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**Managerial Perspectives on
Virtual Customer Integration**

**-
Cognition, Attitude, and Intention**

*Michael Bartl^{*1}
Johann Füller^{*2}
Holger Ernst^{*1}
Hans Mühlbacher^{*2}*

Author contacts:

**1 Otto Beisheim Graduate School of Management (WHU)
Chair for Technology and Innovation Management
Burgplatz 2
56179 Vallendar, Germany
Fon ++49 261-6509-241, Fax -249
mbartl@whu.edu
hernst@whu.edu*

**2 University of Innsbruck
Department of Value-Process Management, Marketing Group
Universitaetsstrasse 15
A-6020 Innsbruck, Austria
Fon ++43 512-507-7201, Fax -2842
johann.fueller@hyve.de
hans.muehlbacher@uibk.ac.at*

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Abstract: Web-based interaction between customers and producers offer new promising ways of bringing customers into the company right to where the value creation begins – in new product development (NPD). Despite the high potential of virtual customer integration (VCI), practical application is limited. The decision of initial utilization of VCI depends on the manager's predisposition - favorable or unfavorable - towards VCI; usually, it is the responsibility of managers and executives belonging to the development, marketing or innovation departments to sanction such a decision. To get a deeper understanding of antecedents leading to the application of VCI, further information is needed. In this paper, the authors shed light on the various factors affecting managerial intention to apply virtual customer integration. The theory of planned behavior (TPB) provides a basis for developing a research model explaining the relation between managers' cognition, attitude, social norms, perceived behavioral control and their intention to adopt VCI. The initial results of our empirical study, wherein we interviewed 94 managers within the consumer goods and services field, show that the TPB accounts for 66 percent of the variance in the managers' intention to apply VCI. Furthermore, the study reveals that social norms and perceived behavioral control are the main factors which influence managerial decision to apply VCI. This contrasts with the widely-held theory that an individual's attitude is the most significant factor of influence.

1. Introduction

Several fields of research accentuate the increasing importance of customer orientation and customer integration. For the success of new products, customer integration is seen as an important factor (Cooper/Kleinschmidt 1995; Griffin/Hauser 1993). Customer orientation also helps to improve customer centricity, which is identified as a superior overall business strategy (Deshpandé et al. 1993; Jaworski/Kohli 1993; Kumar et al. 2002; Narver/Slater 1990). Furthermore, customer integration can serve as a means of establishing a relationship based on trust and commitment (Gruen et al. 2000; Sirdeshmukh et al. 2002; Wikström 1996). Of special interest to the authors is the possibility of integrating customers virtually into the process of new product development and of transferring certain development tasks to them. As shown in empirical research, (Franke/Shah 2003; Hippel 2001; 1988; Hippel/Katz 2002), customers¹ are not only able to create their own products but are also willing to transfer their know-how onto the innovation process. However, due to high interaction costs, the number of customers integrated into the company's value chain (e.g. via focus groups) and the intensity of interaction was quite limited. As new technology for interactive communication, virtual product animation and data handling became more advanced and easily available, the novel internet-based approach of virtual customer integration (VCI) emerged in order to improve NPD by interacting with a mass of former anonymous consumers (Dahan/Hauser 2002). However, with the exception of a few pioneers (see Appendix A), practical usage of the novel VCI approach has been minimal up to now.

The authors try to shed light on the preconditions that led to the implementation of VCI within a company's innovation process. To get a deeper understanding of this operation, further information about the decision making process that leads to the application of VCI is needed. From a socio-psychological perspective, the application of VCI depends on the manager's individual predisposition. Starting from an investigation of the status quo of VCI in the consumer goods and services field, the authors focus on the following two main questions in relation to Ajzen's theory of planned behavior (TPB):

- (1) *What are the managers' attitudes toward VCI and what are the salient beliefs leading to an adoption of this attitude?*
- (2) *Do managers intend to implement VCI in their NPD process in the future, and what determinants influence them in doing so?*

With this study, we hope to provide some insight into the requirements that have to be fulfilled in order to meet managers' expectations, and the major factors that lead to the managerial decision to apply VCI.

¹ The term customer in this article refers to actual users in a consumption context. Hence, the term customer is synonymous to consumer and user as vice versa. This terminology also includes the different states of former, actual or potential purchase, consumption or usage.

2. Virtual Customer Integration into New Product Development

The customers' wants and their acquired knowledge through the actual use of products make them an essential external resource for NPD (Hippel 1988; Leonard-Barton 1996; Thomke/Hippel 2002). VCI intends to utilize customers as valuable resource throughout all stages of the NPD process by integrating them virtually. Several conditions have to be met to get valuable input from customers (Littler et al. 1995). VCI covers all aspects - tools, tasks, product presentations, incentives and web design - which have to be considered in order to create an efficient and effective virtual dialogue between consumers and producers that allows the knowledge transfer.

As the Web lowers the cost of employing large samples of customers (Iansiti/MacCormack 1997) and allows the gaining of rapid-response and instantaneous feedback from customers all over the world, new possibilities for an active dialogue arise. Moreover, web-based visualization of virtual products, their functions and design, as well as innovative interaction methods (Dahan/Hauser 2002) and toolkits², allow customers to participate in NPD in a much more active and in-depth way than existing market research methods, even before physical products and prototypes come into existence. As such, the concept of VCI faces existing barriers of functional fixedness, the missing ability of consumers to imagine alternative functions of existing and familiar products (Ulwick 2002). Moreover, it is a way of supporting customers to articulate and design their own future customized innovations and give producers a clear overview of what exactly they want, especially in the early stages of NPD. Consequently, the R&D team is challenged to consider a shift of need-related tasks to customers and utilize their potential to innovate (Hippel 1988).

By applying VCI, customers can take on different roles and activity levels in NPD depending on the particular task assigned to them (Nambisan 2002). Lengnick-Hall (1996) identified four primary roles of customers within innovation: customers as resource, as co-producer, as user, and as buyer. That is, customers can serve as a source of ideas which includes supplying information or any other tangible/intangible asset to identify product opportunities and generate ideas. They also can participate in a range of activities ranging from actual product design to evaluation of concepts, and even act as co-producers and co-designers. Furthermore, customers can function as users who contribute to product testing, product improvement and pre-market forecasting. Last but not least, they also buy the product. Brockhoff (1998) used the term 'active participant' (*'aktiver Mitgestalter'*) for customers who contribute ideas, problem solutions or designs to new product development. This expression may describe the customer's role best in the context of VCI. The extent of integration mainly depends on the optimal level of economies of customer integration (Ernst 2001; Piller/Möslein 2002).

To date, most research on VCI has focused on the design of tools that can be used, and on consumers' abilities that qualify them for new product development. One angle of research has concentrated on toolkits that allow the transfer of tacit knowledge and enable consumers to become innovators themselves (Hippel/Katz 2002; Thomke/Hippel 2002), while others have focused on the development of superior market research tools for valid virtual concept evaluation and product testing

² Interactive toolkits give customers the capability for trial-and-error learning by doing as changes including price, performance and appearance of virtual prototypes are immediately visible on the screen and can be adjusted to personal preferences. (von Hippel/Katz 2002).

(Dahan/Hauser 2002). Some empirical effort has been carried out to test the applicability of such tools within the design of the virtual interaction itself (Füller et al. 2003). Despite initial positive indications, however, VCI is not a widely spread manifestation in the consumer goods and services industry. To the authors' knowledge, no research has been conducted to investigate managers' expectations on virtual customer integration and what factors influence their intention to apply VCI.

3. Theoretical Framework and Hypotheses

In order to investigate the underlying variables affecting the individual manager's intention to apply the VCI approach, we chose Ajzen's theory of planned behavior (TPB) (Ajzen 2001; 1993; 1991; 1985) for our analysis. TPB allows us to examine the relationship between cognition, attitude, social norms, perceived behavioral control and the intention to apply VCI. Moreover, TPB specifies factors needed for the prediction and explanation of relatively specific behavioral tendencies (Ajzen 2001; 1985). It is an extension of Fishbein's and Ajzen's theory of 'reasoned action' (Ajzen 1980; Fishbein/Ajzen 1975). The difference between both theoretical approaches is the extension of the applicability from actions under complete volitional control to actions under partial volitional control. TPB consists of three conceptually independent variables determining the behavioral intention³. These are: the (1) attitude towards the behavior, (2) subjective norms and (3) perceived behavioral control. In general, the more favorable the attitude and subjective norm and the greater the perceived behavioral control, the stronger an individual's intention to perform the corresponding behavior. Intention is viewed as the immediate antecedent of actual behavior (Ajzen 1980). Fishbein/Middlestadt write: "If one is attempting to predict behavior, the most appropriate predictor would be a measure of the person's intention to perform that behavior" (1995 p.185). Although, as Seeman (1993) remarks, it is naive to construe attitude measurement as an effort to get an elusive one-to-one correspondence between attitude toward VCI, intention and actual behavior.

3.1. Applicability of TPB

"Since much human behavior is under volitional control, most behaviors can be accurately predicted from an appropriate measure of the individual's intention to perform the behavior in question" (Fishbein/Ajzen 1975 p.380). However, certain conditions have to be fulfilled before TPB can be applied successfully. Most important is the considered action that is at least partly under volitional control of the individual. In addition, the measures taken have to be compatible with the other determined criteria. That means that the intention measure has to correspond to the behavioral criterion in terms of action, target, context, time-frame and specificity. Constraints can be minimized by paying careful attention to the correspondence between the performance criterion and the wordings of the attitude, subjective norm and intention questions. By becoming more specific and by administering the measures of attitudes, subjective norms and intentions as closely as possible to the performance time, the statistical relation of the model constructs will increase. In Seeman's words, "It is clear that in some circumstances - e.g. predicting election results - attitude surveys generally

³ Bagozzi and Schneiditz (1985) describe intention as a decision to perform the behavior in question. In hierarchical attitude models intention is synonymous to conation.

function very well as predictors, since the focus is on a narrow and routinized event" (1993 p.13). Many scholars have challenged the sufficiency assumption that only the few predictors in the TPB are enough to account for intentions and behavior. Thus, they introduced moderating variables such as personality traits or organizational context variables to improve the model. Even if, as Hill remarks, "the importance of contextual or situation variables requires explicit recognition," (1981 p.374), the moderating variables are only of limited value to increase the understanding of the attitude-behavior relation, due to the fact that, to a great extent, the improvements in prediction are relatively minor (Ajzen 2001). For actions that have been performed many times, TPB cannot be applied, as intentions may become irrelevant. Such actions become at least partly under the control of automatic processes or habits (Aarts et al. 1998). Within this context - examining managers' readiness to apply VCI - TPB seems suitable as the required boundary conditions are met. Due to the novelty of the VCI approach, habits or automatic processes do not exist as yet.

In addition, TPB has been frequently employed within a business context to get a deeper understanding about factors influencing managers' intentions to adopt new concepts or systems. Lim (2003), for example, applied TPB to research managers' adoption of negotiation support system software; Hill et al (1996). selected TPB to research managers' intention to benchmark; Comado and Frieze (2000) draw on TPB to research managers' intention for pollutional source reduction and Maurer and Palmer (1999) outline that TPB is broadly applied in the context of organizational behavior. The theory has proved suitable for several projects of minor to middle affect on the organization. These projects strongly depend on the individual managers' decisions. In our case, after conducting several interviews in different companies, we concluded that middle and upper managers from either marketing or R&D seem to be responsible for the initial application of VCI.

Consistent with TBP, the research model shown in (Figure 1) was developed to provide a framework to study the relationship between cognition, attitude, perceived behavioral control, and subjective norms, and the behavioral intention to implement VCI. The derived hypotheses are indicated by the notations H(1), H(2) and H(3).

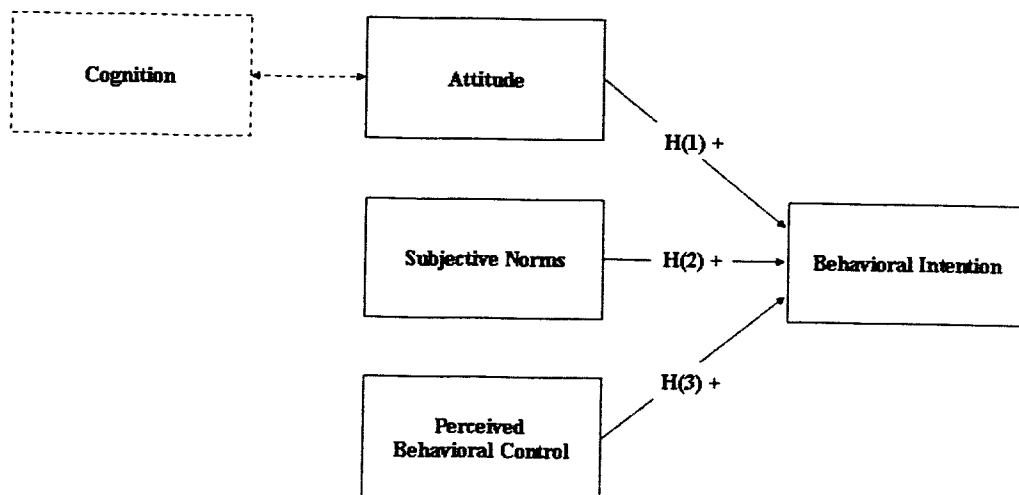


Figure 1: Research Model of the Behavioral Intention to implement VCI in NPD

3.2. Attitude

Attitude is defined as: "an individual's disposition to react with a certain degree of favorableness or unfavorableness to an object, behavior, person, institution or event – or to any other discriminable aspect of the individual's world" (Ajzen 1993 p.41). Attitude can be classified into three subgroups: (1) *cognition* - expression of positive and negative beliefs and evaluations towards the outcome; (2) *affect* - overall expression of feelings and (3) *conation* - expression of intention (Ajzen 1993). Generally it is assumed that the cognitive, affective and conative category each reflect a conceptually distinct component of attitude (McGuire 1985). At present, the discussion continues as to whether attitude can be seen as a single or tripartite construct. In general, a single factor is found to account for much of the variance in the attitudinal responses (Ajzen 2001). In accordance with previous research, we use the term 'attitude' in the sense of the 'affective dimension' (Ajzen 2001). Attitude as affect expresses an overall feeling towards an action which can be measured by semantic differentials such as good/bad, useful/useless or pleasant/ unpleasant.

As stated in our theoretical premise, we expect a positive influence of the manager's overall attitude towards VCI on the intention to apply VCI. Therefore, we assume:

H(1): The managers' attitude will be positively related to their intention to apply VCI.

3.3. Cognition

For the formation of attitude most theorists make use of a cognitive or information processing approach (Ajzen 2001). They assume that the sequence which initiates an intention starts with the processing of information, followed by an evaluation of the information and the development of an attitude (Bagozzi 1982). By applying expectancy-value theory to the model, the underlying cognitive structure of attitude as affect becomes visible (Fishbein/Middlestadt 1995). The sum of one's salient beliefs multiplied by its subjective evaluations form an overall expectancy-value judgment that expresses the cognition towards an action - see (Equation 1).

$$EV = \sum_{i=1}^n (b_i \cdot e_i)$$

b = salient belief

e = subjective evaluation

EV = expectancy value judgement

Equation 1: Expectancy Value Judgement

With regards to the expectancy-value model, Ajzen points out: "Any reaction, - whether verbal or nonverbal, whether cognitive, affective, or conative – that reflects a positive or negative disposition toward an object can be used to infer the latent attitude, but only cognition's that come to mind spontaneously (i.e., salient beliefs) provide a picture of an attitude's informational foundation" (1993 p.44). Assuming that we could measure all beliefs and evaluations accurately, the cognition - measured as EV - should be highly correlated to the attitude as affective dimension (Bagozzi 1982). However, Lutz (1977) for example found only little variance of affect explained as a function of $b \cdot e$. Therefore, Bagozzi (1982) warns against treating EV and affect operationalizations as alternative measures of a single underlying attitude, as is proposed by Fishbein and

Ajzen. Although individuals differ in each own's tendency to rely on thoughts and feelings (Haddock/Zanna 1998), it is the affective dimension of attitude which tends to predominate (Lavine et al. 1998). This means that the overall feelings are primary determinants of attitude and behavior (Ajzen 2001). In certain situations, such as impulsive behavior or affective reaction originated from a relatively strong stimulus, affective reaction can arise before, and be independent of, cognitive processes. This is Bagozzi's (1982) explanation as to why the link between cognition and affect may be relational and not causal. Hence, to get a deeper understanding of which salient positive and negative beliefs towards the outcome have an influence on the overall attitude (affect), a correlation analysis will be conducted. We shall assume that the expectancy value judgements have an influence on the overall attitude towards VCI.

3.4. Subjective Norms

Subjective norms refer to the perceived social pressure to, or not to, perform an action. In other words, a manager's intention depends on what most people who are important to him think about performing the behavior in question (Ajzen 1980, p.57). Pressure may stem from individuals (such as peer group members, subordinates or boss) or groups. Beneath felt normative pressure, as Bagozzi and Schnedlitz (1985) claim, it could be found that subjective norms also depend on the person's need for approval which is defined as a general predisposition to conform to expectations expressed by relevant others. In potent social contexts, that is, within a strong organizational culture, intentions may rather be a function of perceived rewards or punishments. In this sense, one might term 'intention' as being externally guided. In weak social contexts, the individual's attitude will presumably outweigh the intention to influence him/her. (Bagozzi/Schnedlitz 1985)

Although, innovation managers should have full authority to apply VCI – as it is within their area of responsibility - the decision will depend to a large extent on the broader perspective or framework of management - i.e. refusal or affirmation of VCI by other people such as upper managers, peers and subordinates who are important to that person. Due to reward mechanisms such as job-promotion, salary increase and exposure to management, colleagues and subordinates, managers will be forced to align their actions with the overall company norms. Thus, we postulate:

H(2): Positive subjective norms will be positively related to the managers' intention to apply VCI.

3.5. Perceived Behavioral Control

Perceived behavioral control refers to the perceived ease or difficulty of performing the action under consideration. People will avoid doing things which do not realistically seem to be attainable, as failure is costly in terms of self-esteem and wasted time and resources (Sheppard et al. 1988). As Fishbein and Ajzen argue, "people do not intend to perform behaviors that they realize are beyond their ability (1975, p. 372). Perceived behavioral control must be distinguished from "perceived controllability" (which is conceptualized as the belief that someone has volitional control over the performance of a behavior; that is, a person's perception of his or her control over resources, knowledge and cooperation partners necessary to carry out the behavior (Madden et al. 1992) and "self-efficacy", which Bandura (1997) conceptualized as the degree of anticipated difficulty in performing a behavior. Studies have shown that only self

efficacy and not the perceived controllability, added significantly to the prediction of intentions and behavior (Ajzen 2001). The importance of self efficacy as a predictor of intention is greater in the case of activities where the person has only variable or limited control over the behavior (Ajzen 1985). Unlike attitude and subjective norm, the effects of self-efficacy on behavior are not entirely moderated by intention. There is also a direct, independent relation to behavior (Ajzen/Madden 1986).

VCI is a relatively new approach unifying several competencies, such as virtual product design, interface design, statistics and programming literacy. Hence, applying VCI demands certain skills and up-front investments that can hardly be provided from a single manager or his department. The manager will partly depend on people not directly under his control to successfully implement VCI and to overcome initial obstacles. Finally, there are always certain risks of failure associated with new methods, as with new products. Hence, the perceived behavioral control to carry out a VCI project is hypothesized to influence the intention positively. Therefore, we argue:

H(3) The managers' perceived behavioral control will be positively related to their intention to apply VCI.

4. Sample and Online Data Collection

Our instrument for data collection was an online form that is still posted under the web-address www.customizedinnovation.de/englisch until October 2003. The study called "VCI Project 2003" is fielded by the WHU Institute of Technology and Innovation Management in cooperation with the Marketing Institute at the University of Innsbruck. The relevant literature, preliminary interviews with marketing and R&D managers and the obtained experience in several conducted VCI real business projects guided the development of the survey instrument.

Several sections which focus on different aspects of VCI from a company-centric perspective were included in the online survey. The first section includes general information on customer integration and internet usage. To introduce VCI to the respondents, several examples from different industries were presented, supported by several web-based illustrations and short descriptions. Then, as the focus of this paper, the respondents were asked to provide information on their cognition, attitude and intention to apply VCI in the future.

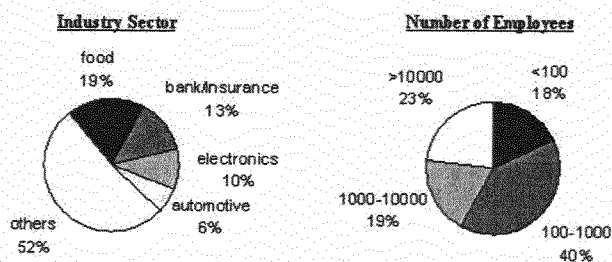
The instrument was extensively pre-tested via a three step approach. The first pre-test involved five scientific assistants and doctoral students; the second and third pre-tests each involved ten managers from different consumer goods and services firms. The online questionnaire was examined on the bases of clarity, ambiguities, usability, technical problems and time estimation. Feedback from each phase led to revisions that improved the readability, wording, construct measures, layout and functionality of the study. These revised and improved versions were then tested in the following step with different groups of participants.

Registered companies in the German and Austrian industry and commerce index were asked to identify appropriate contact persons in the marketing and development departments who seem to be particularly responsible for an initiative such as VCI. After a short description of the VCI research project an email invitation including the link to the online questionnaire was sent to over 650 potential participants, each of whom

were issued with a unique identifying code. A first follow-up mail was conducted after two weeks, a second, after three weeks. Additionally, respondents were able to access the questionnaire via a link placed in the MIT web section of the "Virtual Customer" initiative or directly via the Homepage of the project. Throughout, the survey respondents were automatically prompted by the Web server to complete any omitted items. As an incentive, a summary of the research findings and a free participation for a workshop or conference were offered.

All cases with missing data in any of the fields in the survey and/or questionable fill-in times of less than 20 minutes were eliminated for analysis. Finally, the data collection strategy led to a sample of 94 respondents who had completely filled out the survey. This was an effective response rate of 15,5%. The sample description on a company level as well as on a management level is shown in (Figure 2). The sample is divided up into 19% food, 13% bank/insurance, 10% electronics, 6% automotive firms. The remaining participants came from the cosmetics/health, transportation, sports/games, furniture and other sectors. 40% of the managers' companies were medium sized with 100-1000 employees. On a management level, 54% of the participants were positioned at middle management, which includes area managers and department heads. Upper management positions included the board of directors and managing directors while the lower management level included team managers and administrators. The predominant gender was male, the average age was 37 years (n=78, 16 respondents did not provide their age).

Sample Description - Company Level



Sample Description - Management Level

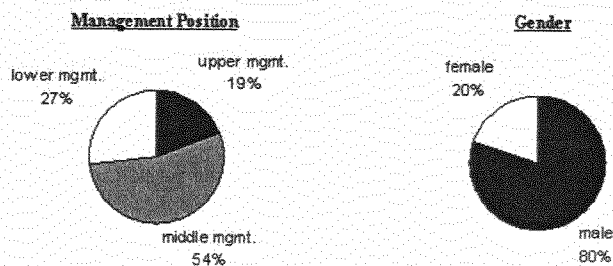


Figure 2: Sample Description (n = 94)

4.1. Measures and Operationalization

All of the survey measurement items are listed in (Table 1). The most salient beliefs and its evaluations representing the underlying cognitions were operationalized after an intense review of literature regarding the advantages and disadvantages of customer integration (Bruce et al. 1995; Gruner 1997; Kirchmann 1994; Littler et al. 1995). Additionally interviews with practitioners were used to specify the salient beliefs. For attitude as affect, a classical semantic differential technique was used to obtain the rating profiles regarding VCI. The four scales are shown in (Table 1) and were used in a similar context by Hartwick and Barki (1994). Using confirmatory factor analysis to test the construct of attitude, the following indexes resulted, indicating a very good overall fit (Chi-square=2,19, df=1, p=0,139, GFI=0,99, AGFI=0,885, CFI=0,99, RMSEA=0,11⁴) The intentions to apply VCI were measured with three items. The first item BI1 was measured with the question, "Do you intend to integrate customers virtually in NPD?". In contrary to the first item which is relatively specific for action and target, the second item BI2 was additionally specific in time, "Do you plan to initiate further steps within the next 12 month in order to implement VCI?". A last item BI3 emphasized the behavioral commitment to integrate VCI in the NPD-process in the future. Using Cronbach's alpha we found the reliability for the behavioral intention to be 0,91. The reliability for the subjective norms could be improved by eliminating the item SN3 and lead to a Cronbach's alpha of 0,87. The perceived behavioral control was measured with a single item operationalized as shown in (Table 1).

5. Results

The online study started with the presentation of several practical examples using picture intensive illustrations and textual explanations in order to provide a clear understanding of VCI.⁵ After the participants had studied the examples, they were asked if their company already utilized VCI as described. It turned out that no single company applied VCI on a full scale, meaning that the actual behavior of VCI could not be observed yet. This indicated the anticipated high degree of novelty of the VCI approach for the different managers and their companies, and reinforces the choice of the TPB with the behavioral intention as antecedent of the final behavior. Nearly all of the companies did not even partially use the Internet to integrate customers online. This is indicated in the left-hand bar-chart of (Figure 3), a diagram on the current application of VCI. This indicates that the expected potential of the Internet to bring customers into the company for NPD has not been exploited yet. This statement is reinforced when we match up to the current application with the behavioral intention of applying VCI (see Figure 4). Although the intention to apply VCI measured with BI as an overall factor seems to be low at first sight (Mean=2,81; S.D.=1,54), over 22% of the

4 We allowed error terms to covary for the closely related semantic scales.

5 The examples can be accessed at www.customizedinnovation.de/englisch

participants were more likely than unlikely to implement VCI. By analyzing the single items of the intention to apply VCI (BI1, BI2 and BI3), we found a tendency that the intention to adopt VCI was slightly smaller if the respondent was actually asked for a certain timely restriction as in BI2 or an unambiguous future commitment as in BI3.

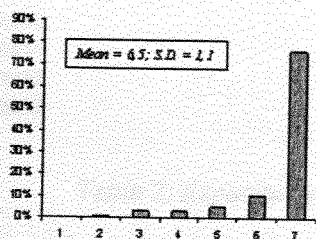
Expectancy Value Judgement		Beliefs Toward the Outcome and Evaluation		Method of Measurement
	Label			
<i>Advantages resulting from VCI</i>	be1	Reduction of the market uncertainties (sales forecast, market acceptance, flop risk).		$EV = \sum_{i=1}^n (b_i \cdot e_i)$ <p><i>b</i> measured on a seven point Likert-type scale, anchored by (1) "strongly disagree" and (7) "strongly agree"</p> <p><i>e</i> measured on a seven point Likert-type scale, anchored by (1) "not relevant" and (7) "very relevant"</p>
	be2	Information about product use in order to determine future needs and requirements.		
	be3	Greater variety of ideas.		
	be4	Acquisition of customers.		
	be5	Increase customer retention.		
	be6	Broader decision basis. With virtual test options several product alternatives can be considered simultaneously.		
	be7	Customer information for NPD can be collected and processed more efficiently (time, cost).		
<i>Disadvantages resulting from VCI</i>	be8	Customers are not able to articulate their requirements for NPD because of a lack of technical knowledge.		<p><i>b</i> measured on a seven point Likert-type scale, anchored by (1) "strongly disagree" and (7) "strongly agree"</p> <p><i>e</i> measured on a seven point Likert-type scale, anchored by (1) "not relevant" and (7) "very relevant"</p>
	be9	The consideration of individual customer contributions leads to a neglect of a balanced target group orientation.		
	be10	Problems exist regarding legal issues to exploit customers' contributions (copyright, licensing etc.).		
	be11	VCI disturbs internal processes in NPD.		
	be12	Lacking secrecy: Competitors can get access to information that should be kept secret.		
	be13	Incremental innovations: The customers ideas and suggestions are oriented on existing solutions		
Construct	Label	Item Description	Method of Measurement	
<i>Affitude</i>	A1	Indicate your feelings towards VCI. I consider VCI to be...	<p>Four-item, semantic differential anchored on a seven point scale</p> <p>(Scales were recorded from 1 to 7-point scales to a bipolar range of -3 to +3)</p>	
	A2	useless / useful		
	A3	worthless / valuable		
	A4	terrible / terrific		
<i>Behavioral Intention</i>	BI1	Do you intend to integrate customers virtually in NPD?	<p>Three-item, seven point Likert-type scale, anchored by (1) "very unlikely" and (7) "very likely"</p>	
	BI2	Do you plan initiate further steps within the next 12 months in order to implement VCI?		
	BI3	VCI will be an integral part of your NPD-process in the future?		
<i>Perceived Behavioral Control</i>	PBC	Assuming that you want to carry out a VCI-project, do you think that you can push through the project in your company?	<p>Single-item, seven point Likert-type scale, anchored by (1)</p>	
<i>Subjective Norms</i>	SN1	The management would appreciate it if you initiate a VCI-project.	<p>Three-item, seven point Likert-type scale, anchored by (1) "very unlikely" and (7) "very likely"</p>	
	SN2	Carrying out a VCI project would be beneficial for your career.		
	SN3	There will be a lack of acceptance for VCI within your company.		

Table 1: List of Measurement Items

As VCI is a very novel approach for the participating managers, and the posed online questionnaire was the first illustration and explanation of the approach to them, the probable adoption rate of 22% seems to be very promising. To sum it up, the application of VCI is very rare, however the intention of future application exists. These results definitely justify further research efforts regarding this evolving approach to integrate customers online.

Current Application of VCI

Does your company already utilize the internet as shown in the examples above to integrate customers into NPD?



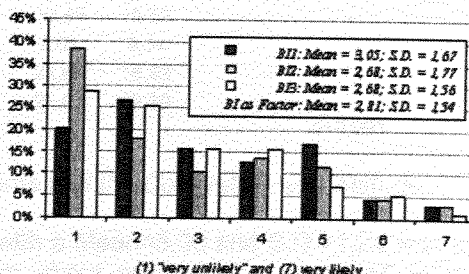
(1) "yes, exactly as shown" and (7) "no not at all"

Behavioral Intention to Apply VCI

B1: Do you intend to integrate customers virtually in NPD?

B2: Do you plan to initiate further steps within the next 12 months in order to implement VCI

B3: VCI will be an integrated part of your NPD process in the future



(1) "very unlikely" and (7) very likely

Figure 3: Current Application vs. Behavioral Intention to Apply VCI

The second part of the descriptive findings refers to the relationship of cognition and attitude which is illustrated in our research model in (Figure 1) by the dotted lines. The relation between cognition and attitude was not included in the structural equation model as we interpreted the connection as relational and not causal as already mentioned. We investigated the single expectancy-values (EV) for all positive and negative beliefs towards VCI, as well as their correlations toward the factor attitude. The results are shown in (Table 2). Insignificant and minor correlations under 0,30 are not included in the table.

	Mean	S.D.	r Attitude
Advantages resulting from VCI			
be1	19,02	13,79	0,50
be2	23,88	14,19	0,53
be3	19,95	12,78	0,52
be4	15,19	12,31	0,41
be5	19,98	13,91	0,35
be6	18,91	12,97	0,58
be7	20,51	13,58	0,57
Disadvantages resulting from VCI			
be8	17,83	13,54	—
be9	15,86	13,40	—
be10	19,49	15,59	—
be11	8,86	9,34	—
be12	22,87	16,83	—
be13	21,05	13,30	—
			p<0,001

Table 2: Expectancy Value Judgements and the Correlation with Attitude

The overall attitude or feeling towards VCI with a Mean=5,00 and S.D.=1,24 was quite positive. As we can see, be2 (Information about product use) and be7 (efficient information collection and processing) have the highest positive EVs and correlations with attitude of 0,53 and 0,57. The acquisition of customers (be4) has the lowest positive EV of VCI. The negative EVs are not significantly related to attitude. This means that the attitude is influenced only by the positive goals and beliefs toward the outcome. However be12 (lacking secrecy), be13 (incremental innovations) and be10 are recognized as the major problems of VCI. These results show that the strongest relation between the overall attitude and single cognitions are with expectancy value judgments related to customer information about product use (be2), efficient information collection and processing (be7) and broader decision basis (be6) to find out about the underlying cognitive structure of attitude towards VCI.

5.1. Causal Model and Hypotheses Tests

A causal modeling method was used to represent the constructs and test the hypotheses. (Figure 4) shows the causal model examined in this article. The data was then analyzed with AMOS structural equation modeling software.

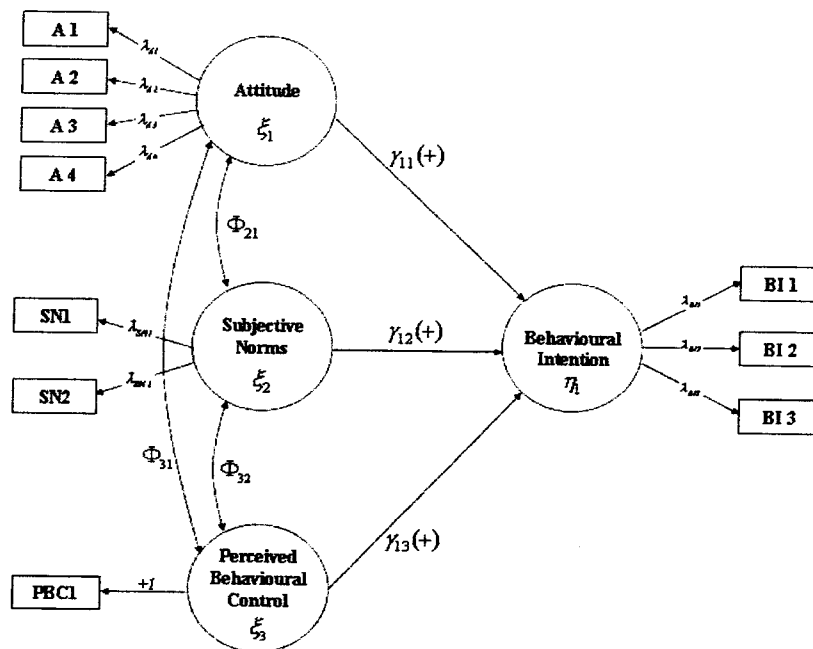


Figure 4: Causal Model of Behavioral Intention to implement VCI in NPD

In the convention of path analysis, Greek parameters stand for parameters to be estimated, circles represent latent constructs, boxes refer to measurements, arrows connecting circles stand for hypothesized causal paths, arrows between circles and boxes are measurement relations and double headed arrows are correlations between the independent variables. The measurement of the latent variable perceived behavioral control was set equal to unity to fix this single item measurement relation. We allowed no error terms to covary in any of the measurement models except the one of attitude explained above. To evaluate the overall causal model we examined multiple indexes of model fit, since it is possible for a model to be adequate on one fit index but inadequate by the standards of others.

The parameter estimates the measurement submodels and the causal paths are shown in Table 3. The fit indexes of the model were very good except for the p-value for the Chi-square test of 0,06. Satisfactory models were achieved with p-values greater than or equal to about 0.10. Nevertheless, the overall evaluation of the model fit which included all indexes still illustrates a good model fit.

Parameter Estimates		Goodness of Fit Indexes	
γ_{11}	0,08	Chi-square	43,10
γ_{12}	0,56	df	30,00
γ_{13}	0,25	p	0,06
λ_{A1}	0,88	GFI	0,91
λ_{A2}	0,90	AGFI	0,84
λ_{A3}	0,92	CFI	0,98
λ_{A4}	0,79	RMSEA	0,07
λ_{SN1}	0,97	RMR	0,10
λ_{SN2}	0,79		
λ_{B1}	0,83		
λ_{B2}	0,92		
λ_{B3}	0,90		
Φ_{21}	0,59		
Φ_{31}	0,50		
Φ_{32}	0,71		

GFI = goodness-of-fit index; AGFI = adjusted goodness-of-fit index; CFI = comparative fit index; RMSEA = root mean squared error of approximation; RMR = root mean square residual

Table 3: Causal Model Results

The expected positive relationship between attitude and behavioral intention (γ_{11}) was not significant ($p=0,37$). Therefore **Hypothesis 1** must be rejected. The subjective norms variable produced a standardized path coefficient of $\gamma_{12}=0,56$ ($p<0,001$). The perceived behavioral control variable produced a standardized path coefficient of $\gamma_{13}=0,25$ ($p<0,05$). All measurement relations (λ) between the latent variables and the measurement items were significant on a $p<0,001$ level. These results supported **Hypothesis 4** and **Hypothesis 5**. Overall these two variables accounted for 66% of the variance of the behavioral intention construct with subjective norms as its strongest predictor. The primacy of subjective norms and perceived behavioral control were also observed by Hill et al. (1996) who investigated the intention to benchmark. Although the insignificant relationship between attitude and behavioral intention cannot be explained by the theory of planned behavior, it seems feasible that managers with minimal experience of a novel concept like VCI tend to emphasize their normative beliefs about views of key groups such as senior management. Moreover, the responsibilities of implementing VCI may not as yet be clearly assigned to the R&D, marketing, e-business or other organizational divisions, meaning that the managers' decision is not completely under volitional control. This can cause a stronger externally-guided intention and a neglect of their own attitude.

6. Concluding Remarks

The study was performed to shed light on the managers' and executives' intention to apply VCI for NPD. Subjective norms and behavioral control were identified as the key

determinants of behavioral intention. The underlying attitude did not have the expected impact on managers' intentions. In other words, the managers' positive attitude towards VCI has no impact on its application. In this study our intention was not to fully explain the process that leads to the application of VCI in a company's innovation process. Rather, our goal was to identify factors influencing individual managers in their decision to apply VCI. In the course of researching this topic, we gained a deeper understanding of the mechanism which drives managers to apply VCI. We concluded that the decision would not be undertaken by a single manager; rather, discussions with other relevant people will play a major role.

As a practical implication, these findings show the importance of top-level management support to initiate changes like the application of VCI. The managers' strong emphasis on subjective norms and perceived behavioral control led to the indication that middle managers are encouraged to take decisions in alignment with others. While decisions in consensus may be worthwhile, the process may be extensive and time consuming. One would have assumed that in dynamic environments a decision made by a single manager based on a thorough trade-off analysis of the strengths, weaknesses, opportunities and threats of integrating customers into NPD would enforce company benefits. The applied TPB provided valuable insight to the conditions which have to be met in order for VCI to be utilized more often by companies.

With regards to the research questions which we posed in the introductory part of this paper, the findings can be summarized as follows:

- *The attitude is formed by expectancy-value judgements consisting of rational beliefs about the positive and negative consequences of VCI and the evaluation of those consequences. Information on product use in order to determine future needs and requirements, efficient information processing with the help of the Internet, a greater variety of ideas and customer retention were highest ranked positive cognitions affecting the attitude. Lacking secrecy, incremental innovation and legal issues were the highest ranked negative ones. However only positive cognitions influenced the attitude significantly. It can be further stated that affect and the underlying cognitions reflect different components of attitude.*
- *22% of the managers were more likely than unlikely to implement VCI. The expected management support, expected career opportunities and the perceived control to be able to accompany and carry out a VCI project emerged as strongest determinants of the intention to adopt VCI, whereas the attitude had no significant influence as factors of prediction.*

We hope that the results of our study stimulate further research on this evolving issue of product development. Certainly, case studies and proposed future research can be conducted to provide a holistic understanding of the VCI process per se, as well as to enter the customer's perspectives on VCI as counterpart of this study.

With reference to the caused resonance of this study and the personal interviews conducted throughout the VCI Project 2003, we can state that innovation practitioners and academics alike expressed great interest in VCI for NPD. On the basis that customers are innovative and willing to contribute, we believe that further research should focus on how to utilize customers as promising sources of innovation. Therefore we strongly recommend the inclusion of the following aspects more thoroughly in the research agenda of VCI:

- *What kind of customers should be integrated?*
- *Where can the customers with the required characteristics be identified and accessed?*
- *What motivates customers to contribute to NPD and to what extent incentives would enforce the desired behavior?*
- *How the web-based interaction itself should be designed efficiently (i.e. intensity, institutionalization, communication pattern and tools).*

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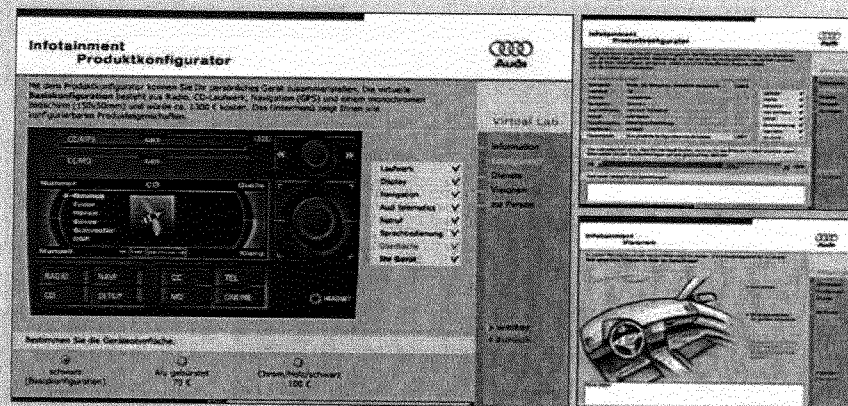
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Appendix A

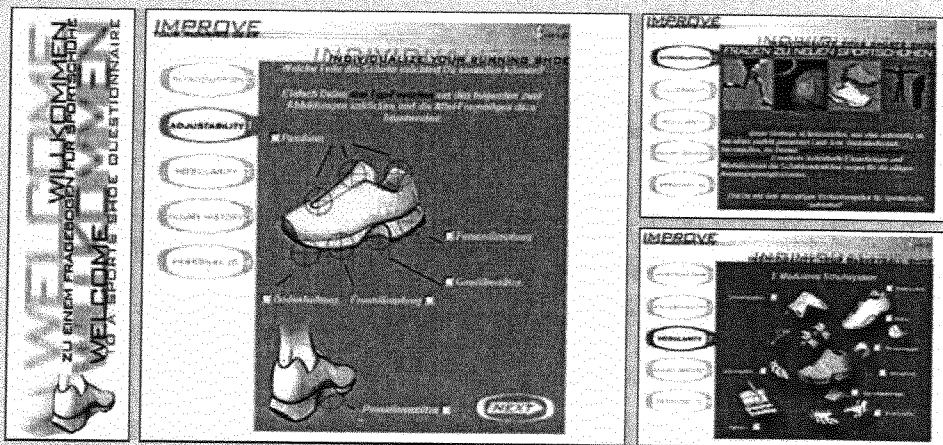
The Practical Application of VCI - Selected Examples

- The Audi AG integrated a web-based interaction platform called "Virtual Lab" in their official Webpage to integrate customers in the development of future Infotainment systems. The Infotainment electronics sector is one of the fastest evolving fields in the automotive world at the moment. These systems integrate state of the art communication and entertainment technologies in the domains of Audio, Video, Navigation, Audi Telematics and General User Interfaces to an overall Infotainment system in the car. Two main objectives were stated at Audi Infotainment. The project should, (1) deliver information about customer expectations, preferences and upcoming trends in the Infotainment world quickly, cheaply and interactively; (2) give insights concerning customer acceptance, perceptions and input quality of web-based customer integration in NPD in general



Different user groups were taken into account to contribute to the producer-user collaboration for the development of Infotainment systems. Lead users (Lead Users are users whose present strong needs will become general in a marketplace month or years in the future) seem to provide valuable inspirations for the creation of Infotainment visions of the future. Early adopters of high-end Infotainment systems including functionalities like navigation, telematics and voice control were assumed to give valuable input for creating promising variations of virtual product concepts and evaluating the recently launched telematics offerings. Heavy users in the low-end segment would give insights in weaknesses of the current product performance as a starting point of system improvements relevant for the next generation systems. Within the stage of Ideas and Concepts users had the possibility to express their Infotainment visions no matter how curious or bizarre they appeared. A design scribble of a possible future interior was introduced as teaser to enhance creativity. In the Design and Engineer stage the user was able to configure their individually desired radio-navigation concepts as virtual prototypes including different combinations of features and functions. The next user task was to evaluate previous launched and further considered Audi telematics services in dependence of different scenarios of usage. The Virtual Lab concluded with questions on demographics and user attributes mentioned above in step two of the case. Overall a sample of nearly 1500 participants was achieved.

- Peugeot initiated a design contest where nearly 2800 design enthusiasts from 90 countries were registered with their proposed car designs on the theme of "Retrofuturism". (<http://www.peugeot-avenue.com>)
- Volvo introduced the "Volvo Conceptlab", a website where future car concepts are introduced and user feedback is collected for NPD (<http://www.conceptlabvolvo.com>).
- Procter and Gamble installed a P&G Advisory Community where users became the chance to participate in designing, testing and launching new products. Under the category "Share your thoughts" on the P&G Homepage the users are able to obtain the status of an R&D advisor by providing contributions to the development of different products. Furthermore there is the opportunity to share patent ideas with the P&G innovation team.
- A world wide acting sports company considered the idea to build adjustable running and basketball shoes to serve the individual needs of their customers regarding cushioning, lateral stability, injury history etc. Athletes were integrated in the concept development and definition of different adjustable modules of the sport shoes.



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