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Frambach, R.T.; Agarwal, M.K.

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The Impact of Innovation Characteristics on Potential Adopters' Transition through Adoption Process Stages

Ruud T. Frambach
Manoj K. Agarwal
Edwin J. Nijssen

vrije   Universiteit   *amsterdam*

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Ruud T. Frambach, Manoj K. Agarwal & Edwin J. Nijssen[1,2]

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Abstract

Research on innovation adoption has suffered from a bias towards understanding the factors that affect the dichotomous adoption/non-adoption decision. Much less attention is devoted to the question why potential adopters fail to progress to the adoption stage from earlier stages in the decision making process. Such knowledge is essential to understand what factors actually underlie the non-adoption of an innovation. As perceived innovation characteristics have been found to influence adoption in a substantial way, we develop hypotheses on their influence not only with respect to the adoption stage, but with respect to previous stages of the adoption process as well. Specifically, we develop hypotheses on the perceived levels and importance of relative advantage, compatibility, complexity and perceived risk in the awareness, evaluation, and adoption stages of the innovation adoption process. The hypotheses are tested using both multivariate analysis of variance and multinomial logit modeling on a sample of 242 organizations, focusing on the adoption process of electronic banking. The results show that the levels of perceived relative advantage and compatibility increase over the stages of the adoption process, whereas the perceived levels of complexity and risk largely decrease. The influence of the characteristics across the adoption stages shows that positive beliefs related to the innovation have highest salience in the initial stage of the process, whereas the salience of perceived complexity-generally considered an undesirable attribute—is highest in the fmal stage. In sum, our results imply that non-adopters are affected by innovation characteristics in a different way, depending on their stage in the adoption process, and therefore should not be considered as one homogeneous group of "potential adopters". These fíndings have important implications for marketing innovations.

INTRODUCTION

Why do some customers respond to marketers' efforts to stimulate the acceptance of an innovation and others don't? What kind of marketing messages should be directed to potential customers who have not adopted yet? Should all non-adopters be treated as homogeneous? These questions are relevant to many types of industries and innovations. In the financial sector, for example, banks are trying to market innovations such as electronic payments, electronic banking, Internet banking, and mobile banking, with varying success. The financial services industry is changing and e-business within the financial services sector is here to stay (see, for example, www.ibm.com, www.sun.com). Therefore it is important to know to what extent customers are more or less favorable towards the idea of adopting new banking technologies and why. A bank needs to know how to segment the customers into groups with varying likelihood of adoption, and what marketing actions to take in order to increase the product adoption probability. With respect to other innovations as well, these are important questions for marketers in all kinds of markets aiming at enhancing the effectiveness of their operations by stimulating the continued use of innovations.

The importance of innovation adoption necessitates a thorough understanding of the factors affecting the adoption process of new products and services at the customer's level. Diffusion theory research has helped to identify and understand these factors and has provided substantial insight into the determinants of the adoption decision. Perceptions of the innovation's characteristics (Rogers 1995; Tomatzky and Klein 1982), and adopter and social network characteristics (Rogers 1995; Damanpour 1991; Gatignon and Robertson 1985) have been found to influence the adoption decision in a major way. However, most studies primarily categorize the market dichotomously into adopters and non-adopters, and thus treat all non-adopters similarly. However, the adoption decision is more of a "process through which an individual or other decision making unit passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to

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implementation of the new idea, and to confirmation of this decision" (Rogers 1995). Treating all non-adopters as a homogeneous group is not very helpful to marketers who are stimulating non-adopters to purchase their product. Past research has been sketchy at best. Gatignon and Robertson (1989) divided the customers into three groups: adopters, rejecters, and undecided. They found that the factors being used by the rejecters were different than those of the adopters. Therefore, the extent to which potential adopters pass through different stages of adoption before actually adopting the innovation clearly needs more attention (Labay and Kinnear 198 1).

In addition, the evaluation criteria that potential adopters apply at each stage (Olshavsky and Spreng 1996) are also important for marketers of the innovation. Research on antecedents of behavioral change in the domain of health psychology suggests that the role of perceptions with respect to a certain behavior differs over the stages of the decision process (Prochaska and DiClemente 1982). In a study of 12 problem behaviors (e.g., smoking cessation, weight control, safer sex, and mammography screening), Prochaska et al. (1994) generally find that negative perceptions (perceived disadvantages of a certain behavior) dominate positive ones in the early stages of the adoption process, whereas perceived advantages of a behavior dominate negative ones in later stages. However, perceived innovation characteristics may not only change over time (which is likely as potential adopters acquire information), but may also have a different effect on the likelihood of potential adopters moving from one stage to another (c. Weinstein et al. 1998). For example, negatively perceived characteristics may become more salient at the point of adoption as the potential adopter is affected by the anxiety of the purchase decision (Ajzen and Sexton 1999). Thus, both the perceived level of innovation characteristics and their salience are likely to differ between the stages of the innovation adoption process. For example, in the early stages, customers may know little about an innovation's relative advantage (low level), but an improvement in perceived relative advantage may be critical for moving to the next stage (high salience). As the customer proceeds towards the adoption stage, through information search, the customer may learn a lot

more about the advantages (high level), but which may not weigh as much as, say, costs or perceived complexity of the adoption (low salience). For marketers this is highly important as more detailed information on the composition of the non-adopter segment enables them to market new products or services more effectively, thus preventing or limiting customer drop out.

The objective of this paper is to investigate to what extent the levels and salience of perceived innovation characteristics change over the stages of the innovation adoption process in a business-to-business marketing context. We define an innovation as " any idea, product or service that is perceived to be new by a potential adopter" (Rogers 1995). This study aims to enhance our understanding of the heterogeneous group of non-adopters of an innovation and, consequently, identify antecedents of transition behavior through the innovation adoption process by organizations. First, we will develop hypotheses on the role of perceived innovation characteristics in the different stages of the adoption process. Next, we will elaborate on the research methodology of the empirical study, followed by our findings. Finally, we will discuss the results of the study, and formulate implications and limitations of the present research.

THEORY AND HYPOTHESES

Stages of Adoption

Adoption theory is widely used to study innovation acceptance. Assuming a hierarchy of effects model, the adoption process is generally depicted as consisting of an awareness stage, a consideration stage, an intention stage, and an adoption stage, respectively (Rogers 1995; Robertson 1971). In the awareness stage, the non-adopter becomes aware of the innovation. In the event that an organization explicitly evaluates whether the innovation should be adopted it enters the consideration stage. In this stage the organization may gather information on the innovation to obtain insight into the specific attributes, advantages, and

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disadvantages or costs of the innovation. As long as the organization acquires information actively or passively, it remains in this stage. Once the organization decides in favor of the innovation, the potential customer enters the intention stage. However, not until the actual purchase is made is the adoption stage entered. Although stages in the adoption process are distinguished conceptually, most empirical research on the diffusion of innovations has used a simple dichotomous approach to study adoption behavior; only adopters and non-adopters are distinguished (Olshavsky and Spreng 1996; Midgley and Dowling 1993). In this respect, previous research has found that adopters perceive higher levels of relative advantages, higher compatibility, lower complexity and lower perceived risk with respect to an innovation than non-adopters (Labay and Kinnear 198 1; Meyer and Goes 1988; Rogers 1995). Although effective, this approach ignores the heterogeneity that non-adopters may display with respect to their perceptions of the innovation. The customers may evaluate the characteristics of the new product differently, depending on their familiarity with the innovation and the degree to which they have considered it for adoption (i.e., their stage in the adoption process). Consequently, the role that perceived innovation characteristics play may vary across the different stages of the adoption process (Velicer et al. 1985; Rakowski et al. 1993).

Changes in Innovation Characteristics over Different Stages

Consistent with the adoption stages depicted in innovation research in marketing, the theory of behavioral change (Prochaska and DiClemente 1982) posits that potential adopters of a certain behavior pass through stages before adoption. The behavioral change will occur when the positively perceived characteristics of the behavior dominate the negative ones, i.e., when the 'decisional balance' (Velicer et al. 1985) is dominantly positive. Generally, the levels of positively perceived attributes of the behavior increase over the stages of the adoption process, whereas negative ones decrease. Depending upon their levels and degree of increase or decrease, behavior change may occur at some stage in the adoption process (Rakowski et al. 1992, 1993, Prochaska et al.

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1994).

However, not only the perceived levels of innovation characteristics change over the stages of the adoption process, but also their valence is expected to change. According to Lewin's (1935, 1938) analysis of conflict and conflict resolution, the positive and negative valances grow in strength as an individual comes closer to making a decision (Ajzen and Sexton 1999). Thus, although the perceived levels of the innovation characteristics may either increase (as expected for the positive ones) or decrease (as expected for the negative ones), their salience can be expected to become stronger. Potential adopters apparently value the perceived innovation characteristics more strongly as the adoption decision comes closer. Consequently, a potential adopter's migration from one stage to the other is the result of the interaction between the perceived level of an innovation characteristic and its salience to the potential adopter; we need to study both these.

Innovation Characteristics

Given the exploratory nature of our study we focus on four perceived innovation characteristics that have been found to be key drivers of adoption and that include the major drivers of customers' leaning requirements with respect to innovations (Gatignon and Robertson 1991), viz. relative advantage, compatibility, complexity and perceived risk. The extent to which a potential adopter perceives the innovation to provide relative advantages over existing products has consistently been found to be positively related to the probability of innovation adoption (Rogers 1995; Robinson 1990; Tomatzky and Klein 1982). Compatibility—defined as the degree to which the innovation matches with the potential adopter's needs and values (Rogers 1995)—is also positively related to innovation adoption. The perceived degree of complexity of the innovation, defined as the extent to which the innovation is perceived as difficult to understand and use (Rogers 1995), has been found to negatively influence adoption. In the context of (information) technology acceptance, both the perceived relative advantage and perceived complexity have been found to play an important role in the adoption

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process (referred to as 'usefulness' and 'ease of use', respectively, in the Technology Acceptance Model; see Davis, Bagozzi and Warshaw 1989). The perceived risk with respect to an innovation, defined as the degree to which risks are perceived as associated with the innovation (Ostlund 1974), has been found to negatively affect the adoption decision (Venkatraman 1991; Nooteboom 1989; Holak, Lehmann and Sultan 1987).

Hypotheses

Below, we will develop hypotheses on how these four perceived innovation characteristics affect the adoption process by addressing both their perceived levels and their salience in the subsequent stages of the process.

Positively perceived innovation characteristics

Level. For any potential adopter aware of an innovation, consideration of adoption is likely to occur when the innovation is perceived to have some relative advantage over currently available alternatives. In other words, the innovation should have superior value. In business-to-business markets this value will be more functional and objectively determined than in most consumer markets (Anderson and Narus 1999). As a result business customers in the consideration stage should perceive higher relative advantage of the innovation than their counterparts in the awareness stage. The same will hold for the later stages of the adoption process. In accordance with results from behavioral change research the highest level of perceived relative advantage will occur at the adoption stage (e.g., Rakowski et al. 1992, 1993). This is also consistent with Meyer and Goes (1988) who find that adopters show higher levels of perceived relative advantage than non-adopters.

A similar argument can be made for the perceived levels of compatibility of an innovation. After having become aware of the innovation and its potential relative advantage the customer will next inquire about its compatibility. In order to progress in the adoption process an increase in perceived compatibility should take

place. As a result the level of perceived compatibility should be higher at the intention stage than at the awareness stage. The more an innovation is perceived to be compatible with an organization's needs, activities, and values, the more likely it is considered for adoption but also the more likely it will be adopted. Innovations that are compatible with a potential adopter organization will have higher perceived benefits (and thus higher value; Anderson and Narus 1999) and will be easier to implement within the organization (Zaltman, Duncan and Holbek 1973). In accord with the behavioral change findings we again anticipate an increase. Therefore,

H„: The level of perceived relative advantage of an innovation increases over the stages of the adoption process.

H,: The level of perceived compatibility of an innovation increases over the stages of the adoption process.

Salience. In general, perceived relative advantage of an innovation is found to be one of the major characteristics to affect adoption of innovations among organizational adopters (Robinson 1990). Thus, perceived relative advantage is expected to significantly influence decision-making in all stages of the innovation adoption process. A similar argument can be made with respect to perceived compatibility. In the business-to-business context, innovations are likely to be considered for potential adoption only if they to some degree match organizations' needs, activities, and values. Therefore, we expect that the perceived compatibility will be important to potential adopters in all stages of the adoption process. However, the salience of both perceived advantage and compatibility are not expected to be constant over the different stages of innovation adoption. Following Lewin's theory of conflict, valences of relative advantage and compatibility are expected to grow in strength as the potential adopter approaches the adoption decision (Ajzen and Sexton 1999). This is consistent with Zaltman, Duncan and Holbek (1973) who argue that compatibility of an innovation becomes a major issue for an organization when the innovation is to be implemented within the organization. Therefore, we

anticipate that organizations in the adoption stage will show the highest salience with respect to relative advantage and compatibility.

H„: The salience of the perceived relative advantage of an innovation increases over the stages of the adoption process.

H„: The salience of the perceived compatibility of an innovation increases over the stages of the adoption process.

Negatively perceived innovation characteristics

Level. Organizations that consider adopting an innovation may not yet be very familiar with it due to its newness. Therefore, the future adopter is very likely to have some questions as to the specific potential of the innovation, its use, and its understandability for the organization. Thus, in the initial stages of the adoption process, the perceived complexity and perceived risk of the innovation will be high (Nooteboom 1989). Research on adoption of health related behavioral change has also found that negative features of an innovation dominate the early stages of the adoption process (Rakowski et al. 1992; 1993). Therefore, we suggest that potential adopters in the consideration stage of the adoption process will perceive a higher degree of complexity and perceived risk than potential adopters who have progressed to the intention and adoption stages. Once the innovation is seriously evaluated for possible purchase, the potential adopter will be more familiar with it (e.g., because of information on the innovation [Ross and Robertson 1990]), and thus will perceive less complexity and less risk (Mamer and McCardle 1987; Prochaska and DiClemente 1982). Most familiar will be the adopters, who consequently will have the lowest levels of perceived complexity and perceived risk (cf. Rakowski et al. 1992; 1993). This is consistent with other findings. Investigating consumers' adoption of solar energy systems, Labay and Kinnear (1981) found that 'adopters perceive [. . .] less risk, [and] less complexity, [...], than do knowledgeable non-adopters' (p. 275). Moreover, in an organizational context on the adoption of new medical technologies by hospitals, Meyer and Goes (1988)

found that organizations in later stages of the innovation process perceived the innovation relatively more low risk and low complexity.

We therefore hypothesize:

H_{3a}: The level of the perceived complexity of an innovation decreases over the stages of the adoption process.

H_{3b}: The level of the perceived risk of an innovation decreases over the stages of the adoption process.

Salience. As potential adopters are generally expected to avoid negative consequences of adoption decisions, innovation characteristics that are deemed undesirable (complexity and perceived risk) will significantly influence customers' progression through the adoption process (i.e., have a significant negative impact). Following Lewin's (1935, 1938) theory of conflict, not only positive but also negative valences grow in strength as one approaches a decision (innovation adoption in our case). Thus, although the levels of negatively perceived innovation characteristics may decrease over the stages of the adoption process, their salience increases. Moreover, Lewin's theory postulates that at some point of the decision-making process the negative valences start to dominate the positive ones; avoidance tendency becomes more important than approach tendency. As formulated by Ajzen and Sexton (1999), " when the time of action approaches, however, the negative consequences loom large in people's minds, and their attitudes toward the contemplated course of action become correspondingly unfavorable" (p. 127). This is consistent with Kahneman and Tversky's (1981) loss aversion theory: potential losses weigh heavier than potential gains. This implies that organizations that enter the adoption stage are expected to be the ones that are most dominantly affected by the potentially negative consequences of the adoption decision (c. Taylor and Todd 1995). Non-adopters in the earlier stages are still too far from the adoption decision to be too concerned with the negative

consequences of the adoption decision relative to the positive ones. Therefore, we expect that the relative influence of negative perceptions of the innovation (i.e., complexity and perceived risk) will increase towards and will be highest in the adoption stage of the adoption process. Hence, we hypothesize:

> H,,: The salience of the perceived complexity of an innovation increases over the stages of the adoption process.
>
> H,,: The salience of the perceived risk of an innovation increases over the stages of the adoption process.

METHOD

Sample

The empirical study focused on the adoption of electronic banking in the Dutch business market. At the time of the study, approximately 5% of Dutch firms had adopted an electronic banking system. The sample was drawn îi-om a database of 20,000 organizations operating in The Netherlands, representative of the population of organizations with respect to the main variables of interest. An initial screening ensured that the organizations in the sample met a number of characteristics. These included having access to at least one personal computer and not being a subsidiary of a large firm (in order to assure independent decision making opportunity). The data collection was carried out by a professional marketing research agency by means of computer assisted telephone interviewing (CATI-system). Interviewers asked for the key decision-maker in the financial services purchase function in the company (cf. Gatignon and Robertson 1989; Gauvin and Sinha 1993). In 53% of the cases the respondent was the CEO or owner of the organization. In other cases, the respondent was the controller (32%), or had some other financial or economic function (15%). All respondents were major decision-makers or well acquainted with the decision process. Thus it is reasonable to assume that the interviewees had an in depth knowledge of the (non-) adoption decision of electronic banking by the organization and that these individuals

were pre-eminently qualified to answer questions about the innovation adoption decision. Industrial buying decisions often involve group decisions and these may favor group interviewing instead of personal interviews. However, the use of individual interviews can be justified as each key decision-maker subverts much of his preferences to the group agent (Day and Herbig 1990). Moreover, in a comparative study on the use of single informants versus multiple informants, Wilson and Lilien (1992) found that "it matters little who is chosen as the informant [..] as long as the informant is reasonably knowledgeable about the buying process". Considering our respondents' position, we can expect this assumption to hold.

A disproportional stratified sample of 593 organizations was drawn. Stratification was based on the variables 'size' (the following categories were used: 1 to 19 employees, 20 to 99 employees and 100 or more employees), 'industry' (categories: manufacturing and construction, trade and hospitality, transport and repair, and business services), and 'adoption status' (adoption versus non-adoption of electronic banking). This stratification scheme was used as pure random sampling would yield too small a number of adopters of the innovation (due to the low penetration level), and an overrepresentation of small organizations. Out of 593 organizations in the sample, 259 responded to our survey, representing a response rate of 44%. From those who responded, 12 had never heard of electronic banking, and 5 cases were eliminated due to missing data, leaving a usable sample of 242 organizations that are aware of electronic banking. Tests for non-response bias showed that the response rate was higher among adopters than non-adopters of electronic banking. This may be due to a higher interest in the subject. Since no significant differences on other variables or the reasons for non-cooperation were found, we do not believe the results to be seriously biased.

Measurement

The *stage of adoption* was measured in line with the scale used by Gatignon and Robertson (1989). Respondents were classified into one of four stages (awareness, consideration, intention, adoption) by asking

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respondents to select one of the following statements (note that we only included respondents who were aware of the innovation): "Electronic banking has not been considered at all" (=awareness); "Electronic banking has been considered, but we decided to reject it" (==rejecters); "Electronic banking has been considered, but we decided to postpone the adoption decision" (=consideration); "Electronic banking has been considered, but we have made no decision yet" (=consideration); "We intend to adopt electronic banking" (=intention); "We have adopted electronic banking" (=adoption).

The perceived innovation characteristics were measured as formative scales (Diamantopoulos and Winklhofer 2001) based on the adoption literature (Tornatzky and Klein 1982). Five-point Likert-type statements were used to measure the different dimensions of four different perceived innovation characteristics, viz. relative advantage, compatibility, complexity, and perceived risk. Items selected from the literature were tuned to the specific innovation used in this study (electronic banking) based on information obtained through expert interviews, qualitative research in the financial sector and publications on electronic banking. Items for the perceived innovation characteristics were chosen such that they would cover the phenomenon as much as possible. Appendix 1 shows the actual operationalizations used in the questionnaire.

Analysis

Analysis of the data was carried out following the two-step approach recommended by Anderson and Gerbing (1988). First, confirmatory factor analysis (CFA) on the independent variables of the model (i.e., the four perceived innovation characteristics factors) was performed using EQS 5.1 (Bentler and Wu 1993) in order to assess and validate the measurement model. Note that we cannot use traditional measures (e.g., Cronbach's alpha) to test for the reliability of the constructs as formative scales were used. Model fit indices are used instead (Diamantopoulos and Winklhofer 2001). Results on estimation of the measurement model showed a satisfactory goodness-of-fit (CFI; Bentler 1990), although the Chi squared is significant (Chi squared=154.11, df-92,

p<.001; Bentler-Bonett Normed [Nonnormed] CFI = .867 [.922]; CFI = .940).

Before proceeding to the next stage of the analysis, we removed the 13 respondents that had considered the adoption but rejected it. We felt that the consideration group should consist of respondents who can potentially still adopt the innovation. The remaining 229 respondents fell into four categories: awareness (n=43), consideration (n=67), intention (n=18), and adoption (n=101). Due to the small size of the intention group, we combined the consideration and the intention group into a new group that we label Evaluation Stage (n=85). The differences among the mean levels of innovation characteristics is tested using Multivariate Analysis of Variance (MANOVA) while the salience hypotheses are studied using Multinomial Logit (MNL) analysis. Results are presented in the following section.

RESULTS

Perceived innovation characteristics' levels over the stages of the adoption process

Table 1 provides the mean levels of the perceived innovation characteristics. Figure 1 is a graphical presentation of the perceived innovation characteristics' levels in the stages of the innovation adoption process.

[Insert Table 1 here]

[hert Figure 1 here]

Multivariate analysis of variance (MANOVA) was used to compare the means across the adopter categories simultaneously for the four innovation characteristics. Table 2 shows that there is a significant difference across the groups between the means of each of the four characteristics. The effect sizes shown by eta squared suggest that compatibility explains the largest amount of variance between groups. Relative advantage and complexity are about even, and perceived risk explains the least amount. The pattern shown in Figure 1 is largely in line with our hypotheses; relative advantage and compatibility show an increasing trend across the

stages, while complexity and perceived risk show a generally decreasing trend. We next tested the hypotheses about differences in means between the three pairs of adoption stages for all the four characteristics more explicitly. We first test to see whether the error variances are equal in the four groups. Levene's test of equality of error variances as well as Box's test of equality of covariances showed that we could not reject the null hypotheses of equal variances and covariances. Thus, we used Tukey's honestly significant difference (HSD) test to evaluate specific post-hoc mean differences between the stages. Tukey's HSD test assumes that the covariances are the same across the groups, and uses the Studentized range statistic to make all pairwise comparisons between groups. It sets the experimentwise error rate to the error rate for the collection for all pairwise comparisons. The results are shown in Table 3. For each characteristic, there were three possible paired differences that could be tested. We report only the pairs that were significantly different. We will now discuss the results in more detail.

Both relative advantage and compatibility show a similar pattern. The awareness stage mean ($M_{Relative\ Advantage}$= 2.87; $M_{Compatibility}$ = 2.98) is significantly different from the evaluation ($M_{Relative\ Advantage}$= 3.56; $M_{Compatibility}$ = 3.74) and adoption stage means ($M_{Relative\ Advantage}$= 3.66; $M_{Compatibility}$ = 3.82), with the perceived relative advantage and compatibility much lower in the awareness stage. As we proceed along the stages, the means increase from the awareness to the evaluation stage, and the adoption stage. The differences between the evaluation and adoption stages are not significant. Thus hypothesis Hl a and H2a are partially supported.

Perceived risk has a similar pattern to that of relative advantage and compatibility; the mean of the awareness stage (M= 3.18) is significantly different than the other two stages ($M_{Evaluation\ Stage}$ = 2.69; $M_{Adoption\ Stage}$ = 2.70). As per the hypothesis, the perceived risk is higher in the awareness stage, and then reduces as the respondents progress along the other two stages. While we had hypothesized significant di fferences in each stage, we find differences only between the awareness and other stages (in the hypothesized direction). Thus

hypothesis **H4a** is partially supported.

Perception of complexity shows a completely different pattern than the other three characteristics, but in the direction of hypothesis **H3a.** We proposed that the perceived complexity decreases over the adoption process. However, we find that perceived complexity between the first two stages ($M_{\text{Awareness Stage}} = 2.91$; $M_{\text{Evaluation Stage}} = 2.69$) is not significantly different. On the other hand, the perceived complexity after adoption is significantly lower ($M = 2.26$) than in any of the previous stages.

In summary, relative advantage, compatibility and perceived risk show significant mean differences between awareness-evaluation and awareness-adoption stages, and no difference between the evaluation-adoption stage. One could collapse the stages into two stages for the purposes of these three characteristics, viz., 'awareness' and 'the rest'. Thus the critical difference between whether firms move to the evaluation stage is on the perceptions of these three characteristics. Once they start to evaluate these innovations, then the average perceptions on these dimensions do not change very much. However for complexity, one could collapse the stages into the traditional adopter-non adopter categories; the perceived complexity in the adoption stage is much lower than the other stages. Thus we see a distinct difference across the four innovation characteristics. It is worth noting that the typical adopter-non adopter categorization would not be appropriate for relative advantage, compatibility and perceived risk.

Perceived innovation characteristics' salience over the stages of the adoption process

In order to explore the salience of the perceived innovation characteristics in the different stages of the innovation adoption process, we estimated a multinomial logit model with the awareness, evaluation, and adoption stages as dependent variable categories using LIMDEP (Greene 1995). The independent variables are the four characteristics. Results are reported in Tables 4 and 5; Figure 2 shows the salience graphically.

[Insert Tables 4 and 5 here]

[Figure 2 here]

The MNL model fits well, with Rho-squared=0.23 (p<0.001). In order to judge the salience of the innovation characteristics in each stage, one may be tempted to focus on the MNL coefficients of Table 4. However the appropriate measure is to use the marginal effects of the characteristics on the probabilities of choice of each of the stages (Greene 2000, p. 861). We assess the marginal effects by using the sample enumeration method (Ben Akiva and Lerman 1985). The results are shown in Table 5. Using the MNL model, we first estimate the probability for each respondent to be in each stage, given his current level of perception of the innovation characteristics. We then average these probabilities across the whole sample; these are estimated to be 0.187 for the awareness stage, 0.373 for the evaluation stage and 0.438 for the adoption stage. These probabilities are close to the current proportions of respondents in each stage. We then systematically change the value for each of the four characteristics for every respondent by 10%. In order to make the results more understandable, we increase the values for relative advantage and compatibility and decrease them for complexity and perceived risk. We expect these changes to move potential adopters from the awareness stage towards the adoption stage. We re-estimate the probability of each respondent being in any of the stages and then average the probabilities over the sample. Thus for example, if the relative advantage perceptions increased by 10%, the average probability of being in the awareness stage would decrease from 0.187 to 0.156 -a decrease of 0.03 1 or 16% from the base (of 0.187). If we apply the new probability to the sample of 229 respondents, we would expect to have 36 (=0.156*229) respondents in the awareness stage, a decrease of 7 respondents from the current 43. Since the perceptions of relative advantage have improved, the average probabilities of the evaluation stages and adoption stage increase by 0.4% and 7% respectively. We would expect 86 respondents to be in the evaluation stage and 107 in the adoption stage. Thus an increase of 10% in the average level of perceived relative

advantage would result in seven people moving from the awareness stage to the evaluation and adoption stages.

A decrease of 10% in complexity perception would decrease the average probability to 0.165 -a decrease of 12% in the awareness stage and a decrease of 9% in the evaluation stage. The adoption stage would gain 12 respondents (+13%), due to a migration of potential adopters from the awareness (5 respondents) and evaluation (7 respondents) stages. Impacts of changes due to other characteristics can be evaluated similarly.

The percentage changes in probabilities allow us to assess the salience of the characteristics in moving respondents from one stage to the other. We can examine the relative influence in two ways. Firstly, we can look in each row, and examine the impact of a change in the characteristic on the change in the probability ofbeing in each of the stages. This allows us to make inference about the adoption stage in which each characteristic has high impact. Secondly, we can also examine the change in each column of Table 5. This allows us to get an idea about which characteristic has the most impact in each stage.

We first examine Table 5 in each row to get an idea about the stage in which each characteristic is relatively more important. For relative advantage, we observe that a 10% increase of its perceived level has highest impact (by percentage change of a potential adopter's probability of being in a certain stage) within the awareness stage, followed by the adoption stage. The adoption stage benefits mostly from the progression of potential adopters from the awareness stage to further stages as the probability of being in the evaluation stage only slightly increases. Thus, perceived relative advantage seems to affect both the initial and final stages of the adoption process most. Similarly, an increase in compatibility will have a strong effect on decreasing the proportion of potential adopters in the awareness stage (-26%). However, its impact in the evaluation stage (+5%) and adoption stage (+7%) are not found to differ substantially, failing to provide convincing support for hypothesis H2b. A decrease of perceived complexity affects the probability of potential adopters to progress to the adoption stage most, followed by the awareness stage and evaluation stage, respectively. The salience of

complexity being highest in the adoption stage is in accordance with our hypothesis (H3b), although it should be noted that its impact on the other stages is substantial as well. Reducing the perceived risk with respect to the innovation has no substantial affect on the probability of progressing to the adoption stage, failing to provide support for hypothesis H4b. Salience of perceived risk seems highest in the awareness stage, although its impact generally seems to be quite limited. Figure 2 shows the pattern of the innovation characteristics' salience (we plot the absolute values of the percentage change in probabilities as the signs depend on the direction of change in the attribute perceptions). All characteristics but perceived risk show a U-shaped pattern rather than an increasing one, as we hypothesized.

If we examine the relative impacts within each stage in the adoption process, we can observe the following pattern. In the awareness stage, perceived compatibility has the highest influence. By enhancing compatibility, the largest migration of potential adopters towards the next stages of the innovation adoption process is achieved, followed by the perceived relative advantage of the innovation. In the evaluation stage complexity has the highest salience, followed by compatibility and uncertainty. Relative advantage appears not to have much influence here. In the adoption stage complexity is most influential. Compatibility and relative advantage are next, with perceived risk being the least salient. Thus the positive product attributes are most important in the awareness stages, while the negative attributes (except perceived risk) are more important in the adoption stage.

DISCUSSION

By identifying factors discriminating between adopters and non-adopters of innovations, most previous research implicitly treated 'non-adopters' as a homogeneous group of individuals or organizations with respect to their innovation adoption behavior. However, at closer look this seemingly homogeneous group consists of potential adopters that differ with respect to both their perceptions of innovation characteristics and their

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evaluation of these characteristics' salience. These differences are found to depend upon the potential adopter's position in the innovation adoption process. For example, we find that organizations in the awareness stage of the adoption process perceive a relatively high level of perceived risk, but are most affected by an increase of compatibility and -to some lesser extend—relative advantage of the innovation. Potential adopters in the evaluation and adoption stages, on the other hand, perceive much lower levels of complexity and risk. However, decreasing the level of perceived complexity even further has the highest impact in stimulating the progression of potential adopters towards the final stage of the adoption process. Thus, although the level of this characteristic may have decreased over the stages of the innovation adoption process, its salience has not. The fmdings of the present study show that it is important to refine extant research on innovation adoption in two ways. First, we must be careful with the dominant focus on adopters versus non-adopters, as the latter group is a highly heterogeneous one. Distinguishing between different types of non-adopters helps us to understand the complex phenomenon of non-adoption much better and to provide more comprehensive and detailed information for making effective decisions with respect to marketing innovations. Second, in this study we argued that it is important to distinguish between the degree to which certain characteristics are perceived to be present and their salience to the potential adopter. Although the hypotheses in the study are not all fully supported, the findings with respect to differences between perceived levels of innovation characteristics and their salience provide convincing arguments to further investigate the necessity of addressing both aspects when studying perceived innovation characteristics as antecedents of adoption. In this respect, a longitudinal study may especially be fruitful to uncover the changing levels and salience of perceived innovation attributes over the adoption process.

Some specific findings of the present study call for further discussion. All hypotheses on the changes in perceived innovation characteristics' levels over the stages of the adoption process are supported except for perceived risk. Its perceived level was found to increase (non-significantly) from the evaluation to the adoption

stage. Although unexpected, this result may be related to uncertainties in the implementation process. The implementation problems faced by organizations trying to make full use of the innovation in the adoption stage may increase their level of perceived risk (Zaltman, Duncan and Holbek 1973).

The hypotheses on the salience of the innovation characteristics within the different stages of the adoption process show a more complex pattern than we expected. Following Lewin's theory of conflict, we expected increases in the salience of all innovation characteristics over the stages of the adoption process. Our findings, however, imply that they all (expect for perceived risk) follow a U-shape. In contrast to expectations, positively perceived innovation characteristics are found to be most important in the initial stage of the adoption process. This finding is highly consistent with the argument that positive aspects of the innovation should be clear and present for potential adopters to start considering adoption of the innovation at all (Robinson 1990). Consistent with our expectations, the perceived complexity of an innovation is most influential in the final stage of the adoption process. Here, the anxiety of making a wrong decision becomes most prominent when the actual adoption decision is imminent. Nevertheless, perceived complexity was also found to be influential in the awareness stage and to some lesser extend in the evaluation stage. Apparently, this characteristic is important in all stages. Perceived risk was found to play only a minor role in the adoption process. This could be attributable to the innovation studied here, electronic banking, which might have been considered to have little influence on the organizations operations. Follow-up interviews with respondents supported this view as managers indicated they considered electronic banking to be part of the organization's supporting activities rather than be part of its primary process.

Managerial implications

The findings of this study provide interesting managerial implications. The present research indicates that

the group of non-adopters of an innovation is a heterogeneous one. This suggests that any marketer of an innovation should carefully distinguish between different target groups within the population of potential adopters, depending on their stage in the adoption process. Organizations that have progressed further in the adoption process will be likely to be sensitive to, and therefore influenced by, different factors than firms that are still in the early stages of the innovation adoption process. The marketing program should be adjusted accordingly, reflecting different targeting for different segments.

More specifically, in the awareness stage, compatibility with existing systems needs to be emphasized. In the consideration stage of the adoption process marketers should clearly communicate how the innovation provides relative advantage to the adopters. A second critical phase in the adoption process seems to be the passing from the evaluation to the adoption stage (Bemmaor 1995). Based on the results of our study, at this stage of the adoption process marketers should reinforce the innovation's fit with the customer's needs and should reduce perceived complexity by clearly communicating the knowledge required to operate the new product. Offering free trial of the new product is an effective way of doing so at the intention stage of the process (Mathur 1998). Marketers should be aware of the high anxiety among potential adopters as they approach the adoption decision. Therefore, as potential adopters progress towards the intention decision, marketers may shift their emphasis from compatibility and advantage issues towards potential inhibitors of the adoption decision such as complexity. Enabling customers to adopt the innovation in an effective way will enhance the probability of actual adoption. Then, in the adoption stage, positive characteristics are important again to reinforce the benefits of adopting the innovation and enhancing its compatibility in order to facilitate organizational implementation of the new product or service.

Limitations

As with any empirical study, this research has several limitations. The present effort towards more in-depth understanding of non-adoption and the antecedents of decisions within the dynamic innovation adoption process clearly is a first step. The current study should be considered exploratory given the fact that the adoption process of a single innovation within a single country is examined. Further, the number of respondents in some of the adoption stages, most specifically in the intention stage, was relatively low so we had to collapse the consideration and intention stages into one single evaluation stage. Also our means of assessing the importance of innovation characteristics within the different stages of the adoption process needs refinement. We have used implicit measures helping us to assess relative importance. It would be important to also employ other direct measures of innovation attribute salience. Future research should therefore validate the results of the present study as well as expand on our knowledge of the factors that explain non-adoption of innovations. As repeatedly noted in the literature, non-adoption remains a relatively untapped area for research. Explicitly focusing on different stages in the adoption process, as we did in the present study, explains why some organizations are non-adopters and provides insight into the extent that organizations really *are potential* adopters and how they may become an *actual* adopter.

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Table 1
Mean Levels of Perceived Innovation Characteristics in the Stages of the Adoption Process

	Awareness stage (n=43)	Evaluation stage (n=85)	Adoption stage (n=101)
Relative advantage	2.87	3.56	3.66
Compatibility	2.98	3.74	3.82
Complexity	2.91	2.69	2.26
Perceived risk	3.18	2.62	2.70

Table 2
Test of Between Subject Effects in MANOVA

	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance	Eta Squared
MODEL						
Relative advantage	19.93	2	9.96	19.99	.000	,150
Compatibility	22.77	2	11.38	41.49	.000	,269
Complexity	15.69	2	7.85	18.77	.000	,142
Perceived risk	9.70	2	4.85	9.81	.000	,080
ERROR						
Relative advantage	112.61					
Compatibility	62.01					
Complexity	94.47					
Perceived risk	111.80					

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Table 3
Means and Pairwise Post Hoc Tests of Differences in **Means** Between Stages*

Innovation Characteristic	Stages Compared			Mean Difference	Std. Error	Significance
	Awareness	Evaluation	Adoption			
Relative advantage	2.87	3.56	3.66			
				.69	0.13	,000
				.79	0.13	,000
Compatibility	2.98	3.74	3.82			
				.76	0.01	.000
				-.84	0.01	.000
Complexity	2.91	2.69	2.26			
				.65	0.12	.000
				.43	0.01	.000
Perceived risk	3.18	2.62	2.70			
				.56	0.13	.001
				.48	0.19	.000

* Only pairs showing a significant difference are shown.

Table 4
MNL Coefficients of Perceived Innovation Characteristics
in the Stages of the Adoption **Process***

	Evaluation	Adoption stage
Constant	-5.89 (.02)	-5.17 (.04)
Relative advantage	1.08 (.00)	1.32 (.00)
Compatibility	1.83 (.00)	1.96 (.00)
Complexity	-0.47 (.20)	-1.47 (.00)
Perceived risk	-0.62 (.08)	-0.42 (.25)

Chi Squared (8 **df)** Rho **Squared=0.23** LL=-185.02
= 107.6 **(p<.001)**

* Multinomial logit coefficients (p-values)

Table 5
Change in Aggregate Probability of Being in **Each** Stage for a 10% **Increase/Decrease** in Innovation Characteristics from Current Value *

	Awareness Stage	Evaluation stage	Adoption stage
Current Probability	0.187 **(n=43)**	0.373 **(n=85)**	0.438 **(n=101)**
Increase by 10%			
Relative advantage	0.156 **(n=36**)** -.031(-16 %)	0.375 **(n=86)** .001(0.4 %)	0.468 **(n=107)** .029(+7%)
Compatibility	0.139 **(n=32)** -.048(-26 %)	0.392 **(n=90)** .018(+5 %)	0.469 **(n=107)** .030(+7 %)
Decrease by 10%			
Complexity	0.165 **(n=38)** -.022(-12 %)	0.340 **(n=78)** -.033(-9 %)	0.494 (113) .055(+13 %)
Perceived risk	0.173 **(n=40)** -.014(-7 %)	0.391 **(n=90)** .018(+5%)	0.434 **(n=99)** -.004(-1 %)

* Absolute value; absolute change (percentage change) trom current probability
** These are estimated numbers obtained by multiplying **average** probability by the sample **size** of 229 (e.g. **229*0.156** = 36)
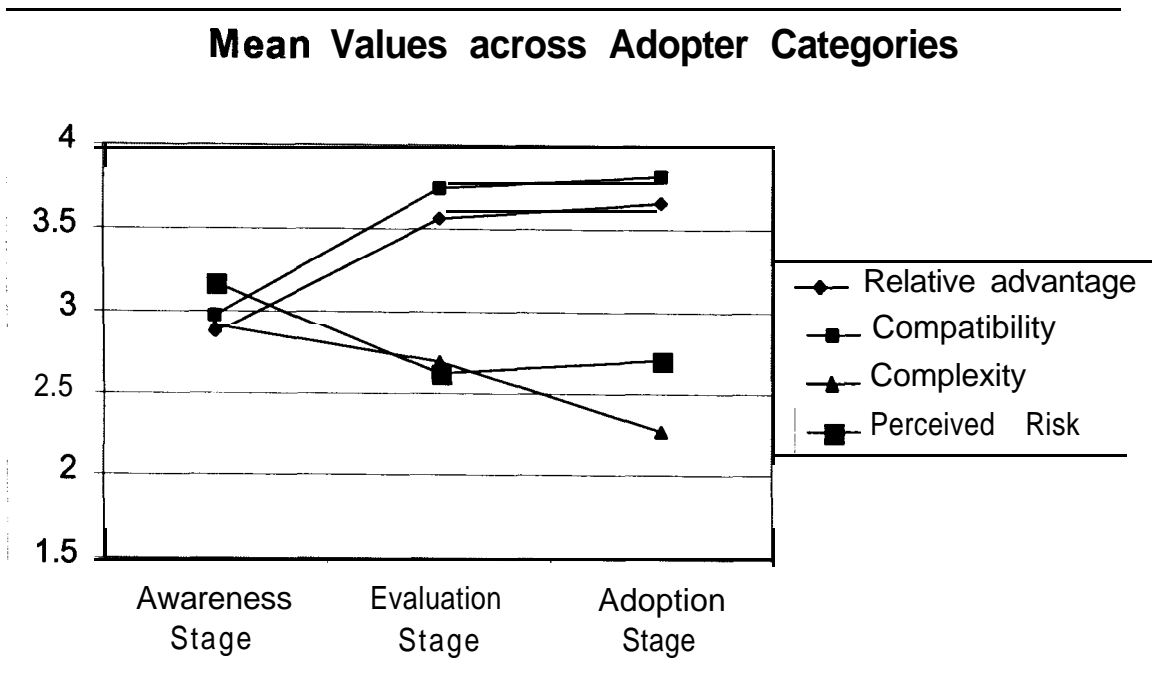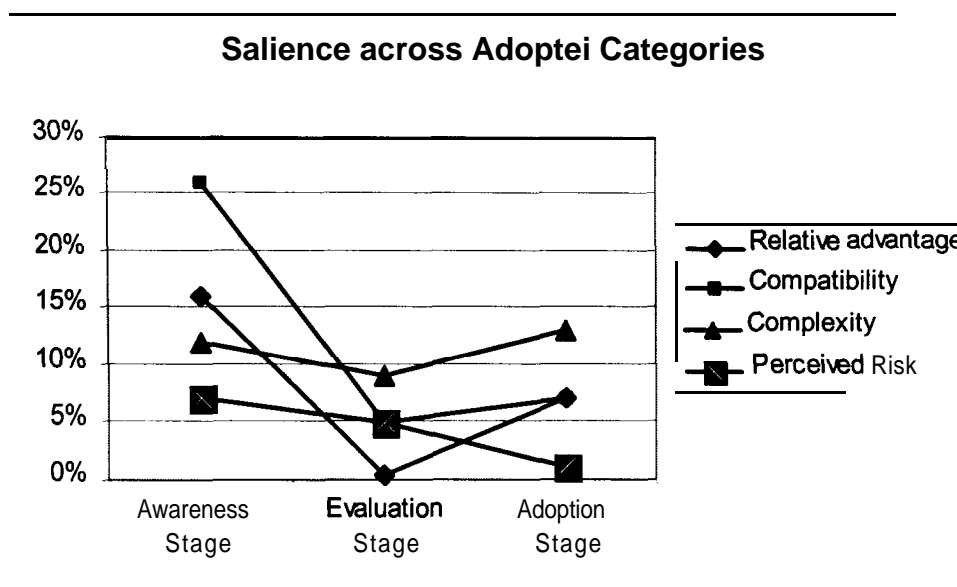
Figure 1

Mean Values across Adopter Categories

Figure 2

Salience across Adoptei Categories

Operationalization of Perceived Innovation Characteristics [a]

Relative advantage (4 items)

[information] "By using electronic banking in this organization, management has better information" (strongly agree [5]/strongly disagree [1])

[financial control] "By using electronic banking in this organization, we have improved control of financial means" (strongly agree [5]/strongly disagree [1])

[system integration] "By using electronic banking in this organization, financial payrnents can be integrated in the financial administration efficiently" (strongly agree [5]/strongly disagree [1])

[costs] "By using electronic banking in this organization, we have lower costs" (strongly agree [5]/strongly disagree [1])

Compatibility (5 items)

[with needs] "The demands we have regarding financial transactions match the properties of electronic banking well" (strongly agree [5]/strongly disagree [1])

[with bank] "Our organization would only purchase an electronic banking system from the bank that also handles most of our payments" (strongly agree [5]/strongly disagree [1])

[with existing equipment] "The equipment in our organization is adequate for electronic banking purposes" (strongly agree [5]/strongly disagree [1])

[with existing knowledge] "The knowledge in our organization is adequate for electronic banking purposes" (strongly agree [5]/strongly disagree [1])

[with existing procedures] "Implementing electronic banking doesn't have serious consequences for the way we organize our financial administration" (strongly agree [5]/strongly disagree [1])

Complexity (2 items)

[knowledge] "One needs specific knowledge to handle an electronic banking system well" (strongly agree [5]/strongly disagree [1])

[ease of use] "Using electronic banking is simple" (strongly agree [1]/strongly disagree [5])

Perceived risk (3 items)

[operations] "In our organization, people are uncertain as to whether an electronic banking system will work well" (strongly agree [5]/strongly disagree [1])

[security] "In our organization, people are uncertain as to whether an electronic banking system is protected properly against unauthorized access" (strongly agree [5]/strongly disagree [1])

[acceptance] "It is questionable whether an electronic banking system will be accepted by the employees of our organization" (strongly agree [5]/strongly disagree [1]

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[a] Questions and statements were formulated taking account of the respondent being an adopter or non-adopter of electronic banking.