumption value and intended usage: Evidence from a smart washing machine

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Abstract:

Technological progress has paved the path to the market introduction of numerous smart products. In our research, we investigate which smartness dimensions increase the consumption values of a consumer product and how these consumption values impact product usage. Moreover, we study whether strong brands foster positive attitudes towards smart products. Our analysis uses data from an online survey with participants from Germany who answered questions with respect to a consumer product with a moderate level of smartness, namely, a smart washing machine. Results show that each of the investigated smartness dimensions increases at least one, but not necessarily all, of the consumption values. Furthermore, emotional value turns out to be a major driver of product usage. As expected, strong brand recognition has a positive effect on perceived smartness of the washing machine. With respect to consumption values and product usage, however, we only found a brand effect for functional value.

Keywords: smart product, consumption value, brand effect

Track: Innovation Management & New Product Development

1. Introduction

In the digitalization era, rapid technological progress has enabled companies to widen their product portfolio and allowed new players to introduce radically new products, implement disruptive business models, and potentially establish novel markets (for an overview in the context of the internet of things, see Decker and Stummer, 2017; Kannan and Li, 2017; Ng and Wakenshaw, 2017). However, this development also bears challenges, as practitioners lack reliable data about which smartness dimensions increase (or decrease) the consumption values of a product and how these affect product usage, thus making prediction of market behaviour difficult.

So far, only a relatively small number of empirical studies have addressed adoption of smart consumer products. Our research contributes to this stream of research in that it investigates another interesting smart product, namely, a smart washing machine, and in that it also examines brand effects for this smart product.

2. Prior work

Most prominently, Rijsdijk, Hultink, and Diamantopoulos (2007) and Rijsdijk and Hultink (2009) investigated various effects of product smartness on consumer perception of innovation attributes and product satisfaction. Generally, product smartness seems to show positive effects, but the extent of these effects differs considerably across product categories. This finding has been confirmed in a recent study by Kaldewei and Stummer (2018) with respect to smart phones, smart watches, and smart TVs. Park and Lee (2014) investigated smartness dimensions of smart phones and their effects on consumption values as well as on use-diffusion and showed that the latter is partly mediated by functional, emotional, and conditional consumption values. They underlined the need to consider product usage as a prerequisite of goal-oriented innovation and product management strategies. Mayer, Volland, Thiesse, and Fleisch (2011) studied smart products in a kitchen environment, concluding that the influence of performance expectancy, effort expectancy, and social influence is moderated by gender. Other researchers have suggested further factors such as the cognitive effort to change habitual behaviour or perceived disempowerment, which may evoke resistance to intelligent products (Paetz, Dütschke, and Fichtner, 2012; Schweitzer and Van den Hende, 2016; Valencia, Mugge, Schoormans, and Schifferstein, 2013).

3. Research framework

In line with the studies mentioned above, we expect that smartness of products will positively affect perceived consumption value, which should consequently have a positive effect on behavioural intentions. Our research framework is similar to the framework used by Park and Lee (2014), but ours differs in that we use the extended consumption values concept of Sweeney and Soutar (2001) instead of the approach of Sheth, Newman, and Gross (1991). The relevance of emotional value has already been underlined in previous works (e.g., Lee, Nam, and Suk, 2011; Park and Lee, 2014; Park, Hyun-Jae, and Kim, 2014) as the adoption of smart products is interconnected with increased risk and fear of losing control (e.g., Lee et al., 2011, Schweitzer and Van den Hende, 2016; Verbene et al., 2012). Hence, emotional experiences and unconscious motives should be examined along with the rational perspective (Valencia et al., 2013). Furthermore, again in line with Park and Lee (2014), we also consider usage intentions.

In short, we investigate (i) the influence of (selected) smartness dimensions on (selected) consumption values and (ii) the influence of consumption values on product usage. With respect to smartness dimensions, we focus on autonomy, reactivity, and multifunctionality (according to Rijsdijk and Hultink, 2009), which were selected based on our assumption that they will play the most prominent role in our application case of smart washing machines. With respect to consumption values, we have opted for emotional and functional value (according to Sweeney and Soutar, 2001). Product usage is measured in terms of variety of use (according to Shih and Venkatesh, 2004).

Transferring findings from literature on the acceptance of conventional products, we also assume that strong brands can generate positive attitudes towards smart products (Del Rio, Vazquez, and Iglesis, 2001; Keller, 1993), as such brands implicitly promise quality, thus garnering consumers' trust (Dodds, Monroe, and Grewal, 1991). Hence, the negative influence of high perceived risk and potential loss of control associated with smart products (Mick and Fournier, 1998) should be alleviated by brand effects (e.g., Chaudhuri and Holbrook, 2001; Verbene et al., 2012).

4. Hypotheses

Accordingly, we focus on three selected smartness dimensions, including (a) autonomy, which can be understood as the ability of a product to act independently, (b) reactivity, which covers the ability to respond immediately to the environment, and (c) multifunctionality,

which describes the technical capabilities and therefore the variety of features provided by a product. Autonomy and reactivity should initially increase the value of a product if the related features facilitate customers' daily lives. However, studies have shown that once these dimensions exceed a critical threshold, the effect is reversed (Rijsdijk and Hultink, 2009). As to consumption values, we focus on (a) functional value, which covers features, performance, and quality of a product, and (b) emotional value, which covers emotional experiences and sentiments regarding the perception and usage of a product, and is assumed to drive consumers' usage intentions (Park and Lee, 2014; Verbene et al., 2012). Some of the following hypotheses (i.e., H1a, H2a/b, H3a/b, H4, H5) are drawn from the study of Park and Lee (2014) and adapted to our application case. The remaining hypotheses (i.e., H1b, H6a-e, and H7) are novel.

As we believe that the smartness level of the washing machine is moderate (i.e., it does not induce fear of losing control, etc.), we expect that both autonomy and reactivity have a positive effect on the investigated consumption values:

H1a: Autonomy of a smart washing machine has a positive effect on the perceived functional value.

H1b: Autonomy of a smart washing machine has a positive effect on the perceived emotional value.

H2a: Reactivity of a smart washing machine has a positive effect on the perceived functional value

H2b: Reactivity of a smart washing machine has a positive effect on the perceived emotional value.

Furthermore, we reckon that we can transfer the (inherent) positive relationship between multifunctionality and functional value as well as emotional value, leading to the following research hypotheses:

H3a: Multifunctionality of a smart washing machine has a positive effect on the perceived functional value.

H3b: Multifunctionality of a smart washing machine has a positive effect on the perceived emotional value.

To investigate users' behavioural intentions towards a smart product, we consider product usage as an indication of prospective market acceptance and potential for long-term market success (Park and Lee, 2014; Shih and Venkatesh, 2004; Yang and Peterson, 2004). Following the results of previous studies (e.g., Mayer et al., 2011; Park and Lee, 2014; Rijsdijk and Hultink, 2009; Sweeney and Soutar, 2001), we assume that higher consumption

values will increase product usage measured in terms of variety of use. We expect that functional benefits are connected to the intended product usage, which obviously touches variety of use:

H4: The functional value of a smart washing machine has a positive effect on the intended variety of use.

In line with Park and Lee (2014) and Verbene et al. (2012), we assume that not only is the functional value capable of driving usage intentions of a smart product but also that irrational and subjective factors are fundamental to evoking customers' intentions to use the smart washing machine in various ways:

H5: The emotional value of a smart washing machine has a positive effect on the intended variety of use.

Following Truong et al. (2017), who found a positive relationship between the strength of a brand and the evaluation of high-technology products, we also expect a brand effect in our application case and therefore assume that a strong brand increases both perceived consumption values and product usage. This is supported by the belief that strong brands imply a promise of quality, leading to a better evaluation of the product or its anticipated value and thus establishing trust. Accordingly, the smartness of a product is hypothesised to be perceived as higher if the product belongs to a strong brand, which could consequently increase the perceived functional and emotional value:

H6a: A strong brand of a smart washing machine increases the perceived autonomy.

H6b: A strong brand of a smart washing machine increases the perceived reactivity.

H6c: A strong brand of a smart washing machine increases the perceived multifunctionality.

H6d: A strong brand of a smart washing machine increases the functional value.

H6e: A strong brand of a smart washing machine increases the emotional value.

As a result of increased consumption values, we expect that a strong brand also increases product usage:

H7: A strong brand of a smart washing machine increases the intended variety of use.

5. Study design

Our empirical study is based on a survey with 400 subjects accessed through an established German market research institute. Regarding age and gender, the subjects are (nearly) representative of the German online population. In a 15-minute online experiment, we gave these participants verbal descriptions of a smart washing machine. Half the

participants received the information that the washing machine was the product of a strong brand (Miele), while the other participants were told the smart washing machine was manufactured by a lesser known brand (Indesit). Other than brand, the descriptions of the machine were identical. On the questionnaire, participants indicated their level of agreement with various statements regarding the specific smartness dimensions (questions drawn from Rijsdijk and Hultink, 2009, and Park and Lee, 2014) and the emotional, and functional value of the presented smart washing machine (taken from Sweeney and Soutar, 2001) on 5-point Likert-type scales. Regarding product usage, we used information about the hypothetical variety of use of the presented washing machine, for which the number of features served as a measure of the variety of use.

To check the validity of our multi-item scales, we conducted confirmatory factor analyses, which showed that all the constructs met the criteria for high reliability. All items have factor loadings above 0.50 and are thus regarded as suitable to constitute the designated factors. Cronbach's alpha values were greater than 0.80, indicating high reliability of the item scales (George and Mallery, 2003). We examined the global quality of our model by calculating χ^2/df ($1.58 \leq 3.00$; see Browne and Cudeck, 1992), comparative fit index (CFI: $0.99 \geq 0.95$; see Kline, 2005), and root-mean-square error of approximation (RMSEA: $0.04 \leq 0.08$; see Hair et al., 2010). All these global quality indicators comply with the respective thresholds, confirming a good overall model fit.

6. Results

We tested our hypotheses via structural equation modelling. The results in Table 1 suggest several significant relationships between the examined variables.

Construct	Functional value	Emotional value	Variety of use
Autonomy → Value	0.141*	0.163*	
Reactivity → Value	−0.136*	0.020	
Multifunctionality → Value	0.376***	0.182**	
Functional value → Use			0.240***
Emotional value → Use			0.687***

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 1. Estimated path coefficients

Findings with respect to the influence of smartness dimensions on consumption values indicate that perceived autonomy not only positively affects functional value but also affects the perceived emotional value (however, both results are subject to a relatively low significance level). The reason might be that autonomy enhances emotional experiences of usage. Interestingly, results regarding reactivity and multifunctionality are in opposition to one another. Reactivity has a significant negative effect on functional value and no significant effect on emotional value. The negative effect of reactivity on the functional value might be explained through the notion of high complexity and the (potential) disturbance that comes with this smartness feature, which may reduce usability (Rijsdijk et al., 2007). Furthermore, reactivity seems not to deliver an emotional experience to customers. Multifunctionality, on the other hand, strongly increases functional value, and it also increases the emotional value triggered by using the smart washing machine. Accordingly, we confirm hypotheses H1a/b and H3a/b, and reject H2a/b.

As expected, the emotional value drives the variety of using the smart washing machine (see lower part of Table 1). Sweeney and Soutar (2001) have already stated that the (somewhat related) willingness to buy cannot exclusively be determined through functional value; rather, emotional experience also plays an important role, and, indeed, we observe a similar relationship for product usage. Consumers who perceive high functional or emotional value are accordingly willing to use their smart washing machine in more ways, and may utilize the full spectrum of features. Consequently, we can confirm hypotheses H4 and H5.

Our final analysis covers the examination of the brand effect on perceived smartness, emotional value, functional value, and product usage of the washing machine. To this end, we conducted several t-tests to control for significant group differences. Subsequently, strong brand recognition indeed seems to increase perceived smartness of the smart washing machine: autonomy, reactivity, and multifunctionality are perceived as higher (all the corresponding p-values are <0.01) for the washing machine supposedly manufactured by Miele compared to the machine labelled as manufactured by Indesit. Hence, the capability of the product and the implied promise of quality that a consumer connects with a strong brand seems to have a positive impact on the perception of smartness. Not astonishingly, this also results in a higher functional value if the washing machine is provided by Miele. Interestingly, none of the conducted t-tests regarding emotional value and variety of use deliver statistical evidence for group differences. Hence, we did not find a corresponding brand effect for emotional consumption value or product usage. Consequently, we confirm hypotheses H6a/b/c/d and reject hypotheses H6e and H7.

7. Conclusions

Our analyses show that for the smart product at hand, each of the investigated smartness dimensions increases at least one consumption value and only one instance showed a negative effect (i.e., reactivity decreases functional value). A moderate level of autonomy, reactivity, and multifunctionality – as is the case for the smart washing machine under consideration – is thus perceived as mostly beneficial by consumers. When observing the effect of consumption values on usage diffusion, emotional value emerged as a particularly effective driver of product usage. A similar effect, although to a lesser degree, has been found for functional value. Consequently, marketing activities should place emphasis on conveying emotional experiences. As expected, strong brand recognition has a positive effect on perceived smartness of the smart washing machine. With respect to the impact of consumption values and product usage, however, we found brand effects only for functional value. Brand accordingly seems to play a role in perceived smartness, but less so for consumption value and product usage.

Remaining limitations of our study may provide starting points for further research: First, we relied on data from a survey among subjects in Germany. Future studies therefore might consider other countries and/or more specific market segments (e.g., with respect to social class or lifestyle). Second, we investigated a single product. More work is necessary to study products with different levels of smartness and/or from heterogeneous industries. Third, we focussed on brand as an additional product-specific characteristic. As some other characteristics may also play roles in consumption values, further research is necessary to determine more drivers of adoption and usage of smart products.

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