A Road To Open Innovation:

A Model Of Technological Innovativeness Of Youth

Dr. Parimal Bhagat, Dr. Rajendar Garg

ABSTRACT

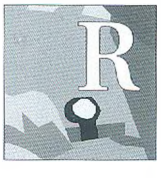
Innovation is one of the last key drivers of competitiveness and growth for the U.S. in the twenty-first century. Open innovation is a buzzword when it comes to new product development. While customers have been regularly involved in the research and development process using various qualitative and quantitative marketing research methods, they were never considered co-creators of products and services. Scholarly research in marketing has focused on the adoption and use of new products with limited research on the design and creation process. The advent of the internet and its facilities for information access and symmetry has resulted in an increase in direct customer participation in the value discovery and value creation process. Certain customers are not just lead users but lead contributors of ideas for the next generation of products. Further, the usage behaviors of younger consumers when it comes on online and new media technologies set them up as market bellwethers. This study defines and measures the technological innovativeness of youth and considers the impact of key variables on this measure. Using Multiple Linear Regression, significant impact of the three independent variables – Creative, Passion, and Expertise on the dependent variable – propensity for Technological Innovations was found. Future research directions to expand the conceptual model and managerial implications of the research are also forwarded.

INTRODUCTION

The ability to innovate consistently, in the past, was considered little more than the innate ability of individuals defying the importance of the nurturing process. Soon after, companies and academic research began to show that innovation management programs implemented carefully could significantly improve the results and innovations could indeed be spurred more consistently in any organization. The research on the propensity to technologically innovate has recently been undertaken by many scholars however, the results have been mixed. A variety of factors influencing the propensity to innovate technologically have been put forth for consideration such as, curiosity, creativity, expertise and passion of the individuals involved as well as other organization factors.

The fundamental purpose of this research project is to determine the propensity for technological innovativeness among young adults. Youth are members of the "digital generation". They are lead users of new technologies and increasingly co-creators of product extensions with the product or service producers. The Time magazine's 2006 Man of the Year – "YOU" – legitimizes the new power of the individual consumer in controlling his consumptive future. Grossman (2006) says "(2006) .. is a story about community and collaboration on a scale never seen before. It's about the cosmic compendium of knowledge." The basic premise of this paper is that this wealth of knowledge and enthusiasm of the youth can be accessed, harnessed and inputed as a core process in innovation.

In this study, the propensity for technological innovativeness is measured as a collection of cognitive and emotional attributes that are responsible for behavior towards new technology products. Constructs capturing aspects of an individual's creativity, level of interest and involvement, and expertise form the antecedent variables in the study. This study is based on data collected from students who are in a business program at a major university in the U.S. The study identifies the role of the antecedents as well as certain demographic and psychographic variables in determining the technological innovativeness of youth in the U.S.



EVIEW OF LITERATURE

Since the transfer of competitive strength in manufacturing to other countries, Innovation is one of the last key drivers of competitiveness and growth for the U.S. in the twenty-first century. While the work environment can be a catalyst or deterrent, the source of all innovation lies in the individual – the citizen of a country. Consumer Innovativeness, in marketing literature, "describes buyers who wish to learn about and own the newest products" (Goldsmith et al., 2003). Another definition of innovativeness is summarized by Hynes and Lo (2006) as "the degree to which an individual is receptive to new ideas and makes innovation decisions independently of the communicated experience of others". The domain for this research is "technology" and most of the variables are measured in this specific domain context.

There has been extensive research in the area of new product development and specifically on the role of creativity and innovativeness in the consumption, adoption and diffusion of new products (Etzel et al., 1976; Hirschman, 1980; Rogers, 1983; Wilkie, 1990; Manning et al., 1995) and the work environment for creating new products (Amabile et al., 1996). However, there is a gap in the literature studying the antecedents and impact of innate domain-specific innovativeness of an individual on a society and its resulting competitive position. There is some studies in the area of Knowledge Management that attempt to relate innovation and knowledge at a city or region level (Dvir and Pasher, 2004) - a theory of geographic locus of innovation based on the concentration of human knowledge capital and resulting formation of knowledge networks.

In Open Innovation, Henry Chesbrough (2003, Chesbrough et al., 2006) investigates a new model of how research and development works in organizations compared to the old model of centralized R&D which is based on deep vertical integration. He proposes "a new logic of innovation ....that leverages the distributed landscape of knowledge" and the diffusion of human capital down to the individual in society. Authors have begun to focus on the role of "open innovation" where companies voluntarily disseminate knowledge of their innovations and, in return, invite participation of individuals outside their organization in their innovation and new product development process. Eric Von Hippel's **Democratizing Innovation** (2005) suggests that users of products and services are increasingly being able to innovate for themselves especially in the technology-oriented product category. In an earlier work, he identified four external sources of useful knowledge: suppliers and customers; university, government, and private laboratories; competitors; and other nations. With the proliferation of information (on the internet) comes the democratization of knowledge. The premise for the future is that companies can channel this creative and innovative potential of the individual – the innovation benefactors - to develop new products which better meet the needs of these individuals. Such customer-driven innovation, sometimes called "Outside Innovation" (Seybold, 2006) is increasingly being used by companies to dynamically co-create new products or product variations especially by technology oriented firms. Although quantitative marketing research techniques such as needs assessment studies and qualitative techniques such as customer scenario analysis have been used over the years as inputs to the R&D design teams, employing lead users as specific inputs to and partners in the design and development process is more recent. There is direct benefit of such collaboration for both partners. While the benefit to firms is obvious, lead users are often given early prototypes for gamma-testing and may also be promised a free product once it is commercially available. The motivation of the individual is aptly stated by Seybold (2006) as "the structural tension between lead users' current reality and their desired outcomes and experiences drives innovation."

This study focuses on the youth – 18-35 year olds who are known to be lead users of new technologies and are rightly called the "digital generation".

OUR CONCEPTUAL MODEL

First, we study the Propensity for Technological Innovativeness (Tech_Innov) of individuals by measuring the impact of a) personal creativity enhancers, b) Passion based on involvement and intrinsic motivation for new technology products, and c) new technology domain knowledge/expertise. Therefore, we postulate that the propensity for technological innovativeness is significantly influenced by creativity, passion and knowledge/expertise of the technology domain. Thus, our proposed model (see Figure 1) gives the conceptual framework for the study

Propensity for Technological Innovativeness (*Tech_Innov*) is defined here as:

> *the degree to which an individual is receptive to creating value in a new technological product or enhancing value in an existing technological product.*

Personal Creativity Enhancer (*CREATIV*) is defined here as:

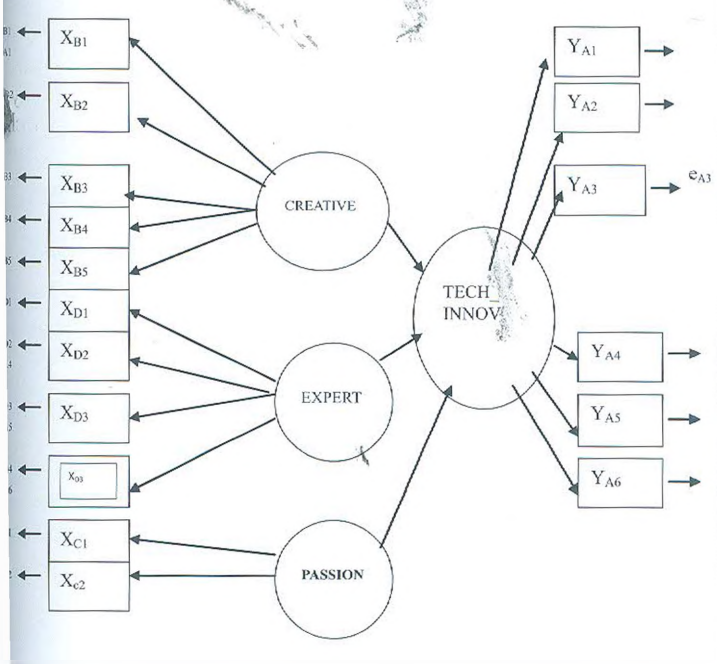
> *individual traits which either act as catalysts (support) for creative production or barriers (with a negative influence).*

Creativity has been shown in business literature to be a necessary but not sufficient condition for innovation to take place.

Passionate Involvement (*PASSION*) for New Technology-based Products drives the innovation-oriented behavior of people in society. Such deep, intrinsic and passionate involvement is defined here as

> *the personal salience or interest in new technology-based products.*

Figure 1
Conceptual Model of Propensity for Technological Innovativeness



Involvement results in both cognitive intensity and affective arousal when acquiring, consuming and *creating* a new (technology) product benefit. A key dimension captured in our survey is the intensity of involvement in this product category. This dimension separates the characteristics of the evangelists – those who not only support the technological environment but help in extending its reach – from the mainstream users of technology products. This variable is seen to be distinct from new technology Domain Knowledge and Expertise (*EXPERT*). Such domain-specific expertise is defined as:

the past cognitive information and experience gained in the technology space.

Demographic characteristics are also studied for the mediating roles. Specifically, income and educational level provide the resources and exposure to experiences that support Tech_Innov. Gender differences are also of importance since past studies have found men to be more attracted to tech-gadgets than women, impacting their level of knowledge and expertise. Next, we obtain an aggregate measure of propensity for technological innovativeness and study the impact of the three antecedent factors on this measure.

The model postulated in Figure 1 uses standard measurement terminology where Y (Ya1, Ya2, etc.) represent endogenous manifest variables and X represent exogenous manifest variables. Errors terms are denoted as such for each of the manifest variables.

METHODOLOGY

This study utilizes survey methodology to obtain self-reported measures of the variables in the model. The subjects are young adults in the age range of 18-35 years. The total number of subjects in the study was 143. Data was collected from subjects drawn from a college town in northeastern United States and had at least some college-level education. There were about 55% males with 90% in the 18-22 years age bracket and over 80% were Caucasian. The data was collected during Fall 2007 using the survey questionnaire.

Several of the scales used in this study are adapted from existing scales in the marketing and management literature (see Bearden et al., 1993). For instance, Goldsmith and Hofacker (1991; Goldsmith et al., 2003; Clark and Goldsmith, 2006) multi-item scale have been modified to reflect the new domain. However, the reliability or internal consistency of the scales was assessed using the Cronbach's alpha statistic. The latent variables, number of items and their reliability statistic is given in table 1. Using Figure 1, the propensity of technological innovations was measured using six likert-type items (labeled as YA1, ...,YA6); personal creativity was measured using five likert-type items (labeled as Xb1,.... ,Xb5); knowledge/expertise in the technology doman was measured using 4 likert-type items (labeled as Xd1, ..., Xd6) and passion was measure using two likert-type scale items (labeled as Xc1 and Xc2). The reliability of the latent constructs as measured is presented in Table 1 below. As it can be seen, reliability of each of the constructs is sufficiently high even though it might be possible to improve the reliability of these scales in future studies.

TABLE 1: Reliability of Scales

Variable	No. of items	Cronbach's alpha
Tech_innov	6	0.7
Creative	5	0.6
Passion	2	0.8
Expert	4	0.9

This study is designed to be technology domain-specific. Respondents are given the following statement at the beginning of the instrument to define and reinforce the context: "New Technology Product includes portable MP3 video players, PDA phones, DVRs, GPS Navigation Systems, Online video gaming, advanced photo-editing software, educational software, etc."

NALYSIS

The purpose of this study is to measure the propensity for innovativeness in young individuals and the impact of several variables lead up to such a tendency. The results will help us profile the individuals along several dimensions. In The Ten Faces of Innovation, Tom Kelley (2005) suggests replacing traditional categories of roles individuals play such as "engineer", "marketer" and "project manager" with the three broad roles of "learning", "organizing" and "building".

Using Multiple Linear Regression, we considered the impact of the three independent variables – Creative, Passion, and Expertise on the dependent variable Tech_Innov. The adjusted-R-square value was 0.315 and all the independent variables were found to have a statistically-significant impact on Tech_Innov (see table 2).

The data was compared on two demographic dimensions - gender and education of parent. Age was not considered since the sample was highly homogeneous in terms of age - traditional undergraduate college students. Using ANOVA, the means for each of the variables were tested for gender differences. The personal creativity enhancers were statistically not different for males and females. However, we found a statistically significant difference in their propensity for technological innovativeness, passion and expertise – in all cases, the males had a higher mean value. Therefore, males showed a higher propensity for technological innovativeness than females. Past research does indicate that males are more (passionately) involved with technology compared to females – more males pursue engineering degrees, likely to use technology gadgets, etc. The level of interest and use of technology-based products would lead to greater expertise in the domain.

The education level of the parent was considered since the young consumers would probably have access to more resources and encouragement from parents with higher levels of education. When the data was analyzed for this dimension, the propensity for technological innovativeness, passion, and creativity were all not significant. However, the level of expertise in the technology-products domain was significantly higher for respondents with more educated parents. This supports our conjecture that educated parents would either themselves see the benefit of understanding and learning about technology-based products and pass on their enthusiasm to their children or provide more resources to their children so that they may learn about these technology-based products.

TABLE 2 : Regression Analysis

Model Summary (b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.562(a)	.316	.315	.56603	1.981

a Predictors: (Constant), EXPERTISE, CREATIVE, PASSION

b Dependent Variable: TECH_INNOV

Coefficients (a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	8.930	.290		30.761	.000
	CREATIVE	.196	.019	.166	10.442	.000
	PASSION	.212	.045	.115	4.689	.000
	EXPERTISE	.426	.024	.439	17.940	.000

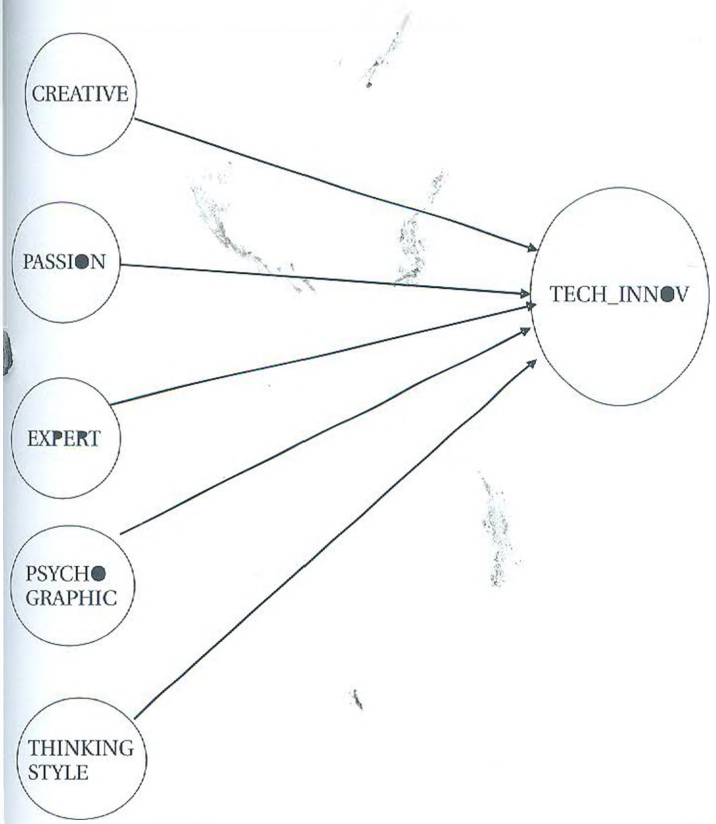
a Dependent Variable: TECH_INNOV

DISCUSSION AND IMPLICATIONS

The measurement model considered for analysis includes the most salient independent variables in the marketing literature. The role of creativity or, specifically, personal creativity enhancers is well documented in the marketing, psychology and sociology literature (Amabile 1996; Burroughs and Mick 2004). Passion, a deeper measure than involvement, captures the inherent motivation in the technology-based products context. Finally, expertise in the technology-based products would lower the cognitive resources needed to create new products and lead to higher technological innovativeness. However, there are other factors that should be considered in understanding the consumer's propensity for technological innovativeness. Figure 2 shows the expanded structural model which includes two new variables. The first such variable is Psychographics (PSY) measured using a simplified adaptation of the Values and Lifestyles scale. While there is research which tries to capture the relationship between creativity and personality, we wish to study the indirect impact of types of activities and interests of the individual with their propensity to innovate.

The second variable of interest is Thinking Styles (THNK). Research has shown that there may be two different forms of creative – artistic creativity and cognitive & process creativity. Innovation may be seen by some as creative problem solving. Burroughs and Mick (2004) summarizes some of the findings and find that certain personal factors such as locus of control and thinking ability "affect creative consumption". They highlight the role of analogical and metaphoric thinking as being vital to creativity. However, innovation according to us requires more - creating value from new ideas - and may require a more complex thinking style. Kindler (2002) proposes a two-dimensional structure – cognitive and emotional. He proposes that individuals measuring high on both dimensions are "experimental and creative, personal and empathic." He makes the case that "the emotional brain is as involved in reasoning as is the cognitive brain." Daniel Goleman (1996) stresses there are two kinds of intelligence: rational and emotional. In his recent book, Social Intelligence, he further elaborates on the (third) dimension of intelligence in social interaction. A new field in marketing, neuromarketing, aims to study this phenomenon from a physiological perspective. We would explore the correlation between the type of thinking style – cognitive and emotional - and the individual's propensity to innovate.

Figure 2
Expanded Model–Propensity For Technological Innovativeness



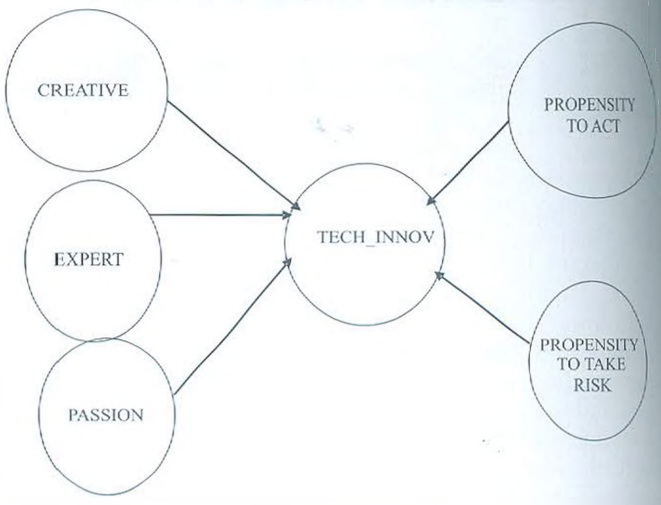
The dimensionality of the construct Tech_Innov would need to be tested under more robust conditions in terms of sample size and composition. An exploratory factor analysis using Principle Component Analysis and Varimax rotation with Kaiser Normalization revealed a possible two factor model. The structural model is given in Figure 3. After further interpretation of the descriptions of the items loading on each of these two factors, we call the factors "the propensity to act in a timely manner" and "the propensity to take risk". However, to test such a model, we would need to create a distinct measure of "overall propensity for technological innovativeness".

This research is positioned to measure the propensity for technological innovativeness among youth. The reason for using this narrow young population context is to focus on technologically more inclined young population. However, it would be interesting to extend this research to all population groups and study differences by age.

There are several managerial implications of this research. Co-creation is increasingly appreciated and utilized by companies. P&G Inc.'s Connect-and-Develop initiative allows individuals (and other smaller companies) to provide solutions and work collaboratively with the company's scientists. Such models of open innovation are finding increasing support among business executives. This impacts the new product design and development process and the internal research and development process of companies. Extending the impact of open innovation to larger units of analysis, such consumer-supported open innovation would drive the competitiveness of cities, regions and countries.

It would be interesting to see differences in the propensity for technological innovativeness across countries, especially between United States and the BRIC- countries. This would be possible if we are able to derive a measure of National Technological Innovativeness Index, similar to the University of Michigan's American Customer Satisfaction Index (Fornell 1996). The ACSI is obtained from cross-sectional and longitudinal benchmarking studies across products and services. Similarly, a NTII measure would be one of the factors indicating the innovation potential and vitality of a country in terms of growth through new ventures.

Figure 3
Factors of Propensity for Technological Innovativeness



REFERENCES

1 Amabile, Teresa M., Regina Conti, Heather Coon, Jeffrey Lazenby and Michael Herron (1996), "Assessing the Work Environment for Creativity", Academy of Management Journal, vol. 39, no. 5, 1154-84.

2 Bearden, W.O., Netemeyer, R.G., Mobley, M.F. (1993), Handbook of Marketing Scales: Multi-item Measures for Marketing and Consumer Behavior Research, Sage Publications Inc., Thousand Oaks, CA, .

3 Burroughs, James E. and David Glen Mick (2004), "Exploring Antecedents and Consequences of Consumer Creativity in a Problem-Solving Context", Journal of Consumer Research, vol. 31, p. 402-411.

4 Chesbrough, Henry (2006), Open Innovation: The New Imperative for Creating and Profiting from Technology", Harvard Business School Publishing.

5 Chesbrough, Henry, Wim Vanhaverbeke and Joel West, eds. (2006), Open Innovation: Research a New Paradigm. Oxford University Press.

6 Clark, Ronald A. and Ronald E. Goldsmith (2006), "Global Innovativeness and Consumer Susceptibility to Interpersonal Influence". Journal of Marketing Theory and Practice, vol. 14, no. 4, pp. 275-285.

7 R Dvir, E Pasher (2004). Innovation engines for knowledge cities: an innovation ecology perspective. Journal of Knowledge Management, Vol.8, no.5.

8 Etzel, Michael J., James H. Donnelly, Jr., and John M. Ivancevich (1976), "Social Character and Consumer Innovativeness", The Journal of Social Psychology, 100, 153-154.

9 Fornell, Claes, Michael D. Johnson, Eugene W. Anderson, Jaesung Cha and Barbara Everitt Bryant (1996), "The American Customer Satisfaction Index: Nature, Purpose, and Findings", Journal of Marketing, vol. 60 (Oct.), 7-18.

10 Goldsmith, Ronald E., Leisa R. Flynn and Elizabeth B. Goldsmith (2003), "Innovative Consumers and Market Mavens". Journal of Marketing Theory and Practice, Fall, 11, 4; p 54.

11 Goldsmith, Ronald E. and Charles F. Hofacker (1991), "Measuring Consumer Innovativeness", Academy of Marketing Science Journal. Summe 1991. vol. 19, Issue 3, p. 209.

12 Goleman, Daniel (1995), Emotional Intelligence. Bantam Books. Goleman, Daniel (2006), Social Intelligence: The New Science of Humar Relationships. Bantam Dell: a division of Random House, New York.

13 Grossman, Lev (2006), "Time's Person of the Year: You". In Time Inc., Dec. 13, 2006.

14 Hippel, Eric von. (2005), Democratizing Innovation, MIT Press, Cambridge, MA. Hirschman, E.C. (1980), "Innovativeness, Novelty Seeking and Consumer Creativity", Journal of Consumer Research, Vol. 7, December, pp 283-295.

15 Hynes, Niki and Stanley Lo (2006), "Innovativeness and Consumer Involvement in the Chinese Market", Singapore Management Review, vol. 28 no. 2.

16 Kelley, Tom (2005), The Ten Faces of Innovation. Random House, Inc.

17 Kindler, Herb (2002), Clear and Creative Thinking: Your Key to Working Smarter. Course Technology, a division of Thomson Learning.

18 Manning, Kenneth C., William O. Bearden and Thomas J. Madden (1995), "Consumer Innovativeness and the Adoption Process", Journal o Consumer Psychology, 4(4), 329-345.

19 Rogers, E. M. (1983), Diffusion of Innovations, The Free Press, New York, NY.

20 Seybold, Patricia B. (2006), Outside Innovation: How Your Customers Will Co-Design the Future of your Business.

21 Wilkie, W.L., (1990). Consumer Behavior, 2nd ed., John Wiley & Sons, Inc.