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RESEARCH NOTE

Innovation Process and Performance in Small- to Medium-Sized Firms: A Conceptual Framework

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This study maps out the innovation process in Small and Medium Enterprises (SMEs) that can fundamentally affect business performance. The development of the conceptual framework can be used to encourage and enhance successful innovation management for SMEs. Overall, effective innovation is based on managing this process as a whole and on building up capacity and competency at each stage in the innovation. The framework put forth in this study is being proposed to be used as template for the development of a management development program for SMEs' owner-managers and as a practical tool for diagnosing SMEs' support systems.

Keywords: Innovations, inventions, R&D, technological change

Concepts of innovation in business stemmed mainly from the work of economist Joseph A. Schumpeter. He viewed innovation as distinctly different from invention, which he held occurred in isolation of innovation and which could or could not be coupled with innovation (Robertson, 1967).

Anthropologist H. G. Barnett (1953) defines innovation as any thought, behavior, or thing that is new because it is qualitatively different from existing forms. This is a considerably broader definition than Schumpeter's setting up of a new production function. Technological innovation has had a major impact on international trade, industry structure, formation, and development of new firms and industries, as well as the growth and the survival of existing firms and industries. The effectiveness of firms in originating, developing, and implementing technical innovations is viewed as a function of three sets of factors: (1) characteristics of the firms' environment; (2) internal characteristics of the firm itself; and (3) flows between the firm and its environment (Utterback, 1971). Environmental factors, primarily the definition and communication of needs for innovation and secondarily the existence and communication of technical information, are viewed as both stimulating and limiting the firms' potential for innovations.

One of the problems in this area of research has been the need to develop consistent definitions, measurements, and a model of the process of innovations within the firm and the firm's environment. This problem has been stated clearly by Marquis (1969). He said that innovation is not really a single action, but a total process of related subprocess. It is not just the conception of a new idea, nor the invention of a new device, nor the

development of a new market. The process is all of these things acting in an integrated way toward a common objective, which is technological change.

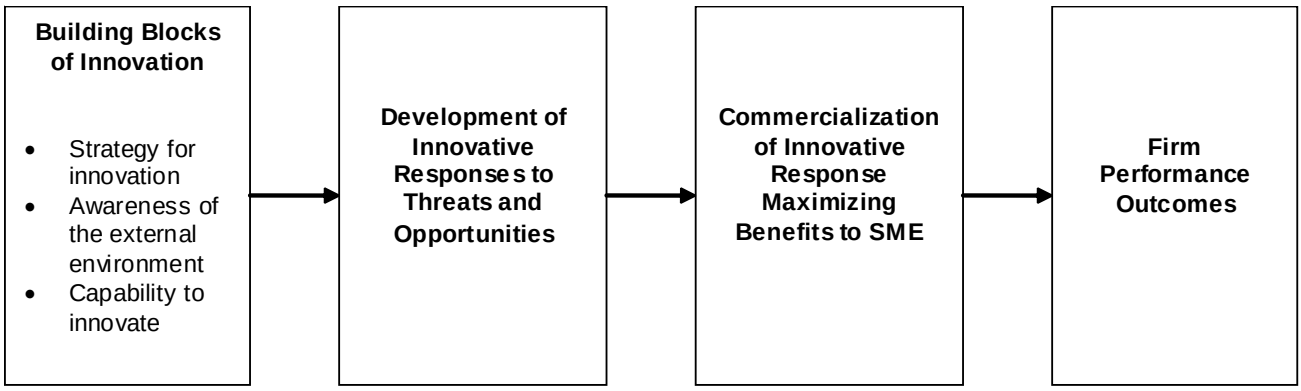
Following the suggestions of Schmookler (1966) and Marquis (1969) on the definition of innovation as distinct from invention, an invention is an original solution resulting from the synthesis of information about a need or want and information about the technical means with which the need or want may be met. In effect, an invention must be followed by entrepreneurial action before it has significance in economic terms. Thus, innovation could be defined to refer to an invention which has reached market introduction in the case of a new product, or first use in a production process, in case of process innovation. The main point is that an idea has been carried far enough to begin to have an economic significance. While Schumpeter (1934) focuses on technological changes in his definitions of innovations, and does not necessarily involve the introduction of a new element in the economic process, he somehow put forward a classification that includes five forms of innovation, whose basic aspects are still used, namely; product innovations, process innovations, organizational innovations, new markets and use of new sources for getting raw materials and other inputs.

Another classification extensively found in related economic literature is one that distinguishes between radical and incremental innovations (Barquero, 1999). Radical innovations are those that produce great discontinuity in the productive and industrial system, or generate and develop new industrial activities. They tend to cause industrial revolutions. On the other hand, incremental innovations are those technological changes and adaptations that involve progressive improvement of products and processes, like small engineering changes, changes in design and product specifications to meet customer needs.

THE PROPOSED MODEL

Building on the conceptual analysis on innovation processes in small- to medium-sized enterprises literature of Atherton and Hannon (2000), the framework for successful innovation management for SMEs, as shown in Figure 1, suggests insights into the constituent parts of the innovation process within the SME. According to this perspective, the development of an underpinning conceptual framework for innovation process in SMEs can be presented in four main stages, namely: (1) the building blocks of innovation strategy for innovation, awareness of the threats and opportunities in the external environment, and the capability to innovate within the small business; (2) the development of innovative responses to threats and opportunities experienced by the small business or its key stakeholders; (3) the strategic commercialization of the innovative response that

Figure 1. *Innovation process conceptual model of SMEs.*



will maximize the benefit of innovation to the SME; and (4) firm performance outcomes.

The operational framework (see Figure 2) being proposed for the conceptual model above is composed of three variables, namely: (1) a set of independent variables which include strategy for innovation, awareness of external environment, capability to innovate number of innovations adopted from R&D investment, and firms' innovative culture and characteristics; (2) a set of dependent variables related to firm performance outcome; and (3) a set of intervening variables related to the commercialization of the innovative response.

The framework suggests that the building blocks for innovation will be measured by multi-items scales identified by Baldwin and Gellatly (2003) for innovation strategies. The process of innovation is embedded in an environment with political, social, technological, and economic elements identified by Utterback (1971). The other independent variable, the capability of the firm to innovate, can be measured by the number of innovations adopted and the firm's culture and other organizational characteristics (Hurley & Hult, 1998). The intervening or mediating variable is the commercialization of which mediates the relationship between the building blocks of innovation and firm performance outcome (financial, non-financial, and innovative capacity). Each variable indication is operationally defined as follows:

PROBING THE MODEL

The findings of Boston Consulting Group's (BCG's) fourth annual global survey and report on innovation points to a risk-averse culture, lengthy development firms (lack of speed) for innovations, and frustrations with the return on innovation investments (Daniel, 2008). Respondents to the survey – 2,500 executives from around the globe – recognize that performance and growth hinge on innovation, but not everyone is good at it.

However, the interest of this proposed model is to analyze the small- to medium-sized enterprises' innovative potential, that is, to evaluate local SMEs' capacity to create or modify products or processes and to introduce them to the market. Innovation in small businesses can be conceived of as a management process and a challenge that can fundamentally affect business performance (Atherton & Hannon, 2000).

As previously mentioned, Utterback (1971) proposed that three sets of factors influence the effectiveness of firms in originating, developing, and implementing technical innovations. Environmental factors are viewed as both stimulating and limiting the firm's potential for innovation. Internal factors which affect the synthesis of information into ideas and solutions to development problems are viewed as influencing the effectiveness of the firm in response to its environment. Likewise, barriers to communication between the firm and its environment, for a given set of internal characteristics, are viewed as limiting the firm's response.

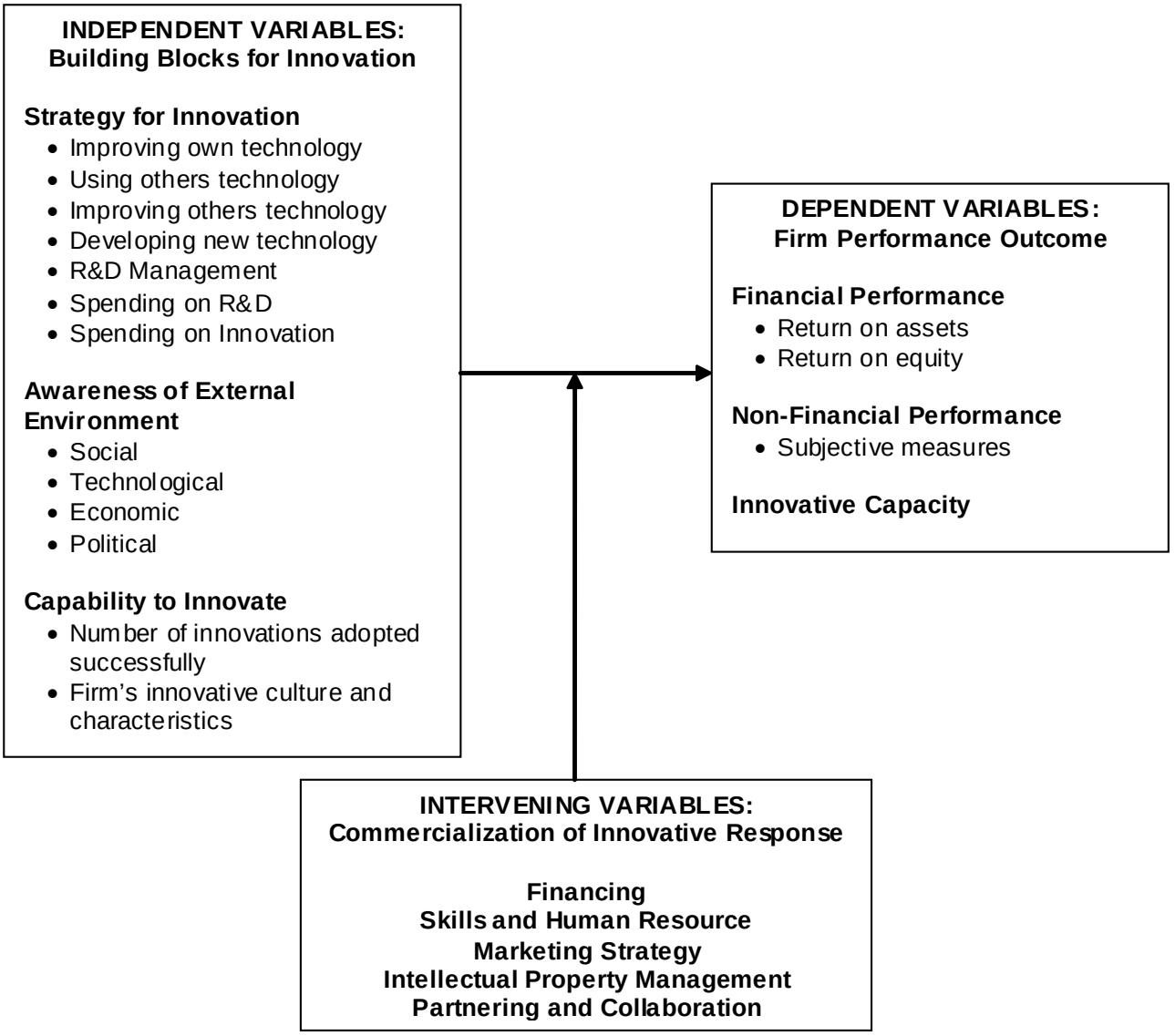
Building Blocks of Innovation

Atherton and Hannon (2000) referred to strategy for innovation, awareness of the external environment and opportunities, and capability to innovate within the small business as building blocks of innovation.

Baldwin and Gellatly (2003) put forth that innovative small and large firms are considerably more likely to feel that they are superior to competitors with regard to spending on innovation, spending on R&D, and R&D management. Likewise, both large and small innovative firms also place more emphasis improving their own existing technology, using other technology, and developing new technology.

The process of innovation is considered occurring in three overlapping phases, namely: (1) idea generation, (2) problem solving, and (3) implementation possibly followed by diffusion. Utterback (1971) suggested that the idea generation phase results in origination of a design concept or technical proposal, perhaps via synthesis of several pieces of existing information. The problem-solving phase results in an original technical solution, or an

Figure 2. *Operational framework.*



invention. The implementation phase results in market introduction of the original solution making it an innovation. Diffusion is the mechanism of communication and increasing use through which an innovation results in economic impact. Diffusion is not strictly a part of innovation as defined, as it occurs in the firm's outside environment.

Studies of the impact of the economic environment by Schmookler (1966) and Enos (1962) indicate that innovation is a function of the extent of the market and of factor costs, that is, the frequency of innovation maybe expected to increase when the market for a particular product is expanding. Firms apparently tend to innovate in areas where there is a fairly clear short-term potential for profit (Peck, 1962). This suggests a possible explanation for innovations representing a breakthrough or has the potential to change the character of a whole industry. A case in point is that of DuPont's major product innovations in the period 1920 to 1950 that were originated by firms and individuals outside DuPont (Mueller, 1962). Utterback (1971) suggested that it appears that

neither the cost nor the technical knowledge required in producing an innovation is the crucial constraints faced by the firm. The primary limitations on a firm's effectiveness in innovation appear to be its ability, and perhaps aggressiveness, in recognizing the needs and demands in its external environment.

Capability to Innovate

Cohen and Levinthal (1990) argued that the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities. They label this capability as a firm's absorptive capacity and suggest that it is largely a function of the firm's level of prior related knowledge. Their empirical analysis of R&D investment suggested that firms are in fact sensitive to the characteristics of the learning environment in which they operate. Both Cohen and Levinthal (1990) proposed a model to explain R&D investment, in which R&D both generates innovation and facilitates learning for the organization.

Innovation Implementation

Innovation implementation within an organization is the process of gaining targeted employee's appropriate and committed use of an innovation (Klein & Sorra, 1996). An organization's failure to achieve benefits of an innovation it has adopted may reflect either a failure of implementation or a failure of the innovation itself. Bushe (1988), Hackman and Wageman (1995), Klein and Ralls (1995), and Reger, Gustafson, De Marie, and Mullane (1994) all suggest that quality circles, total quality management, statistical process control, and computerized technologies often yield little or no benefit to adopting organizations, not because their implementation is successful.

Small Firm Innovative Advantage

The small firm innovative advantage tends to occur in industries in the early stages of the life-cycle, where total innovations and the use of skilled labor play a large role, and where large firms comprise a high share of the market.

Acs and Audretsch (1987) found that large firms tend to have the relative innovative advantage in industries which are capital intensive, concentrated, highly unionized, and produce a differentiated good. The small firms tend to have the relative advantage in industries which are highly innovative, utilize a large component of skilled labor and tend to be composed of a relatively high proportion of large firms. Evidence also supported Winter's (1984) prediction that the innovation activity of small and large firms responds to different technological and economic environments. Khan and Manopichetwattana (1989) found that scanning was positively correlated with innovation and so were challenges to the firm in the form of environmental dynamism and heterogeneity. Prior research (e.g., Miller, 1983) has shown that centralization in small firm management structure correlates with entrepreneurship. Khan and Manopichetwattana's (1989) findings could not extend the relationship to innovation.

Concepts and Types of Innovations

Schumpeter (1934) defined innovation as the result of establishing a new production function, a change in the set of possibilities to define what a product is and how it could be. This definition focuses on technological changes in productive factors, which does not involve the introduction of a new element or novelty in the economic process.

From this definition, Schumpeter put forward a classification that includes five forms of innovation, whose basic aspects are still used (Romani & Atienza, 2007), namely:

- Product innovation – refers to the introduction into the market of a new product or qualitative change in an existing product;
- Process innovations – refer to new ways to produce in an industry or a substantial changes in the existing ones;

- Organizational innovations – the type of innovation that introduces a meaningful changes in the organizational structure, and the implementation of advanced management techniques and new or substantial changes in the company's strategic guidelines;
- Opening of new markets; and
- Use of new sources for getting raw materials and other inputs.

The first two categories of the classification are currently used to assess science and technology policies.

Commercialization of Innovation

Among various interesting definitions of commercialization, Rosa and Rose (2007) gave out one distinct definition that is as a component of the broader innovation process turning an innovation into a marketable product or service and can include trials or studies that make a financially viable operation more profitable. Commercialization has more to do with taking R&D from the laboratory to the stage where it can find application in an industrial setting. The commercial and technological development functions are completely integrated and are articulated within the firm (Cornford, 2002).

The model proposed by the Canadian Expert Panel on Commercialization identifies the following elements: (1) financing, (2) skills and human resources, (3) marketing strategy, (4) intellectual property management, and (5) partnering and collaboration.

According to Rosa and Rose (2007), a non-exhaustive list of elements and activities that a firm should integrate into its commercialization process are based on (1) skills, acquisition, development and training (e.g., trials of prototypes and engineer's test, quality testing, etc.); (2) managing intellectual property through patents, trademarks, copyrights, secrecy, and royalties; (3) controlling growth process through advertising, technical and commercial support, outsourcing, and subcontracting; and (4) developing access to the market through product launch, publicity campaign, market niche, market segmentation, exports, and the search for new markets and distribution channels and financial and physical resources (e.g., to identify and find financial capital and human resources).

Failure Factors to Commercialization

Two obstacles invariably come up as being the most important: the lack of financial means and support, and specialized personnel, especially those who are used to selling and promoting innovative products. Some SMEs lack the personnel who are able to develop the product and to sell and promote it (Rosa & Rose, 2007).

The products developed are usually successful from a technical standpoint, but it was the commercialization stage that sometimes failed, mainly owing to the lack of human resource qualified to promote the products. SMEs sometimes resign themselves to being purchased by larger firms that have the means to commercialize innovation, since they more often have a marketing team. Another obstacle is the quick changes in customer preference and market demand changing faster than the time needed to develop the new product. Red tape and the time required to obtain compliance authorization is sometimes too long and can cause the market to be lost to competitors. Rosa and Rose (2007) argue that SMEs seldom have the means to follow a well- established formal and strategic procedure for commercializing new ideas. By contrast, large firms have the financial means and the specialized personnel to follow a formal procedure for commercializing new products.

As regards to protection of intellectual property, SMEs recognized it as an important aspect, but they do not always have the financial means to acquire it. Finally, some SMEs (Rosa & Rose, 2007) look at failures as necessary evil, causing firms to grow and learn regarding commercialization.

Characteristics and Culture of Innovative Firms

Participants in the international experts' symposium "A Culture of Innovation and the Building of Knowledge Societies" jointly organized by UNESCO and the Institute for Strategic Innovations (Moscow, 10-11 November 2003), defined a culture of innovations as a specific expression of societal dynamics, of self-reflection, and of collective aspirations. At the enterprise level, innovation determines competitiveness. Innovation reflects current power and institutional relationships and may sometimes increase inequality. A culture of innovation must be inclusive. Inclusion is only possible through the empowerment of individuals, employees, customers, clients, and citizens.

What constitutes an innovation culture? Leading by example from the top (i.e., with the owner-manager needing to instill an innovation mindset across the enterprise, and have it followed consistently) is part of this culture (Angel, 2006). Aside from the owner-manager's enhanced leadership capabilities, the development of frontline supervisory skills to improve employee engagement and retention, cooperative creative business practices, organizations-wide self actualization all lead to a shared knowledge and learning organization. Information technology can be a powerful innovation and change enabler when used to faster adaptive processes.

The research of Erlendsson (2005) revealed that innovative companies:

- share a number of cultural traits in common
- are inclusive, that they discover and implement new ideas regardless of where in the organization they originate
- display flexibility with regard to their processes
- are most likely to use alliances and partnerships as a means of adapting to market shifts.
- have formal and structural processes to encourage and test innovation
- foster a whole culture of innovation so that new ideas are constantly surfacing and being tested, while older ideas are kept alive to be adapted to new circumstances.

Mediation Effects

The technological innovation process operational model in Figure 2 proposes that an effective commercialization of the innovative response mediate the relationship between the independent variables (building blocks of innovation and innovative response) and the dependent variables (the firm performance outcome). When organizations adopt innovations, the challenge is to create the conditions for innovation use and a strong climate for innovation implementation or commercialization. The reason for hypothesizing a mediating effect is that when the commercialization phase is fully developed, it may or may not influence the firm's performance outcome. Likewise, commercialization phase is seen as a transcending capability that is developed gradually over time in the life of the firms through the interaction of the various aspects of innovative firms. The mediating effect of commercialization occurs because the attributes of the independent variables can create internal tensions, if they do not contribute to an effective commercialization of the firm's innovative response. The study of Atherton and Hannon (2000) found support in the hypothesis that commercialization of innovative response mediates the relationships between the "building blocks" of innovation and the innovative response – and company performance outcome.

Measuring Firm Performance

The dependent variables will be measured with items that require the owner-managers to reflect on performance for the last three years and indicate the degree to which they agreed with the following possible subjective measures of performance: if business is achieving its full potential; if the individuals are satisfied with the level of business

performance; firm gives the opportunity and encouragement to do the best work the individuals are capable of achieving within an innovative firm culture. Financial performance indicators for each firm in a particular industry or industry groups can be calculated like return on assets (ROA), return on equity (ROE), and owner or shareholder return over a three-year period for each SME. Further, this approach provides confirmation that owner-managers were reflecting on performance over a three-year period, as opposed to focusing on short-term gains. Lumpkin and Dess (1996) propose multiple performance measures such as revenue growth, market share and profitability. Non-financial considerations may be important such as reputation, goodwill and public image, fostering innovative culture, innovative capacity, competitive advantage, and the commitment and satisfaction of employees as a well as a personal satisfaction and fulfillment from the business and harmonious labor-management relation as among the ultimate goals of an entrepreneur (Edralin, 1998).

CONCLUSION

In this study we mapped out the innovation process in the SMEs that can fundamentally affect business performance. The development of the conceptual framework inspired by Atherton and Hannon (2000) can be used to encourage and enhance successful innovation management for SMEs. Overall, effective innovation is based on managing this process as a whole and on building up capacity and competency at each stage in the innovation process detailed in Figure 1.

The framework put forth in this study is being proposed to be used as template for the development of a management development program for SMEs owner- managers and as a practical tool for diagnosing SMEs support systems.

In conclusion, taking a process approach and examining how SMEs innovate and develop new capabilities to compete, along with the role of learning and market orientation in the process should enhance our understanding of how firms learn, change and perform.

The study likewise revealed that SMEs seldom have the means to follow a well-established, formal, and strategic procedure for commercializing new ideas.

In contrast, large firms have the financial means and the specialized personnel to follow a formal procedure for commercializing products.

This study focuses on the commercialization for the commercialization procedures, where basically certain elements and activities must be mastered in order to effectively commercialize new ideas. The functional activities to be mastered include the transfer and creation of knowledge, skills acquisition, development and training, financial and physical resources, organizational management, and customer relations.

REFERENCES

Acs, Z. J., & Audretsch, D. B. (1987). Innovation market structure and firm size. *The Review of Economics and Statistics, 69*(4), 567-574.

Angel, R. (2006). Putting an innovation culture into practice. *Ivey Business Journal, January/ February 2006*, Reprint # 9B06TA08. Retrieved July 1, 2008, from http://www.iveybusinessjournal.com/view_article.asp?intArticle_ID=605

Atherton, A., & Hannon P. (2000). Innovation processes and the small business: A conceptual analysis. *International Journal of Business Performance Management, 2*(4), 276-292.

Baldwin, J., & Gellatly, G. (2003). *Innovation strategies and performance in small firms*. Cheltenham: E. Elgar.

Barnett, H. G. (1953). *Innovation: The basis of cultural change*. New York, NY: McGraw-Hill Book.

Barquero, A. V. (1999). *Development, networks and innovation: Lessons on endogenous development*. Madrid: Piramide Ediciones Sa.

Bushe, G. R. (1988). Cultural contradictions of statistical process control in American

manufacturing organizations. *Journal of Management, 14*, 19-31.

Cohen W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation – Technology, organizations, and innovation. *Administrative Science Quarterly, 35*(1), 128-152.

Cornford, A. B. (2002). *Innovation and commercialization in Atlantic Canada*. Retrieved July 1, 2008, from http://www.acoa-apeca.gc.ca/English/publications/ResearchStudies/Pages/InnovationandCommercializationin Atlantic Canada.aspx

Daniel, D. (2008). *Executives' frustration with innovation spending grows, BCG study finds*. Retrieved January 25, 2008, from http://www.cio.com/article/127650

Edralin, D. M. (1998). *Entrepinoy: Paths to successful entrepreneurship*. Manila: De La Salle University Press.

Enos, J. L. (1962). Invention and innovation in the petroleum industry. In R. R. Nelson (Ed.), *The rate and direction of inventive activity: Economic and social factors* (pp. 299-322). Princeton, NJ: Princeton University Press.

Erlendsson, J. (2005). *Innovative firms focus on R&D and new product Introductions*. Retrieved January 25. 2008, from http://www.hi.is/~joner/eaps/y3_92317.htm

Hackman, J. R., & Wageman, R. (1995). Total quality management: Empirical, conceptual, and practical issues. *Administrative Science Quarterly, 40*, 309-342.

Hurley, R. F., & Hult, G. T. M. (1998). Innovation, market orientations and organizational learning: An integration and empirical examination. *Journal of Marketing, 62*(July), 42-54.

Khan, A. M., & Manopichetwattana, V. (1989). Innovative and noninnovative small firms: Types and characteristics. *Management Science, 35*(5), 597-606.

Klein, K. J., & Ralls, R. S. (1995). The organizational dynamics of computerized technology implementation: A review of the empirical literature. In I. R. Gomez-Mejia & M. W. Lawless (Eds), *Implementation management of high technology* (pp. 31-79). Greenwich, CT: JAI Press.

Klein, K. J., & Sorra, J. S. (1996). The challenge of innovation implementation. *Academy of Management Review, 21*, 1055-1080.

Lumpkin, G., & Dess, G. (1996). Clarifying the entrepreneurial orientation: Construct and linking it to performance. *Academy of Management Review, 21*(1), 135-172.

Marquis, D. G. (1969). A project team plus PERT equals success. Or does it? *Innovation 1*(3), 28-37.

Miller, D. (1983). The correlates of entrepreneurship in three types of firms. *Management Science, 29*(7), 770-791.

Mueller, W. F. (1962). The origins of the basic inventions underlying DuPont's major product and process innovations, 1920-1950. In R. R. Nelson (Ed.), *The rate and direction of inventive activity: Economic and social factors* (pp. 323-360). Princeton, NJ: Princeton University Press.

Peck, M. J. (1962). Inventions in the post-war American aluminum industry. In R. R. Nelson (Ed.), *The rate and direction of inventive activity: Economic and social factors* (pp. 279-298). Princeton, NJ: Princeton University Press.

Reger, R. K., Gustafson, I. T., De Marie, S. M., & Mullane, J. V. (1994). Reframing the organization: Why implementing total quality is easier said than done. *Academy of Management Review, 19*(3), 565-584.

Robertson, T. (1967). The process of innovation and the diffusion of innovation. *Journal of Marketing, 31*(1), 14-19.

Romani, G. A., & Atienza, M. (2007). *Small and medium enterprise innovation in region of Antofagasta - Chile*. Retrieved December 20, 2007, from http://www.cyta.com.ar/ta0406/v4n6a2.htm

Rosa, J. M., & Rose, A. (2007). *Report on interviews on the commercialization of innovation*. Retrieved January 25, 2008, from http://www.statcan.gc.ca/pub/88f0006x/88f0006x2007004-eng.pdf

Schmookler, J. (1966). *Invention and economic growth*. Cambridge, MA: Harvard University Press.

Schumpeter, J. A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*. Cambridge, MA: Harvard University Press.

Utterback, J. (1971). The process of technological innovation within the firm. *Academy of Management, 14*(1), 75-88.

Winter, S. G. (1984). Schumpeterian competition in alternative technological regimes. *Journal of Economic Behavior and Organization, 5*(3-4), 287-320.