

**SOURCES OF INNOVATIVENESS:
AN INTEGRATED EMPIRICAL STUDY**

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Printed at INSEAD, Fontainebleau, France.

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October 1996

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Sources of Innovativeness: An Integrated Empirical Study

Abstract

One of the central planning themes behind new product launches is the correct identification and marketing to opinion leaders, early adopters, or innovators. Motivated by the comprehensive review in Gatignon and Robertson (1985), this paper simultaneously tests various prevailing consumer theories concerning the identification of this key segment of consumers. We study ten home-office and high-end consumer electronics innovations using a sample of some 900 individuals from the “lead” segment. In addition to uncovering new aspects of consumer innovativeness, including one’s proneness to be affected by marketing activities and intra-family influences, our study gauges the relative importance of all relevant forces driving individual adoption timing for new products, as hypothesized in the extant literature.

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INTRODUCTION

Marketing managers have long recognized that the successful launch of new products greatly depends on their acceptance by a small nucleus of opinion leaders, or innovators, who act as information gatekeepers to the mass market. When marketing new products, the correct identification and adaptation of marketing plans to these consumers is critical during the earliest phases of the product life cycle. Academic research in marketing has mirrored this concern in attempts to profile the typical "innovative" segment of consumers which acts as the first node in the critical path to new product take-off. In order to contrast the innovator from other segments of the market, the consumer behavior literature has, since the 1960s, considered various aspects of new product adoption and diffusion (Arndt 1967, and Robertson 1967, 1971). Gatignon and Robertson (1985) have summarized this literature within an integrated framework, which positions various research streams into numerous propositions concerning innovative behavior at the individual level. Figure 1 shows the *core model* from which most consumer studies on consumer innovativeness can be positioned (adapted from Gatignon and Robertson 1985, p. 850). Previous studies have focused on two basic forces: (1) personal variables, related to the person who adopts the innovation (demographics and psychographics), and (2) product variables (related to the innovation's perceived attributes). Based on these forces, "innovators" may be easily identified and correctly addressed via the marketing mix (pricing, communications, distribution, and product design). Despite the substantial research conducted on this important topic, a fuzzy picture, as opposed to an empirical generalization, has emerged because work has progressed across constructs in an independent manner.

In addition to augmenting the core model for more recent consumer theories, this study represents an attempt to simultaneously estimate the relative importance of the various forces which are likely to affect consumer adoption timing or innovativeness. Table 1 lists consumer studies for each of the two basic forces, the general constructs considered, and each study's findings. The literature reviews in Gatignon and Robertson (1985) and Holak and Lehmann (1986) have noted, as shown in Table 1, that existing studies fail to compare *all* relevant variables (hypotheses) and basic forces in a single model. While a number of studies compare the relative importance of subsets of the variables within each of the forces (see, for example, Robertson and Kennedy 1968, Ostlund 1974, or Hirschman 1980) or the relative importance across two forces (Ostlund 1973; Holak 1985, 1988), none to our knowledge simultaneously

considers the potential redundancy and relative importance of the various factors within each force, while also measuring mediation effects. Our paper is a direct response, therefore, to the call made by Gatignon and Robertson (1985, p. 864), among others, who suggest that "the entire framework should be considered".¹ In doing so, our study represents a first step in providing insights into the following research questions:

RQ1: Do the variables (hypotheses) suggested in the extant literature reflect independent constructs or are they manifestations of fewer underlying constructs?

RQ2: Are there mediation effects among the variable categories or do the basic forces affect innovativeness independently?

RQ3: Across the various forces, which appear to be most relevant in predicting one's proneness to innovate (adopt early)?

RQ4: Does the profile of innovators radically change across generations, or cohorts of consumers facing an innovation at various stages of the life cycle.

This last question is most important to manufacturers of new products launched into relatively mature categories. Most manufacturers do not sell the pioneering product within a new category. For any new product irrespective of when it is launched in the category life cycle, there will always be a temporal segmentation structure across consumers. For categories which may already be several decades old, question RQ4 asks whether "innovators" amongst the current cohort of consumers (e.g. consumers in the 1990s who currently aged 20 to 25 purchasing microwave ovens, a category created in the 1960s) have a similar trait profile to the typical innovator when products are launched to the first generation of consumers (e.g. innovators among adults in the 1960s for microwave ovens). Should we find that "cohort" innovators have the same profiles as "original" innovators, this allows us to extend the theory of innovation adoption (Rogers 1983) to new products, irrespective of when these might be launched in the category life cycle.

Our paper is organized as follows: the next sections summarize a general model, justify our survey methodology and describe the data collection procedure. We then estimate the core model, and test a variety of prevailing hypotheses. Since much of this study replicates earlier works, care is made to highlight the incremental insights gained in relation to the existing

¹ Throughout the text we will refer to certain propositions, given by number, suggested in Gatignon and Robertson (1985).

literature. The paper ends with concluding remarks, caveats and suggestions for further research.

THEORETICAL ARGUMENTS

The Core Model

As the primary goal of this research is to integrate existing theories of diffusion within a single study, we explicitly assume the general model (Figure 1) as our working hypothesis based on a systematic review of the literature published since the early 1960s (the key papers included are summarized in Table 1). Most of the factors in the model, therefore, are not original to this research and have been previously motivated in Rogers (1983), Gatignon and Robertson (1985) and Holak (1988). The *core model* consists of two forces affecting innovativeness, or adoption timing: (1) personal characteristics, and (2) product characteristics (which are perceived). Personal characteristics can be further classified into two separate groups: (1) demographics (e.g. age, wealth), and (2) psychographics (e.g. attitudes toward various forms of risk). Perceived product characteristics are typically classified in the literature as six independent constructs which follow the acronym ACCORD (see Rogers 1983, p. 15 and Angelmar 1990): (A) relative advantage over alternative innovations, (C) complexity, (C) compatibility with social norms, (O) observability of innovation benefits, (R) social, financial or other risks, and (D) divisibility or pre-use triability.

Model Extensions

In addition to replicating previous constructs, our core model augments the previous literature in line with recent suggestions made in Gatignon and Robertson (1985). They conclude (p. 864) that the core model is basically the same paradigm as developed in rural sociology and that "consumer research has made little progress in advancing diffusion theory". Our study responds to this observation by exploring three areas: (1) consumer responsiveness to change agent actions, (2) consumer's product and information search habits, and (3) consumer's reliance on immediate, family-based interpersonal influence.

Gatignon and Robertson (p. 864) note that most diffusion studies fail to investigate the potential variances in consumer's propensities to respond to change agent (the firm's) actions. To consider these, we have added a class of variables, labelled *Consumer Behavior*, which measure (1) the extent to which consumers use certain marketing actions as signals of quality (see, for example, Rao and Monroe 1988), (2) consumer information search and shopping

behavior, and (3) consumer proneness to using various media and information sources prior to adoption. Rogers (1983) hypothesizes that earliest adopters are most affected by change agent communications. Gatignon and Robertson (1985, p. 862) further propose that "the greater the individual's propensity to use mass media or sources external to the immediate social system (relative to interpersonal contacts within the social system), the earlier the adoption". Similarly, the normative marketing literature has modelled advertising so as to mostly affect earliest adopters (Horsky and Simon 1983).

Second, in extending the traditional model we will consider the role of interpersonal influences generated from immediate family members (children, spouses, and parents), which has been considered in consumer research on non-innovation consumption behavior for high-involvement products (see Dubois and Marchetti 1993). We conjecture that such influences can play a role in innovation adoption for three reasons: (1) many household innovations are consumed by multiple family members; higher usage within an innovative family (i.e. families with innovative parents) may extend innovativeness to all members therein (Robertson 1971; Danko and McLachlan 1983; Dickerson and Gentry 1983; Peters and Venkatesan 1973), (2) these represent major focal points for family discussion and would tend to make members receptive to new ideas in general (Midgley and Dowling 1978), and (3) Robertson (1967) notes that discontinuous innovations result in substantial behavioral change which makes their adoption high involvement purchases and subject to multiple decision-makers.

In addition to including new (behavioral) constructs, the second area where our study augments the core model responds to Gatignon and Robertson's (p. 864) recommendation that tests of diffusion theory include "multiple measures of these constructs". From an exhaustive review of the literature, a *master list* of constructs or variables was created. In most cases, work in this area has relied on single-item measures of basic constructs, and these measures have been re-used across studies, leading to a number of redundant constructs. By integrating the inventory of existing measures and grouping these by construct, we have subsequently incorporated multiple measures for each (as the same construct has been studied using different single-item measures across studies); for the categories studied, discussed below, this resulted in a battery of over 200 questions. Relying on these extant measures allows us to uncover statistically interdependent or "underlying" constructs which may have been assumed independent in previous studies (RQ1).

Finally, Gatignon and Robertson (p. 864) note that "the literature has been largely concerned with direct relationships or main effects". The model in Figure 1 explicitly allows mediation effects, as defined by Baron and Kenny (1986), between personal variables and innovativeness, via product perceptions. The consumer behavior literature commonly finds, for example, that

perceptions may, in fact, be partially generated by personal factors (e.g. that certain demographic groups perceive the value of certain products more than others). With the exception of Holak (1988) who considers interactions between certain personal and product variables, most authors have treated these first two forces in isolation, or independently. In general, perceptions are considered to be generated from independent, yet unidentified sources. We now discuss our approach to study these extensions to the core model.

METHODOLOGY

Diffusion Relevance Requirements

We begin by considering two shortcomings of random-sample-based diffusion research which some authors argue lead to little, if not biased, insights into the forces driving individual adoption timing (Rogers 1983). The first is that random samples will likely pick up an insufficient proportion of "innovators", as these represent, for most products, a very small percent of the general population; typical sample sizes, therefore, are generally insufficient to capture a sufficient number of highly innovative, opinion leading consumers. The second criticism is based on early studies relying on random samples finding, for example, that innovators are young, cosmopolitan, educated and economically affluent. In addition to finding that these characteristics reflect interdependent constructs when a whole population is considered (e.g. only the affluent can be cosmopolitan), the innovations studied in this context are purchased almost exclusively, for example, by incomes above a certain threshold, and that within that particular population segment (or social class), the results are no longer valid (e.g. higher incomes, cosmopolitanism, etc., may not lead to greater innovativeness). For most products, consumer surveys are best conducted within the segment of consumers likely to have a higher than average concentration of innovators (e.g. the highly educated, upwardly mobile, and cosmopolitan consumers in the case of high-priced consumer goods). This social stratum is a primary market for many consumer product innovations. The study of innovativeness within this affluent segment is, therefore, of greater academic interest than studies using a given population in general. This allows us to test, for example, whether affluent and cosmopolitan consumers are earlier adopters than equally affluent less-cosmopolitan consumers (or that the more affluent consumers among the cosmopolitan are more prone to early adoption).

The Respondents

Based on the methodological concerns stated above and in keeping with the general research questions raised in the introduction, data on ten home-office and high-end consumer electronics innovations have been collected from more than 900 graduate students from a business school

in Europe. In contrast to the extant literature which universally considers American consumers, our respondents come from 38 countries and reflect a multinational community of young, affluent consumers.² Respondents are matched, in part, by the admissions procedure on the basis of age, education, professional experience (3 to 5 years and above), academic potential, and, indirectly, absolute income levels. It must be stressed that sample matching on average characteristics does not eliminate variances required for hypothesis tests; i.e. there are both wealthy and middle-class respondents within the sample. Table 2 shows the proportions, means, and standard deviations for various individual measures. The respondents are, on average, highly educated, mobile, young (28 years on average), and mostly single professionals, many of whom own a house/apartment. These individuals represent, therefore, a leading segment for products targeted to young households with some affluence (Zielinski and Ward 1984); this seems especially true in Europe where home ownership is uncommon for this age group. Indeed, the average respondent fits closely with the generic description of innovators and early adopters: "higher income, higher education, younger, greater social mobility" (Gatignon and Robertson 1985, p. 861). With respect to measures of innovativeness, discussed below, we find that within this affluent segment there are clearly "innovators" and "laggards" (i.e. a large proportion of the respondents are neither innovative, nor opinion leaders, despite these having the average generic "innovator" profile of being young, mobile, cosmopolitan and affluent).

The Innovations

Based on interviews with three European electronics manufacturers³ who asserted the sample relevance of the products in question, the following ten categories were ultimately chosen for our study: cellular telephones, pocket pagers, personal computers, video cameras, high definition television, cable television (a recent innovation in Europe), satellite reception dishes, digital audio tape recorders, video cassette recorders, and microwave ovens. Among the possible alternatives, these products were chosen with certain design issues in mind. First, all of the categories are readily recognized by a multi-cultural sample which would be drawn from the lead segment (the young, affluent, cosmopolitan class). Second, previous diffusion research has successfully used such products to test theories of diffusion, with some using student samples allowing for direct comparison (Holak 1988; Holak and Lehmann 1986). Third, the products studied are both dynamically continuous and discontinuous innovations (Robertson 1967) and likely to be subject to diffusion processes. Fourth, in order to avoid obtaining

² In unreported analyses, available from the authors upon request, various tests were undertaken to verify whether culture of origin impacted the study's dependent or independent variables; in general, it did not; we therefore assume that these potential effects are minimal.

³ These included a white goods manufacturer, Calor SA, a home electronics and computer manufacturer, Thompson SA, and a telecommunications firm, Ericsson Radio Systems.

similar responses across the categories, three are home-office oriented (personal computer, cellular phone, pocket pager), five are visual entertainment oriented with wide variances in prices (high definition television, video cameras, cable television, video cassette recorder and satellite television), one is audio entertainment oriented (digital audio tape recorder), and one is cooking/time efficacy oriented (microwave oven).

Finally, five products are "existing innovations" which had substantial differences in cross-country diffusion patterns, though the percent penetration of these was typically less than 10 percent for most of the countries represented in the sample when the data were collected (1990-1992): personal computers, cable television, video cameras, video cassette recorders, and microwave ovens. The other five innovations are classified as "recent innovations" in that these had less than one percent penetration across all countries, or were as yet to be sold to the public (but were well publicized in the popular press -- digital audio tape recorders, and high definition television). With respect to category relevance, for the existing innovations respondents show a higher than average adoption level (compared to total population statistics) within their age groups, by country, for personal computers (averaging 65 percent), video cassette recorders (22 percent) and microwave ovens (32 percent).⁴ This supports our assumption and management assertions that the respondents are actual consumers of the products in question, and are a leading segment.

Cohort Innovativeness

By having included existing innovations, we are offered the opportunity to evaluate "cohort innovativeness" which we define as the degree to which individuals, within a social strata, are prone to adopt non-contemporary innovations. Parker (1992) notes that upwards from 40 percent of the sales of many consumer innovations remain first purchases, or initial adoptions, even after the category is several decades old. Every year, new consumers enter the market (due to family life cycles or the natural aging process) and that within-cohort diffusion results in certain consumers being more prone to adopt innovations than others ("cohort innovators"); each cohort always faces innovations, though many of these innovations will have been launched prior to when the cohort (or age group) belong to the lead segment. Our study, to our knowledge, is the first designed to evaluate whether the profile of cohort innovators is radically different from traditional innovators (the first generation innovators who were the lead segment when the innovations were initially launched).

⁴ Aggregate adoption data for these categories, across countries are available from Euromonitor, Ltd.

Implementation

A self-administered questionnaire assessing intentions, behaviors and perceptions towards the ten product categories was completed by 941 respondents. Approximately 900 responses were complete and usable for the analysis. Some 25 to 35 minutes were required to complete the questionnaire. Since this was generally the first questionnaire administered to students following their arrival on campus and they were instructed that responses were to be incorporated into future class discussion, there was virtually ubiquitous response. In order to avoid possible campus acclimation biases, or "MBA-oriented" responses, the questionnaire was administered during the first weeks of the academic year.⁵

The instrument design closely follows the work of Holak (1988) and Holak and Lehmann (1986). The questionnaire consisted of three parts. Part 1 obtained purchase intentions and ownership levels for the 10 product categories. Intentions ("how likely is it that you will personally own these items within one year after graduation") were measured on a 10-point Juster (1966) scale and were used as surrogate measures for innovativeness. This scale has been widely used in the literature (Jamieson 1986; Urban and Hauser 1980; Holak 1988). To assess innovativeness towards electronics in general, another variable was measured, in a different part of the questionnaire, using a 7-point likert scale: "How likely are you to buy the latest home electronics gadget or innovation?".⁶

The second part of the questionnaire assessed general psychographics (venturesomeness, self confidence, risk aversion, cosmopolitanism; see, for example, Yapa and Mayfield 1978), demographics (age, income, personal wealth, number of children, education) as well as various consumer behaviors (information search habits, information seeking and giving behavior, marketing signal use levels and media proneness; see, for example, Green et al. 1974; Summers 1972). To assess family influence on adoption, data were collected on marital status, number of dependents, likelihood to make decisions with spouses, and parent ownership of innovations. It is important to note that parents owning these innovations must themselves be innovators as they have adopted in the earliest phases of the diffusion process for the product categories in question. In this way, we can examine whether the offspring of innovators are, themselves, innovative compared to other persons in their cohort. Questions - except for the demographic variables, parent ownership and media exposure - were asked on a 7-point likert-scale (1 = behavior not very likely, 7 = very likely); more detailed discussions of the scales used are given

⁵ In a test which compared two groups of respondents who participated in the study a few weeks apart, we found no significant differences across most independent measures.

⁶ We have also considered a third measure of innovativeness: the record of individual ownership for the innovations in question. As almost all students had to move to participate in the programme the analysis with this variable only showed significant results for a few factors (product factors, Family life-cycle and Parent ownership).

in the next section. Most constructs were based on adapted single-item measures used in the extant literature. As multiple measures were used here, these were randomly dispersed within the questionnaire in order to avoid **order biases** likely to be generated by having within construct questions follow each other in order. Where possible, various measures (education, income, family structure, nationality, etc.) were cross-validated using statistics generated from the business school admission process.

The third part of the questionnaire asked the subjects to evaluate the products on various characteristics (compatibility, relative advantage, complexity, triability, perceived risk and communicability) using a 7-point scale; see, for example, Holak (1985), Holak and Lehmann (1986), Labay and Kinnear (1981), Ostlund (1974), and Rogers (1983). Again, in contrast to most published diffusion surveys, constructs which are multidimensional in nature (e.g. perceived risk, relative advantage) are explored using multiple items. For example, besides directly asking the overall relative advantage of the product compared to alternatives, the construct "relative advantage" is also measured in terms of the product's potential in reducing physical labor, saving time and providing enjoyment/pleasure. Question ordering was randomized to avoid order biases. Product perception questions were followed by media usage measures across seven items: "When deciding to purchase home electronics, which sources of information do you often rely on?" Answers were grouped based on whether the information source was change agent (firm) originated (television advertising, radio advertising, print media advertising, sales persons) or generated from independent sources (personal friends, consumer magazines, expert opinions).

EVALUATING THE CORE MODEL

We now turn to the first two research questions: (RQ1) do the variables (hypotheses) suggested in the extant literature reflect independent constructs or are they manifestations of fewer underlying constructs? We apply factor analysis (principal components with varimax rotation) to each of the three conceptually independent variable categories: personal variables, consumer behavior variables, and product perception variables. In the case of personal variables, both demographics and psychographics were simultaneously considered in a single factor analysis. Before reporting multivariate analyses, correlations between each factor and innovativeness, for each category, are presented for descriptive purposes.

Personal Variables (Demographics, and Psychographics)

Six factors were retained (eigen-value, $\lambda \geq 1$) for the personal variables. The personal variables clearly split into demographic and psychographic factors, allowing us to conclude their

independence within this analysis. Table 3 reports the factor structure and the member variables' loadings.⁷ Each personal factor shows strong face validity and, together, represent important concepts that have previously been used to describe individuals on the innovator-laggard continuum. Table 3 shows the explained variance by factor and pairwise correlations of the retained factors with innovativeness for each variable category.

Table 5 reports pairwise correlation of factors with intentions to purchase. Beginning with demographics, the table provides little evidence that income and education and mixed evidence that age and family life-cycle affect innovativeness (family life-cycle is only significant for some existing innovations closely related to the "home". It is important to draw attention to the fact that the sample has been matched on these dimensions so limited insight is given by our analysis on their impact within general populations. However, as these respondents are drawn from a lead, or qualified, segment, the analysis indicates that these demographics are not worthwhile as "within" segment constructs. The dummy variable, Parent Ownership, has a strong consistent and significant effect across products (i.e. the children of innovators are innovative). According to Hirschman (1980), greater product knowledge leads to innovativeness since less cognitive effort is needed for the adoption. Parent ownership likely leads to more product knowledge and may reduce perceived risk related to adoption. With respect to psychographics, (Proposition #23 of Gatignon and Robertson), the data indicate that innovators tend to be venturesome and favourable toward risk. This is more so for recent innovations.

Consumer Behavior

Four factors are generated ($\lambda \geq 1$) from the consumer behavior variables. Again, the factor structure reported in Table 3 shows strong face validity. Signal usage and Media proneness are highly correlated with innovativeness especially for recent innovations (much more so than the factor Opinion Leadership traditionally considered - Table 5). Some of the innovators, therefore, may come from a population that tends to rely on these signals rather than on independent information sources or his/her own judgement (an assumption often used in diffusion modelling; see Horsky and Simon 1983).

According to Figure 1 demographic, psychographic and consumer behavior factors enter the model independently. This has been confirmed by regressions that showed only insignificant relationships between these two categories (adjusted R-squared less than 0.01 and insignificant t-statistics for each variable). In our subsequent terminology we will thus call these two

⁷ Variables not loading on any of the factors or dummy variables are reported separately in Table 3 and were also considered in the analysis.

categories personal factors and conceptually we refer to dimensions related to the person who is a potential adopter of the innovation.

Product Perceptions

From the product perception variables, only three factors were retained, as reported in Table 4. This fulfilled the " $\lambda \geq 1$ " criterion for most of the products in the analysis. The first factor, Relative Advantage, explained a significant part of the variance ($\lambda=2.21$) and was very coherent across products. Three variables (relative advantage, enjoyment/pleasure and lifestyle compatibility) loaded consistently and significantly (≥ 0.70) on the factor. In the case of three products (Cable TV, Pocket pager and Mobile phone), two variables, both related to the concept of Advantage (reduces physical labor, time saved), also loaded on this first factor with somewhat smaller loadings (0.60). In the case of High Definition Television (HDTV) communicability also had a significant loading (0.59). The next two factors had a much less consistent factor pattern across products. The second one essentially represents Complexity (the variable loads for each of the products with the exception of Mobile Phone). "How easy to repair" and "triability" are also important for this factor (they load for five and seven products respectively). Finally "obsolescence", "time saved", communicability and "enjoyment/pleasure" also load for a few products. The most important variables loading on Factor 3 are "time saved" and "reduces physical labor". Less important (loading for only three products) are "triability" and "communicability". Returning to RQ1, it is important to see that the perceived product attributes, introduced by Rogers (1983) and summarized by the ACCORD acronym are not statistically independent constructs. They rather seem to represent three underlying factors two of which (Relative advantage and Complexity) are consistent across the product categories studied. It is important to recognize that the variables compatibility and relative advantage may represent different dimensions of the same construct. This interpretation is intuitively appealing since compatibility may be seen as an advantage over other alternatives.

Correlations of the product factors with innovativeness (Table 5) confirm Proposition #27 of Gatignon and Robertson with the exception of complexity. The Complexity factor as well as the variable "complexity" are positively related to innovativeness although the factor contains variables that were found to be positively related to innovativeness previously. Since innovators may find complexity desirable for such innovations, perceived complexity may not negatively affect this segment's adoption timing. Consistently with previous research, product related variables, especially Relative Advantage dominate personal factors in affecting innovativeness.

Mediation Effects

We now investigate the second research question (RQ2) concerning the interdependence of factors. Figure 1 suggests that the above defined personal factors affect innovativeness directly and/or indirectly through perceptions. Perceptions are thus influenced by personal factors but are not determined by the later. To test for the mediation effect of perceptions we use the method proposed by Baron and Kenny (1986, p. 1177):

"To test for mediation, one should estimate the three following regression equations: first, regressing the mediator on the independent variable; second, regressing the dependent variable on the independent variable; and third, regressing the dependent variable on both the independent variable and on the mediator. ... To establish mediation the following conditions must hold: first, the independent variable must affect the mediator in the first equation; second, the independent variable must be shown to affect the dependent variable in the second equation; and third, the mediator must effect the dependent variable in the third equation. If these conditions all hold in the predicted direction, then the effect of the independent variable on the dependent variable must be less in the third equation than in the second. Perfect mediation holds if the independent variable has no effect when the mediator is controlled."

The above test was used to assess mediation effects for each product. Table 6 summarizes the results.⁸ The first perception factor, Relative Advantage, was found to be a mediator of some personal factors for each of the products with the exception of Pocket pager. Factor 2, Complexity, was found to have a mediating effect in the case of Cable TV, DAT and HDTV and finally the third factor was found to be a mediator only for DAT. In most cases the mediation was not "perfect" in the sense defined above. The only personal factor that was mediated by perception factor(s) consistently across products is Parent Ownership. For recent innovations, Signal-usage was also somewhat consistent; the significance level in the second regression was much less ($p\text{-value} < 0.05$, not reported in the table) for DAT and Pocket pager. Cosmopolitanism was mediated in two cases (for Video camera and Satellite TV) as well as Venturesomeness (for PC and Mobile phone).

Perceptions, therefore, are partly explained by personal factors. Among these, our study clearly shows that family influence has a major role in forming perceptions about a product. Family influences substantially reduce perceived adoption risk through increased knowledge and trial. Another interesting conclusion is that people heavily relying on marketing signals are prone to adopt new innovations and these signals (physical appearance, price and brand) also seem to affect innovativeness through perceptions. This conclusion begs a vast research question: can firm actions generate individual innovativeness? These and additional origins of

⁸ In Table 6 only the mediation effect of the first product factor is shown because of space limitations and its dominant influence on innovativeness.

perceptions clearly require further investigation. Finally, we note that the mediation effects uncovered appear for both recent and existing innovations implying that the profiles of cohort innovators parallels that of contemporaneous innovators (RQ4).

Relative Effects

Next we examine the relative effects of the various adoption forces. Two models were considered: (1) a full model of all effects, and (2) a nested model containing the highest number of significant factors uncovered. The nested models reported in Table 7 are based on likelihood ratio tests between the two models; in all cases, the full models are rejected in favor of the nested alternative ($p\text{-value} > .01$). In addition to a by-product analysis, the last two columns of the table provide aggregate results using average intention across products and the alternative independent variable, "likelihood to buy the latest electronic gadget". In order to gauge the relative importance of the various factors theorized in the literature (RQ3), we begin by looking at the impact of those few personal factors that were not found to be mediated by perceptions. Among these, Family Life Cycle was found to have some effect in the case of PC, Cable TV, Video camera, VCR, Microwave, and HDTV most of which are existing innovations. Age had a direct positive effect in two cases (DAT and Video camera). Cosmopolitanism and Information Seeking had small negative direct effects in the case of Video camera and HDTV respectively. The rest of the personal factors that had a significant correlation with innovativeness in Table 5 (Venturesomeness for instance) were generally found less (or not) significant once the product factors were included in the model. Similar results were found when we averaged across products. Interestingly when using the general scale, "propensity to buy the latest electronic gadget" Opinion Leadership became the most important personal factor. As in previous research, we, therefore, conclude that product factors dominate personal variables (RQ3). This conclusion holds for both cohort and contemporaneous innovativeness (RQ4).

As a final check, we performed forward stepwise regression on the full models. Here again, the perceptual factor Relative Advantage consistently and clearly dominates all other factors. Parent ownership, Family life-cycle, Signal-usage and Venturesomeness are the few other significant forces explaining innovativeness, though the result is less consistent across categories. The explained variance attributed to these later two factors is consistently and substantially less than that of Relative Advantage (partial adjusted R-squared statistics smaller than 10% of the full model's). This result also holds when averaging across product categories.

Table 8 provides a comprehensive summary to the third research question (RQ3): among the various forces, which appear to be most relevant in predicting one's proneness to innovate (adopt early)? Table 8 classifies the relationships on a spectrum from "none" to "strong", based on the statistical tests presented in the study (i.e. no entry signifies no relationship found, whereas "strong" indicates highest explanatory power). As pointed out earlier and confirming previous research, product perceptions are strong predictors of innovativeness but variables currently used in diffusion research are not sufficient to explain these perceptions. This holds true for all types of innovations and the two types of innovators considered: cohort and non-cohort. Family Life Cycle has a weak, direct influence mainly on "cohort" innovativeness. Parent Ownership has a strong effect, partially mediated by Relative Advantage. Venturesomeness and Signal usage are shown to have some direct and mediated influence on innovativeness, mostly for recent innovations. Most other personal factors (age, income, education, cosmopolitanism, risk aversion, information seeking and media proneness) hypothesized in the literature have negligible influence on innovativeness for the categories studied (e.g. variances in cosmopolitanism among the lead segment has no affect on innovativeness).

Summary

Our study's findings can be summarized as follows:

- *Psychographic factors*: Venturesomeness and Financial risk proneness have a positive effect on innovativeness (Proposition #23 of Gatignon and Robertson). The effect of the later is more accentuated for recent innovations. In general, psychographic factors have minimal effects on innovativeness;
- *Demographic factors*: In the present sample Age, Education and Income are unrelated or marginally related to innovativeness. Family Life Cycle positively affects "cohort" innovativeness for existing innovations. Parent Ownership has a significant positive effect on innovativeness;
- *Consumer Behavior factors*: People relying heavily on marketing signals are likely to adopt earlier;
- *Product factors*: Perceived product attributes used in diffusion research are components of three orthogonal factors. The first factor is clearly related to Relative Advantage and Compatibility whereas the second factor is related to Complexity (RQ1). Relative Advantage is found to dominate other perceptual factors in explaining innovativeness. The direction of perceptual effects partly supports Proposition #27 of Gatignon and Robertson. For the sample used in this study Complexity was positively related to innovativeness contradicting previous research;
- *Mediation effects*: Parent Ownership and (marketing) Signal-usage were found to be mediated by Product factors; the later only in the case of recent innovations. Family

Life Cycle was found to have significant direct effects on innovativeness for non-home-office innovations;

- *Relative Effects*: product perceptions dominate adoption timing; these perceptions are partly explained by the family environment. Given the weak link between personal and product factors, perceptions still remain mostly unexplained (RQ2);
- *Cohort Innovativeness*: Family life-cycle affects cohort innovativeness whereas Venturesomeness, Risk proveness and Signal-usage mostly affect innovativeness for recent innovations. Effects of Parent ownership and Product factors are similar for recent and existing innovations.

CONCLUDING REMARKS

Inspired by the comprehensive review of Gatignon and Robertson (1985), this paper reports an integrated study of consumer adoption theories. Our empirical study is based on a battery of over 200 questions generalizing previous constructs used in the literature; our sample matching procedure overcomes weaknesses identified earlier by focusing on subjects who are within the lead segment of consumers for the ten electronics products studied. Our primary conclusions can be summarized as follows:

- many supposedly independent constructs suggested in the literature, including Rogers' ACCORD acronym, may, in fact be related; in particular, perceived compatibility and relative advantage are highly interdependent;
- there appears to be a strong family effect on innovativeness; the offspring of innovators are more likely to be innovators themselves;
- innovativeness is, in part, driven by one's receptiveness to change agent actions (marketing communications) rather than other personal constructs;
- confirming the extant literature, perceptions more so than any other forces drive innovativeness. Although family influences often explain perceptions, these are not generated by other diffusion constructs and remain, therefore, largely unexplained.

While Gatignon and Robertson suggest to approach new product adoption research in an integrated framework, the disadvantage of having such a large scope comes from the trade-off between breadth and depth. In most of the cases we had to content ourselves with existing scales given the length of the questionnaire. Considering this limitation, our study suggests that further research is needed. In particular greater emphasis should be made on developing causal models which can explain individual-level variances in product perceptions (i.e. why one individual perceives a tangible product to be highly advantageous or complex, while another does not). Three domains may prove useful in this regard. First, additional variables should be considered. Presumably these variables might be able to describe the competitive, social or

physical environment of the diffusion process and factors affecting general consumption patterns of the population. Second, even if perceptions are explained to some extent by these variables, market-driven (change agent) factors should also be considered by future research (e.g. firm-level advertising may go beyond generating awareness and actually may affect an individual's innovativeness). Finally, perceptions can be seen as manifestations of causal mechanisms generated at the individual level. As the mechanisms considered in the diffusion literature generally fall short in explaining variances in perceptions, further work in this regard appears warranted.

Finally, we highlighted the fact that managers launching products into mature categories will always face a given cohort of consumers. Within a given cohort, some consumers will adopt earlier than others (i.e. they are more innovative). This cohort, of course, may not even have lived during the introductory phase of the product category itself. We find that most aspects of the profile of innovators within later cohorts for these existing innovations are similar to the profile of innovators for innovations which are at their earliest phases of the product life cycle. This result implies that many of the concepts introduced by diffusion theory may be applicable to launches of any new products, even into categories which have reached some level of maturity within the original, or contemporaneous social system (e.g. the adult population living in the 1960s when, say, microwave ovens were launched). Likewise, even for mature products which have never been modified since launch, the profile of innovators within a given cohort of consumers will likely be similar to the profile of the original innovators when the product was first launched. We must see this result with some caution given our study's limited scope (i.e. to ten consumer electronics products). Broader attempts to generalize this result to other categories should prove extremely useful.

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FIGURE 1: SOCIAL AND CROSS-CULTURAL INFLUENCES ON INNOVATIVENESS

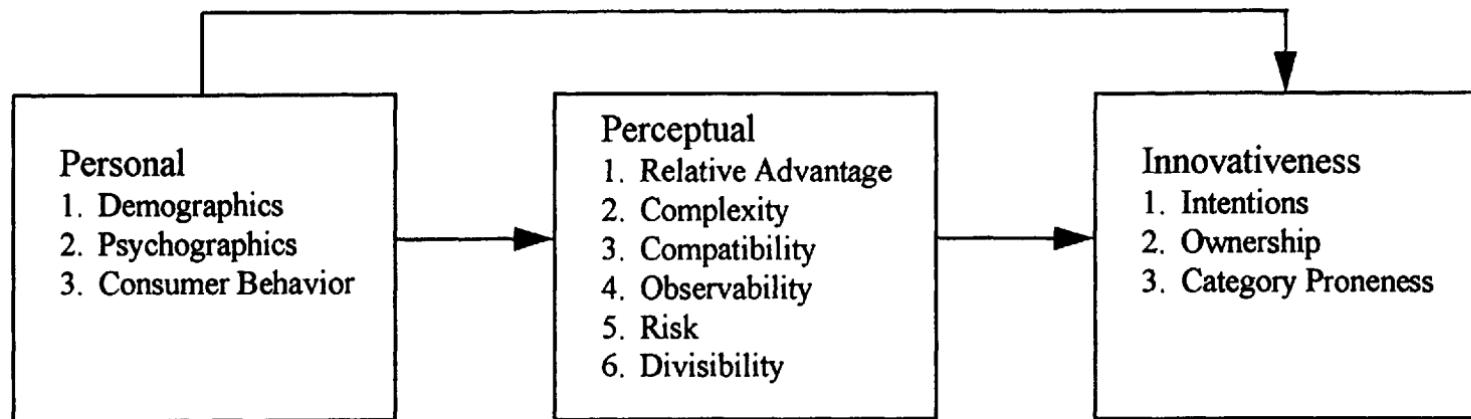


TABLE 1: LITERATURE REVIEW ON CONSUMER INNOVATIVENESS

PERSONAL VARIABLES:

Rogers (1983)	Describes innovators as "venturesome", early adopters as "respectable", the early majority "deliberate", the late majority "skeptical", and the laggards "traditional".
Robertson (1971); Danko, and McLachlan (1983); Dickerson, and Gentry (1983); Peters, and Venkatesan (1973)	Innovators will be drawn from the heavy users of the product category.
Hirschman (1980)	Greater knowledge about the product leads to innovativeness, since less cognitive effort is required for the adoption.
Bass (1969); Midgley, and Dowling (1978)	Innovativeness is the degree to which an individual is receptive to new ideas and makes innovation decisions independently of the communicated experience of the others.
Green, Langeard, and Favell (1974); Summers (1972)	Innovators are more exposed to mass media.
Yapa, and Mayfield (1978)	Innovators are more cosmopolitan.

PRODUCT VARIABLES:

Rogers (1983); Orlitzky (1974)	Relative advantage, compatibility, triability, and observability are positively related to the speed of diffusion. Complexity and perceived risk are negatively related.
Orlitzky (1974); Labay and Kinnear (1981)	Perceived innovation characteristics are more effective predictors of innovativeness than personal variables.
Holak (1985); Holak and Lehmann (1986)	Among the six important product attributes, compatibility, relative advantage, and perceived risk have a consistent (direct) effect on purchase intentions and the other three variables have an indirect effect.

TABLE 2: SAMPLE CHARACTERISTICS

Means, Proportions and Standard deviations (in parentheses)

MATCHED VARIABLES:	SAMPLE AVERAGES
Age	28.3 (2.45)
Years at university	5.9 (1.46)
Years work experience	4.7 (2.03)
% owning house	47
% owning car	100
<hr/> PURCHASE INTENTIONS: <hr/>	
1. PC	8.12 (2.69)
2. Cable TV	4.89 (3.06)
3. Video camera	3.91 (2.92)
4. DAT recorder	3.26 (2.49)
5. Sat. TV dish	2.97 (2.32)
6. VCR	7.08 (3.08)
7. HDTV set	3.52 (2.6)
8. Pocket pager	2.91 (2.18)
9. Mobile phone	4.46 (2.74)
10. Microwave oven	7.66 (2.85)

TABLE 3: PERSONAL AND CONSUMER BEHAVIOR FACTORS

Variable Category	Rotated Factors	Variables	Loading
1. Demographics:	Age	Age	0.9
		Years of work experience	0.8
	Income	Income before the programme	0.9
		Expected income after programme	0.9
	Family Life Cycle	Number of houses owned	0.7
		Number of cars owned	0.7
		Number of children	0.5
	Education	Number of non-native languages spoken	0.7
		Number of years at university	0.7
	Parent Ownership	(dummy variable)	N/A
2. Psychographics:	Venturesomeness	Likely to start a company within one year	0.6
		"How venturesome are you?"	0.8
		"How self confident are you?"	0.5
	Cosmopolitanism	Number of continents visited	0.8
		"Number of clubs you are member of"	0.7
	Physical Risk aversion	Likely to play life-threatening sport	N/A
		Likely to bet on horses or in casino	N/A
		Likely to use price as a signal of quality	0.8
3. Consumer Behavior:	Signal- usage	Likely to use brand name as signal of quality	0.8
		Likely to use physical appearance as signal of quality	0.6
		Likely to research before buying	0.6
	Opinion leadership	Likely to give advice to others	0.8
		Number of shops visited before buying	0.7
		Likely to jointly decide on purchase	0.5
	Information seeking	Likely to seek advice from others	0.6
		Price sensitivity	0.7
	Media proneness	Exposure to firm sent information	0.8
		Exposure to independent information sources	0.7

TABLE 4: PRODUCT FACTORS

(Factor loadings and lambdas)

Factor name (lambda)	Loading Variables	Existing Innovations					Recent innovations				
		PC	Cable TV	Video Camera	VCR	Micro Wave	DAT	Sat. TV	HDTV	Pocket Pager	Mobile Phone
Relative Advantage 2.21	Relative Advantage	0.69	0.71	0.76	0.71	0.72	0.73	0.75	0.79	0.72	0.73
	Lifestyle compatibility	0.78	0.78	0.84	0.83	0.81	0.78	0.78	0.71	0.74	0.76
	Enjoyment/Pleasure	0.69	0.68	0.79	0.78	0.54	0.82	0.77	0.79		0.73
	Reduces physical labor	0.53	0.52			0.69				0.71	0.69
	Time saved		0.58							0.63	0.57
	Communicability								0.59		
Complexity 1.61	Complexity	0.61	0.73	0.69	0.66	0.77	0.75	0.71	0.72	0.79	
	How easy to repair	0.61	0.59	0.57	0.67				0.51		
	Triability	0.67		0.66	0.68		0.71	0.53	0.75		0.68
	Obsolescence		0.69			-0.7		-0.57		-0.63	
	Communicability	0.59		0.53						0.68	
	Enjoyment/Pleasure									-0.58	
	Time saved					0.84				0.51	
F3: Other 1.38	Complexity									0.76	
	Reduces physical labor			0.76	0.75		0.79	0.71	0.81		
	Triability		0.74			0.63				0.64	
	Obsolescence	0.75									
	Communicability		0.83			0.75				0.72	
	How easy to repair					0.59				0.68	
	Time saved	0.75		0.82	0.76		0.83	0.69	0.76		0.51

Note: a.) Only variable loadings larger than 0.5 are reported

b.) Factor lambda is averaged across products

TABLE 5: PAIRWISE CORRELATION OF FACTORS WITH INNOVATIVENESS

Factor Name:	Lambda:	Existing Innovations					Recent Innovations				Latest Electric Gadget		
		PC	Cable TV	Video Camera	VCR	Micro Wave	DAT	Sat. TV	HDTV	Pocket Pager			
PERSONAL FACTORS													
1. Demographics													
Age	1.88		-0.08*	.17***				.08*					
Income	1.52												
Family Life-Cycle	1.46			.19***	.09*	.13***					.09*		
Education	1.26		.09*		-11*								
Parent Ownership	N/A		.39***		.21***	.21***	.36***	.24***	.33***	.15***	N/A		
2. Psychographics													
Venturesomeness	1.66	.17***	.10**				.12***	.09*	.13***	.13***	.25*** .18***		
Cosmopolitanism	1.39			-.18***				-.08*			.08*		
Physical risk aversion	N/A		-.06*								.08*		
Financial risk aversion	N/A		.07*		.10**			.10**	.09**	.08*	.10** .14***		
3. Consumer behavior													
Signal-usage	1.78		.11***	.08*	.08*	.08*		.12***	.11***		.16*** .20***		
Opinion leadership	1.77	.13***				.07*				.10**	.28***		
Information seeking	1.22					.07*				.08*	-.08*		
Media proneness	1.16	.09**	.12***					.08*	.11***	.08*	.07*		
PRODUCT FACTORS													
F 1: Advantage	2.21 b	.43***	.53***	.60***	.54***	.43***	.43***	.53***	.29***	.43***	.45*** N/A		
F 2: Complexity	1.61 b		.25***	.15***		.11**	.15***	.09*	.16***		.09** N/A		
F 3: Other	1.38 b		.07*	.14***	.08**		.17***	.19***	.16***	.13***	N/A		

Note: a.) *: < .05, **: < .01, ***: < .001

b.) average across products

TABLE 6 : ADVANTAGE AS MEDIATOR BETWEEN PERSONAL FACTORS AND INTENTIONS

Regression type:		Existing Innovations					Recent Innovations				
		PC TV	Cable Camera	Video VCR	Micro Wave	DAT	Sat. TV	HDTV	Pocket Pager	Mobile Phone	
Regress. 1:	R-squared:	0.08	0.07	0.09	0.08	0.09	0.08	0.08	0.06	0.04	0.08
Dep. var.:	Age	-.14***		.12**							
Advantage	Family Life Cycle			.14***							
	Parent Ownership		.40***	.37***	.44***	.32***	.76***	.57***	.40*	.57***	.39***
Indep. var.:	Venturesomeness	-.14***									.16***
Personal factors	Cosmopolitanism		-.15***	-.13***	-.10*			-.12**			
	Signal-usage		.13***	.17***	.15***	.14**	.15***	.17***	.20***	.13**	.18***
	Opinion leadership	.20***					.15***				-.14***
	Information Seeking					.19***					
	Media proneness							.14***			
Regress. 2:	R-squared:	0.05	0.19	0.12	0.06	0.08	0.17	0.1	0.16	0.03	0.13
Dep. var.:	Age			.54***			.28**				
Intention	Family Life Cycle	.23*		.60***		.39***					.25*
	Parent Ownership		2.65***	.62*	1.32**	1.32***	3.65***	1.97***	3.13***		1.22***
Indep. var.:	Venturesomeness	.48***							.30**	.24**	.69***
Personal factors	Cosmopolitanism			-.57***				-.26**			
	Signal-usage							.37***	.35***		.51***
	Opinion leadership	.27*					.28*				
	Information seeking										
	Media proneness	.25*	.30**	.27*							
Regress. 3:	R-squared:	0.19	0.45	0.45	0.31	0.27	0.33	0.38	0.23	0.22	0.31
Dep. var.:	F 1: Advantage	1.03***	1.47***	1.65***	1.56***	1.02***	.90***	1.16***	.63***	.96***	1.16***
Intention	F 2: Complexity		.74***	.38***			.27**	.27***	.30**		.27**
	F 3: Other			.44***			.25**	.46***	.31***	.24**	
Indep. var.:	Age			.36***			.25**				.52***
Personal factors and Advantage	Family Life Cycle	.25*		.46***	.27*	.38***					
	Parent Ownership		1.94***		.73**	1.27***	2.60***	1.46***	2.27***		
	Venturesomeness	.35***									.34***
	Cosmopolitanism				-.36***						
	Signal-usage								.30**		.87**
	Opinion leadership										
	Information Seeking								.32***		
	Media proneness										
Mediated variables: (by Relative Advantage)		Venture Oplead	Parent O. Family Ic Cosmop. Age	Parent O. Seeking	Parent O. Cosmop.	Parent O. Signal U.	Parent O. Signal U.	Parent O. Venture	Parent O. Signal U.		

Note: *: < .05, **: < .01, ***: < .001

TABLE 7: RELATIVE IMPORTANCE OF PERSONAL AND PRODUCT FACTORS IN EXPLAINING INNOVATIVENESS

(Significant regression coefficients in the retained nested models)

Factor Name:	Existing Innovations					Recent innovations					Average Intention	Latest Electric Gadget		
	PC	Cable TV	Video Camera	VCR	Micro Wave	DAT	Sat. TV	HDTV	Pocket Pager	Mobile Phone				
PERSONAL FACTORS														
1. Demographics														
Age				0.34***				0.23*						
Income														
Family Life-Cycle	0.23*	0.19*	0.43***	0.29*	0.39**				0.19*					
Education														
Parent Ownership		1.91***		0.81**	1.25***	2.63***	1.39***	2.31***		0.83*	1.63***	0.79*		
2. Psychographics														
Venturesomeness	0.36**								0.19*	0.55***	0.20**			
Cosmopolitanism			-0.33**								0.19**			
Physical risk aversion														
Financial risk aversion									-0.20*			-0.22*		
3. Consumer behavior														
Signal-usage	-0.21*							0.33**		0.33**	0.19*	0.23**		
Opinion leadership												0.36***		
Information seeking								-0.20*						
Media proneness												-0.22*		
PRODUCT FACTORS														
F 1: Advantage	1.04***	1.49***	1.68***	1.60***	1.04***	0.94***	1.15***	0.65***	0.99***	1.19***	0.97***	0.61***		
F 2: Complexity		0.75***	0.39***		0.26*	0.29**	0.22**	0.34**		0.27*	0.34***			
F 3: Other		0.23*	0.43***		0.27*	0.44***	0.33**	0.23*						

Note: a.) Full model has been rejected against the retained model at p=0.01 level.

b.) *: <.05, **: <.001, ***: <.0001

c.) In the case of Average Intention and Latest electric gadget, the independent variables Parent Ownership and Product factors are averaged across products.

TABLE 8: RELATIVE IMPORTANCE OF FACTORS ACROSS PRODUCTS

Factor Name:	Direct effects	Mediated effects
PERSONAL FACTORS		
1. Demographics		
Age		
Income		
Family Life-Cycle	weak	
Education		
Parent Ownership	strong	strong
2. Psychographics		
Venturesomeness	medium	weak
Cosmopolitanism		
Physical risk aversion		
Financial Risk aversion		
3. Consumer behavior		
Signal-usage	weak	medium
Opinion leadership		
Information seeking		
Media proneness		
PRODUCT FACTORS		
F 1: Advantage	strong	N/A
F 2: Complexity	medium	N/A
F 3: Other	medium	N/A