INNOVATION EVALUATION AND PRODUCT MARKETABILITY

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A sample of more than 2300 innovations provided to an evaluation program was analyzed to determine basic information about the sample itself and the general quality of those innovations. The largest groups of innovations were categorized as home furnishings, personal consumption goods and recreational/entertainment products. While most innovators were judged as having good technical experience, they were seen to be lacking in management and marketing experience. Their innovations were positively judged for functionality but were judged negatively for marketability. Evaluators considered market preparedness and its acceptability by the marketplace to be critical in the potential success of any new innovation.

INTRODUCTION

When innovation happens, inventors are usually passionate and enthusiastic about their inventions. However, this excitement can also lead to wasted time, effort, and money on an idea that lacks commercial potential. It may solve a problem for the inventor or a few of his/her friends, but the idea may not be appealing to a broader audience. The resources invested in this failed idea could have been applied to a more feasible invention.

There is no guarantee whether an idea will be successful in the marketplace. Numerous factors such as product quality and firm strength help determine its feasibility (Kim, Jones and Knotts 2005). For corporations, the number of ideas necessary for new product development varies between 50 and 500 depending on the industry. Peterson (2006) found that idea generation was a difficult process in small firms, in part, due to their lack of personnel and information. For independent inventors, the odds are even higher at 100 to 1,000 depending on the market (WIN Innovation Institute). Udell and Hignite (2007) suggest that the best method for improving these odds is to determine the ideas with the most market potential through evaluation. Evaluating ideas will not eliminate the risk, but it will help inventors avoid wasting resources on projects that have little demand potential.

The Marketing Management Journal
Volume 19, Issue 2, Pages 84-90

INNOVATION EVALUATION

Evaluation is normal and necessary, especially in business. From job interviews to performance appraisals to customer feedback forms, evaluation is part of our society. Evaluations, however, can make people nervous because they may lead to an undesirable outcome (Udell, Atehortua and Parker 1995). This fear may cause some inventors to skip the evaluation step in the innovation process. If the consequences are low, avoiding evaluation may not matter. In the marketplace, however, the stakes are high and errors are often very costly. Therefore, skipping the evaluation step for new products can be fatal. According to Udell (2004), "at the idea stage, the odds against success can run as high as 1 in 3,000 and the costs can easily reach the $10,000 mark or higher, so it pays to evaluate."

Innovation evaluation should be systematic and comprehensive, with its main purpose focused on analyzing the idea and determining if any further investment should be made. As English (2007) stated, it is more realistic for an

evaluation system to identify potentially unsuccessful ideas rather than successful ones because there are many variables in the innovation process that can affect product marketability. The second objective of innovation evaluation is to provide feedback regarding errors and to suggest a proper commercialization strategy (Udell 2004). In this paper, we focus on the Preliminary Innovation Evaluation System (PIES) and its ability to analyze ideas and inventions before market entry.

Preliminary Innovation Evaluation System

The Preliminary Innovation Evaluation System was initially developed as part of a National Science Foundation grant at the University of Oregon in 1974. Since that time, this structured evaluation format has been used to evaluate over 30,000 ideas, inventions and new products in the United States, Canada and elsewhere. These evaluations are designed to:

1. Identify ideas and inventions worthy of further development
2. Provide feedback
3. Identify potential errors or areas requiring special attention
4. Suggest strategies for further development or commercialization

The PIES instrument consists of 45 criteria grouped into eight different categories which address societal impact, business risk, demand analysis, market acceptance, competitive criteria, experience factors, commercialization strategies, and market structure issues (see Evaluation Criteria). For each criteria, there are five or six possible responses along with the option to mark an area as "not applicable". The minimum desirable level of compliance is the median of the responses available. An example of an item and its responses is given below:

Functional Feasibility: In terms of its intended functions, will it do what it is intended to do? This product:

A. is not sound; cannot be made to work.
B. won't work now, but might be modified.
C. will work, but major changes might be needed.
D. will work, but minor changes might be needed.
E. will work; no changes necessary.

Currently, the PIES instrument is being used as part of the World Innovation Network (WIN), an invention assessment program at Missouri State University. "The WIN program provides inventors, entrepreneurs, and product marketing/manufacturing enterprises with an honest and objective third-party analysis of the risks and potential of their ideas, inventions, and new products" using the Preliminary Innovation Evaluation System (WIN Innovation Institute). About 2300 innovations have been submitted to the WIN Program for product evaluation since 1997. This study examines the results of that program. We present descriptive statistics and results, followed by a brief discussion of critical factors in the invention evaluation process.

METHODOLOGY AND RESULTS

Participants

Participants in this program voluntarily submitted their innovation ideas to evaluators in return for a compensated, professionally developed independent analysis of the innovation and its market potential. Evaluators, in turn, thoroughly examined each innovation presented and provided both analysis and feedback which was intended to help the participants make decisions about further market and product development strategies. The balance of this study will examine basic information gathered so far about the participants and the quality of the innovations which have passed through this program.

Descriptive Statistics

The results of this study are at the earliest stages of analysis. However, there are some basic descriptive analyses that can be run on the program's participants. To date, the data on approximately 2310 innovations is available for analysis. While this represents a large sample size, it does not reflect over 2300 separate

innovators but rather over 2300 innovations. A good number of participants have submitted multiple innovations to the program for evaluation. We do not yet have the data on the number of innovations submitted per person, but visual screening of the data ordered by participant has revealed that some have submitted as many as a dozen samples to the WIN Innovation Institute.

Additionally, demographic data on the innovators themselves is not yet available, but some descriptive information on the type and location of the sample group is available. Of the 2310 innovations submitted, some 2231 (96.6 percent) were submitted by U.S. sources. Of the 79 international innovations, 50 (63.2 percent) were from Canada. Other countries represented include: Australia, China, Israel, Tunisia and several Latin American, European and Arabic countries. The greatest percentage of U.S. states represented is as follows: California (9.6 percent), Texas (7.6 percent), New York (6.9 percent) and Florida (6.4 percent). The balance of states each had 5.0 percent or less of the total sample.

Table 1 shows the distribution of innovations by type. The groupings represent a loose interpretation of NAICS types adapted to this program by the authors. No such grouping was done by the program administrators. As the table shows, nearly half of the innovations were identified as either home furnishings (12.5 percent), personal consumption goods (16.9 percent) and recreational/entertainment products (16.5 percent). About 1/6 of the sample falls into the "other" category either because of difficulty in identifying an NAICS grouping or because of small category size.

Evaluation Criteria

Table 2 shows the specific items used in evaluating each innovation. Some innovations did not merit analysis using all criteria based upon the stage of the innovation (e.g., an idea versus a fully-prepared prototype) or the type of innovation itself. However, certain items seemed to be more commonly identified as market-ready than others across the sample. These innovations averaged (on the 1 to 5-or-6 scale) high for production feasibility (4.94), service (4.54), legality (4.54) functional feasibility (4.24), research and development (4.19), societal impact (4.08) and environmental impact (4.00), while the innovators themselves scored well on technical experience (4.38). However, the group scored poorly on average in such areas as: potential sales (2.61), promotion (2.60), product life cycle (2.45), stage of development (2.35), and product line potential (1.97). Innovators themselves scored average to below average in the experience areas of management (3.13) and marketing (2.96). Average overall market attractiveness for these innovations was a mediocre 3.01, with only 504 (21.8 percent) scoring an above average mark. The majority (1175, 50.9 percent) were found to have a market attractiveness that was "marginal – rejection by investors/licensees is likely."

TABLE 1
Innovation Groups

Innovation Type	Number	Percent
Animal Products	86	3.7
Building/Construction	98	4.2
Food/Beverage	112	4.8
Home Furnishings	288	12.5
Personal Consumption Goods	391	16.9
Recreational/Entertainment	381	16.5
Safety/Security	168	7.3
Scientific/Technological	180	7.8
Textiles/Office Products	49	2.1
Transportation	171	7.4
Other	386	16.7
Total	2310	100.0

The final recommendation, based largely on the evaluator's subjective summation of the totality of the criteria scores (but not on a mathematical average of them), came in the following form:
Not Recommended (Under 30)

TABLE 2
Innovation Evaluation Items

BUSINESS RISK CRITERIA	SOCIETAL CRITERIA
Functional Feasibility	Legality
Production Feasibility	Safety
Stage of Development	Environmental Impact
Investment Costs	Societal Impact
Payback Period	COMPETITIVE CRITERIA
Profitability	Appearance
Marketing Research	Function
Research and Development	Durability
DEMAND ANALYSIS CRITERIA	Price
Potential Market	Existing Competition
Potential Sales	New Competition
Trend of Demand	Protection
Stability of Demand	EXPERIENCE FACTORS
Product Life Cycle	Marketing Experience
Product Line Potential	Technical Experience
MARKET ACCEPTANCE CRITERIA	Financial Experience
Compatibility	Management Experience
Learning	Production Experience
Need	COMMERCIALIZATION STRATEGIES
Dependence	Technology Transfer
Visibility	New Venture
Promotion	Initial Distribution Strategy
Distribution	MARKET STRUCTURE ISSUES
Service	Overall Barriers to Market Entry
	Overall Market Attractiveness
	Overall Risk Assessment
	Overall Expected Value

Should Be Very Limited And Cautious (30-34)
Should Be Limited And Cautious (35-40)
Recommended But Need To Resolve Unknowns (40-41)
Recommended For Limited Development/Commercialization (42-43)
Recommended For Moderate Development/Commercialization (44-45)
Recommended For Significant Development/Commercialization (46-48)

Scores above a 44 are less common simply as a result of the nature of the innovation process. Table 3 shows the frequency of each recommendation. Less than twenty percent of all innovations submitted for review were assessed as being market-ready (score of 42 or above), while almost three-fourths were deemed to have only minimal market-worthy characteristics (score between 30 and 41). This is normal according to the program administrators since most innovations that arrive for evaluation have good beginnings in an idea born from the innovator but have poor market acceptability.

Regression Analysis

To see which criteria seemed to be those that evaluators subjectively used most often in making the recommendations, we performed a basic stepwise linear regression of the criteria items onto the dependent variable (recommendation). As Table 4 shows, the majority of the variance is accounted for by technology transfer (licensing potential), stage of development and profitability. Market preparedness for the innovation and its acceptability by the marketplace could serve as general groupings for the remaining criteria. The total adjusted r-square value of 0.535 is high and suggests that these criteria were deemed critical by evaluators to the innovation's potential market success.

CONCLUSIONS

While much more research on this database is needed, some critical factors do seem to be apparent. Innovations are brought to evaluation (and possibly to potential investors) at such an early stage of development that they are not ready for full market penetration. In fact, many innovations in this sample were probably reasonably good ideas at conception, at least in the innovator's mind, and were probably the result of a perceived problem that the innovator wished to solve for the market. However, evaluators judged the vast majority of these innovations as unfit or highly questionable for further development past the stage when they were encountered. Does this mean that we should discourage innovation from the non-

TABLE 3
Evaluator's Recommended Action

Recommendation	Number	Percent
Not Recommended	179	7.9
Should Be Very Limited And Cautious	578	25.5
Should Be Limited And Cautious	892	39.3
Recommended But Need To Resolve Unknowns	228	10.0
Recommended For Limited Development/Commercialization	245	10.8
Recommended For Moderate Development/Commercialization	147	6.5
Recommended For Significant Development/Commercialization	0	0.0
No final recommendation given	41	1.8
Total	2269	100.0

TABLE 4
Regression Analysis
(dependent variable: evaluator recommendation)

Criteria Item	R-Square Change	Adjusted R-Square	Significance
Technology Transfer	.407	.406	.001
Stage of Development	.056	.461	.001
Profitability	.035	.496	.001
Product Life Cycle	.008	.504	.001
Distribution	.006	.509	.001
Promotion	.005	.514	.001
Trend of Demand	.005	.519	.001
New Venture	.004	.523	.001
Legality	.005	.527	.001
Function	.004	.531	.001
Societal Impact	.002	.532	.019
Potential Sales	.002	.534	.018
Service	.002	.535	.027

corporate individual? Not at all. Rather, the innovator should, early on, take the time to determine whether or not this innovation is both functional and marketable. While functionality is critical to an innovation's being able to actually "fix" a problem, it is unsuitable unless the greater market is willing to accept it. The majority of these innovations had the technical know-how (e.g., production and functional feasibility), but they lacked the market-worthiness that is also important to the success of a new venture (e.g., potential sales and product line potential). Evaluators seemed to use this marketability strongly in their assessments, especially in the areas of technology transfer, stage of development and profitability.

LIMITATIONS AND FUTURE RESEARCH

This is the first step in the investigation into a new database on innovation and innovators. As such, our conclusions are limited to this specific sample, but its size may indicate that the results are at least partially generalizable to the population. Future research will focus on the impact of gender and type of innovation, among other things, on the quality of innovations. We are also in the process of following up on the sample group to determine to what extent innovators used the information gained from evaluators and whether or not they attempted to market the innovations they had assessed.

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