

In, Green, B., Cressy, R., Delmar, F., Eisenberg, T., Howcroft, B., Lewis, M., Schoenmaker, D., Shanteau, J., & Vivian, R. (eds.). (2000). *Risk behaviour and risk management in business life*. Dordrecht, The Netherlands: Kluwer Academic Press. (pp. 151-159).

Social/Psychological Barriers to Successful Management of Technological Innovation

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Throughout history, the importance of innovation and discovery has been recognized. As expressed by the following writers, there has also been a concern for limitations or barriers to innovation.

He that will not apply new remedies must expect new evils; for time is the greatest innovator (Francis Bacon, 1642)

There are three things which the public will always clamor for, sooner or later: namely, Novelty, Novelty, Novelty (Thomas Hood, 1836)

Discovery consists of seeing what everybody has seen and thinking what nobody has thought (Albert Szent-Gyorgyi von Nagyrapol, 1962)

The position taken in this chapter is that is not the absence of good ideas or lack of motivation that inhibits innovation in a business. Rather, it is the presence of social and psychological barriers that is the key problem for managers. The purpose of the research described here is to explore the sources and potential resolutions of the behavioural barriers to innovation.

This paper is organized into five sections. The first provides background and a model of the problem of innovation management. The next section presents an overview of our research approach. The third is a summary of the major trends in results. The fourth section looks at interpretations and connections to other lines of research. And the last section describes our efforts to help managers.

Background

It is a truism that any company that does not innovate and improve will fail. Maintaining the status quo, either consciously or unconsciously, will inevitably allow the competition to catch up and gain the upper hand. For any business, therefore, innovation is a necessary part of survival (Cooper, 1994).

Yet when a company is at the height of success, the tendency is to keep doing the same

things that led to success in the first place. That is, most managers assume, *if it ain't broke don't fix it*. One of the most difficult times to think about is making changes while in the midst of a hot streak.

A related problem is that success in business means that managers are under severe time pressure (Rubenstein, 1989). They are too busy getting the product out the door and satisfying customers to consider innovations. Later when things have slowed down, it is often too late to think about new directions. Thus, time pressure inhibits innovation.

It should not be surprising, therefore, to find that failure rates for innovations range from 40% to 80% for new consumer products (Mowen, 1995). The success rate for industrial products is somewhat better, ranging from 20 to 40%. These figures indicate the need for better decision making about innovation.

Research Approach

To begin our research, we developed a generic eight-stage model of the innovation process. This model was derived from various ideas proposed in the literature on innovation. As such, this model can be considered an amalgamation. The stages in our model are not sequential. We do not believe the innovation process follows any set series of steps.

Table 3.4.1

Psychological Model of the Process of Technological Innovation

Generation of Ideas
Assessment of Ideas
Prioritization of Ideas
Emergence of a Champion
Allocation of Resources
Research and Development
Prototype and Testing
Implementation of the Innovation

Although all stages of the innovation process are important, we decided to focus our efforts on the first four stages. These stages represent the steps in the process where we felt that psychological barriers have the strongest influence.

To study the barriers to innovation, our research plan involved five steps:

(1) *Identification of the barriers to innovation.* To do this, we interviewed over 40 managers and/or owners of small manufacturing firms in Kansas. Most of the companies employ between 20 and 200 employees. In our interviews, we asked both about successful and unsuccessful attempts at innovation. We also looked into technical, economic, and behavioural factors.

(2) *Assessment of the barriers to innovation.* We connected the barriers identified by the managers to the various stages in our model. In this process, we quickly discovered that it was vital to identify the “choke points” in an organization. These represent either the organizational or structural concentration of decision authority in of one or two people.

(3) *Gathering of stories about the barriers to innovation.* Our approach involved asking managers to tell us about actual cases where innovations either succeeded or failed. Specifically, we asked them to describe barriers that they had to deal with using real cases. These stories were then encoded and classified (see below).

(4) *Development of decision-support tools.* Using a case-based approach along with Bayesian influence diagrams, we are developing a set of “tools” on how to deal with barriers to innovation. Rather than providing expert recommendations, these tools offer experienced-based suggestions on coping with financial, planning, marketing, technical, organizational, and managerial barriers. These tools operate in the same fashion as one friend talking to another.

(5) *Evaluation of tool effectiveness.* We are presently trying out the decision-support tools with managers of small firms in Kansas. Our plan is to obtain feedback both on the managers’ assessments of the tools and on the appropriateness for different types of companies and managers. We anticipate that evaluation and improvement of the tool will continue for several years.

To conduct the study, a team of researchers came together representing four disciplines: engineering, management, psychology, and computer science. This team has designed, implemented, and interpreted the results of the study. Some aspects of the research are still ongoing, i.e., the evaluation of the tool (step 5).

Results and Major Findings

Preliminary research revealed that in most small businesses, there is a *choke point* in the decision making process. That is, there are one or two people in the company that control the decisions made by the firm. Everything passes through them – therefore the term choke point. Even in moderately large sized firms employing several hundred workers, these choke points seem to exist.

The decision makers at the choke points are obviously busy people. They must handle many day-to-day problems that demand immediate attention, e.g., payroll, inventory, finances, personnel, suppliers, and customer demands. These problems must be solved quickly, or the company will be unable to function. Clearly, there is little chance for these decision makers to think about making major changes.

Managers must of necessity focus on short-term problems. That means there is little, if any, time to think about long-term concerns. Yet it is precisely these long-range issues that lead to major innovations and upgrades in the product or manufacturing process. One implication of this finding, supported by our observations, is that the changes that do occur are more likely to be *evolutionary* rather than *revolutionary*. Instead of making major changes in a product or process, managers only have time to think about making small adjustments.

After visiting with managers of over three dozen companies, some trends have become clear. Since these interviews lasted up to four hours, it is not possible to summarize all that the research team learned from visiting the managers. However, the results in the following two tables summarize the major findings. Table 3.4.2 provides a partial listing of

typical comments made by managers of companies visited by the research team. These comments are presented in raw form, with no effort to interpret or classify these comments.

Table 3.4.2

Selected Comments From Managers: Reported Barriers to Innovation

Most of my time is taken up by daily fire fights
Analysis, paralysis
I don't make a decision until I run out of reasons not to
I only make changes I can understand
The market is not ready
This new product (innovation) is not us – it is not what we do
We are too small to make big changes
If it ain't broke, don't fix it
My generation is analog. Most innovations now are digital
Who has time? I am too busy getting the product out the door
We need to avoid over committing ourselves
We are making money – what's the problem?

These and many other comments about barriers were classified by the researchers in two ways. First, the comments were assigned to one of nine categories: *time constraints, risk and uncertainty, lack of fit to priorities, lack of resources, lack of economic payback, wrong decision maker, resistance within the organization, lack of a champion or advocate, and a history of past failures*. Then the comments within categories were assessed for importance on three phases of initiation: *pre-initiation, initiation, and post-initiation*.

This two-way classification of the comments yields an ordinal impact of each type of barrier on the three stages of initiation. In Table 3.4.3, these impact assessments were either high (+), medium (o), or low (-).

Table 3.4.3

Classification of Reported Barriers to Innovations

Type of Barrier	Impact on Initiation Phase		
	Pre-	During	Post-
<i>Risk and Uncertainty</i>	+	+	+
<i>Time Constraints</i>	+	+	+
<i>Doesn't Fit within Priorities</i>	+	+	+
<i>Lack of Resources</i>	o	o	+
<i>Lack of Payback</i>	-	o	+
<i>Wrong Decision Maker</i>	-	o	+
<i>Organizational Resistance</i>	-	o	+
<i>Lack of a Champion</i>	-	+	+
<i>History of Past Failures</i>	-	-	+

As these results make clear, the first three barriers had an impact at all three levels of innovation. These are the “big three” psychological barriers. Each of these barriers has important effects that inhibit innovation at multiple levels.

Perceived risk and uncertainty affects us all. Most people are risk adverse; that is, we prefer not to take chances. Instead, we like to play it safe and avoid risky situations. Of course, adopting an innovation is by definition risky. As the saying goes, *no one get's fired for staying with the status quo – but you may if you make a change*. This obviously creates a tension, since innovations are essential if a company is to survive.

It is possible for most managers to deal with perceived risk – if they have enough time and resources. They need time to think and reflect on the benefits versus the level of risk involved. And they need resources to investigate the pro's and con's of a proposed innovation, e.g., customer reactions, financing, and production capacity. Unfortunately, both time and resources are in short supply.

Time constraints and time stress are a consistent problem for managers. A successful manager is, by definition, be a very busy person. There are numerous demands on his/her time, with little opportunity for contemplative thinking. Obviously, they have little time to spend on what may turn out to be a dead-end idea. If a manager has a list of 100 things to do today, thinking about innovation is probably going to be something like 95th on the list.

Priority setting is a constant problem for a manager. The day-to-day concerns of running a business must be addressed or the work product may not make it out the door. Thus, most managers are constantly *fighting fires*. These immediate problems threaten short-term work output and must be solved. However, adopting an innovation requires long range planning and thinking ahead. But that is precisely what most managers are unable to attend to.

Helping Managers

To help managers cope with the barriers to innovation, we are developing a series of decision support tools. These tools are being designed around the observations and insights of the managers we interviewed in the research. In addition to asking managers to list barriers to innovation (see Table 3.4.2), we also asked them to describe how they dealt with those barriers. Specifically, we wanted the managers to tell us about “success stories” where they overcome barriers to innovation. A partial listing of the comments generated appears in Table 3.4.4. They illustrate the types of comments given.

Table 3.4.4

Selected Comments by Managers on Dealing with Barriers to Innovation

Innovation is the 'fun' part of the business
Think evolution, not revolution – but then make the changes
Innovation can't wait – do it now
We make money to buy new 'toys' so we make more changes

*You have to take a chance – nothing ventured, nothing gained
The best time to make an innovation is when you are doing the best
Make everybody in the firm responsible for making at least one improvement
Listen to your customers – they have good ideas
Know your own strengths and weaknesses – play to your strength
Adopt a ‘1,000 flowers bloom’ philosophy
Everyone in a company is a ‘knowledge resource’ – use them
Its more fun to build one new product than it is to sell 100 of an old product*

These comments suggest many potentially useful coping strategies that can help managers deal with barriers to innovation. We want to use such comments by incorporating them into some easy-to-use communication tools. Although the tools are still in the testing stage, we can describe some elements and ideas behind their design.

- In looking at previous efforts to help managers make decisions about technological innovations, we found that most were designed as decision support systems (DSS) using artificial intelligence (AI) technologies. For a variety of reasons, these computer programs have met with resistance from the decision makers they were intended to help. For instance, users dislike systems that designed to “think for them”; they are more favorably disposed toward systems that help them think (Shanteau, 1992).
- To avoid the user-resistance problem of previous efforts, we decided to take a different route. Most DSS/AI systems in effect replace the decision maker and make a final recommendation. Our alternate approach is based on building tools that “talks to” managers and offers advice. “Story telling” is an effective means of communicating and understanding high-level knowledge (Schank, 1990).
- The content of these tools comes from a database of comments made by practicing managers (see Table 3.4.4). These stories and lessons learned are constantly updated as new managers tell us about their successes and failures in using these tools. An important feature of the tools is a built-in feedback and upgrade algorithm to allow us to continuously add new stories based on the experiences of other users.
- Interacting with the tools is analogous to communicating with a highly qualified and experienced manager. This manager-in-the-tool reflects a composite of the different types of advice received. From the user’s perspective, it seems as if another manager is helping them make decisions about innovation.
- The tools are designed to be portable and easily accessible by a manager in his/her office. We do not want a system that requires extensive hardware or software. Instead, we want a system that is highly portable, interactive, and easily updated. Fortunately, some recent developments in interactive software development have simplified our task.
- The tools are intended to be customized for each user. The specific preferences of each manager will be reflected in the way that he/she interacts with the tools. If a visual input is preferred, then that is the way the information will be presented. If verbal interaction is preferred, then that is the mode that will be used. These preferences will be entered

initially and then be used later.

- The tools are being compartmentalized so that managers can get as much as little advice as they want or need. If the user only wants to have financial input, then that tool alone will be made available. If the manager wants a complete breakdown for the proposed innovation, then many different tools will be used.

Discussion and Interpretation

Based on these findings, we believe that it is not the inability to come up with technological innovations that is the problem. In our research, we have seen lots of creative ideas generated within these businesses. Instead, the problem is the ability of managers to know when to adopt and when not to adopt these ideas. The choke point arises because busy managers do not have the time or resources to compensate for the perceived risk of going ahead with an uncertain innovation. Thus, there are many missed opportunities for implementing new technologies.

In previous papers on decision making expertise, the first author presented a list of domains categorized by whether good performance or poor performance was reported in the literature (Shanteau, 1992). (A reduced version of this chart appears in Table 3.7.1.) For instance, weather forecasters have been reported in many studies to be reliable and well calibrated when making short-term forecasts. In comparison, research on clinical psychologists has consistently revealed low levels of validity as well as low levels of between/within-reliability.

As observed in Shanteau (1992), there is a pattern to those domains. Most of the good-performance domains involve decisions about physical properties or stable systems. In contrast, most of the poor-performance domains involve decisions about human behaviour.

This distinction may be used to explain why managing innovations is the limiting factor. Since generating an innovative idea is on the good side, it is often done well – just like the other high-performance domains. However, managing an innovation falls on the other side, and is generally poorly done. This may help explain the *paradox of innovation* – how can managers who are so good at coming up with new ideas have such difficulties in managing those ideas?

Final Comments

The National Science Foundation (NSF) in the United States is presently sponsoring over 30 projects looking at management of improvement. Eleven of these grants have been to examine Management of Technological Innovation and 20+ projects are looking at Transformations to Quality Organizations (Woo, 1997). The topics being investigated range from *cost modeling for engineers* and *evaluation of environmental costs to innovation in retail banking* and *improving quality in a dual workforce R&D environment*. As

such, these 30+ projects investigate a variety of perspectives on management of improvement.

Nonetheless, an analysis reveals that only two projects focus on small- to medium-size companies. Yet it is these companies that are the source of a disproportionate proportion of innovations (Cooper, 1994). Only three of the projects are looking at social/psychological barriers to innovation, which we believe are more difficult to overcome than technical/financial issues.

The project described in this paper is unique in that we are the only NSF-supported research study looking at the behavioural barriers faced by small-to-medium-size companies. Moreover, we are attempting to reduce the impact of these barriers using a flexible, case-based approach to developing decision support tools to help managers. In essence our approach is based on letting experienced managers tell their stories to other, less-experienced managers. We are not trying to be experts in an AI system. The experts in our research are the managers who are leading small-to medium-size businesses. We believe that practicing managers are more likely to listen to and follow the advice of their colleagues. Our job as researchers is to provide the means for this to take place.

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Acknowledgments

The research described in this paper was supported, in part, by a National Science Foundation Grant # DMII 96-12126 from the Division of Design, Manufacture, and Industrial Innovation, Program on Management of Technological Innovation, Directorate for Engineering. We most gratefully acknowledge the patient and helpful cooperation of the many small business managers in Kansas who contributed their time to make this project possible.

The other members of the research team working on this project include Farhad Azadivar (Advanced Manufacturing Institute), Sharon Ordoobadi (Department of Industrial and Manufacturing Systems Engineering), and Jeffrey W. Tucker (Manufacturing Learning Center) at Kansas State University.