SUSTAINABLE ENTREPRENEURSHIP PROJECT

Determinants of Product Innovation

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§1 Introduction

Companies of all sizes have a number of incentives and imperatives to engage in new product development and innovation. Researchers have been particularly interested in exploring the determinants of product innovation in small- and medium-sized enterprises and have compiled an extensive list that includes, among other things, certain professional and personal characteristics of the founders, owners and top managers (i.e., age, education, prior experience, cosmopolitanism, internal locus of control, propensity for risk taking and tolerance for ambiguity); firm characteristics (i.e., size, age, sales turnover, existence of written strategy, degree of internationalization, employment of scientists and engineers, environmental scanning and cooperation with technology providers); skills of the workforce, particularly the availability of qualified scientists and engineers; structure (i.e., formalization, centralization, professionalization and administrative intensity); internal efforts to acquire and develop technologies (i.e., investment in research and development and/or training and in-bound licensing strategies); intensity of networking and research and development; external technology linkages; internal controls; existence of a design office; institutional support and industrial cooperation; and environmental factors (i.e., dynamism and complexity, intensity of competition, environmental change, importance of external barriers and level of networking).[1]

§2 External environment and product innovation

Companies conduct their innovation activities, such as new product development, within a broad and continuously evolving external environment and this environment necessarily has a strong influence on the product development process including, of course, the products that companies decide to develop in an effort to satisfy the needs of their external customers. There are a variety of factors that are part of any company's external environment; however, among the most important in the minds of many researchers are technology, demand, regulatory and legal constraints, patents and other intellectual property rights, suppliers, market conditions, the industry in which the company is operating and societal culture.[2] As noted elsewhere in this Part, one of the keys to

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[1] For a full list, including citations to the works referred to in the literature review, see J. De Jong and P. Vermeulen, "Determinants of Product Innovation in Small Firms", International Small Business Journal, 24(6) (2006), 587, 590-591. See also A. Hadjimanolis, "An Investigation of Innovation Antecedents in Small Firms in the Context of a Small Developing Country", R&D Management, 30(3) (2000), 235 and Y. Kim, K. Song and J. Lee, "Determinants of Technological Innovation in the Small Firms of Korea", R&D Management, 23(3) (1993), 215.

[2] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 12-13. This list is not intended to be all-inclusive and other factors will certainly be relevant. For example, one survey of differences across countries with respect to the influence of various stakeholders found that employees were considered to be the strongest stakeholders in relation to Japanese firms, with unions being viewed as key partners with management when decisions are made about strategy and productivity improvements; however, for companies in the US and in parts of Europe (i.e., Denmark, Italy and Scotland) the strongest stakeholder influences came from customers. See W. Tomlinson, S. Paulson, J. Arai and D. Briggs, "Company Identity, Quality Improvement and Labor-Management Relations in Danish, Italian, Japanese, Scottish and U.S. Firms", National Productivity Review (Spring 1991), 129.

effective performance with respect to product innovation is the ability to scan the external environment to identify ideas for new products and sources for the inputs that will be required in order to develop those new products. While this discussion assumes that companies are "given" the environment in which they must operate the influences go both ways and companies, acting alone or in concert, can take steps to change certain of the environmental factors on their own such as by lobbying for new laws and regulations or launching campaigns to influence consumer demand.

§3 --Technology

Technological changes influence the way in which companies approach product innovation in a number of different ways. For example, researchers such as Qualls et al. have observed that changes in technology often lead to significant reduction of product life cycles.[3] In addition, new technologies are disruptive because they enable the creation of new products and thus lead to the elimination of older products based on technologies that have become obsolete. Of course, these technologies may appear in the products themselves and thus open the door for consumers to enjoy new features and solve problems in their live for which there was no realistic solution before the products were developed and available on that market. Frequently, however, technological changes influence product innovation from a process perspective and Hayes and Jaikumar noted how strategies for organizing product development were significantly transformed by new technologies such as computer aided design, computer aided manufacturing, computer aided engineering, computer integrated manufacturing and flexible manufacturing systems.[4] According to Pina e Cunha "[t]hese technologies allowed for more flexibility, speed of development, and delivery, thus introducing significant changes in organizational operations, including new product development".[5]

The willingness and ability of a single company to build a technology-based core competency can transform entire markets and industries if the company is able to establish a quasi-monopoly position that changes market conditions and consumer demand and forces competitors to embrace similar technologies and/or develop new one capable to supporting even more sophisticated products or processes. Even if a company is not the established "technology leader" in its chosen markets access to, and use of, the latest "state-of-the-art" technologies is essential for simply keeping pace since technologies are being substituted much more rapidly and companies with a strong technological foundation are better positioned to move quickly and purposefully to adapt to their turbulent environments. For example, the process-oriented technological tools listed above facilitate exacting and precise product customization to meet the specific demands of customers and also enable closer collaboration with suppliers.

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[3] W. Qualls, Olshavsky and R. Michaels, "Shortening of the PLC—An Empirical Test", Journal of Marketing, 45(4) (1981), 76.

[4] R. Hayes and R. Jaikumar, "Manufacturing's Crisis: New Technologies, Obsolete Organizations", Harvard Business Review, 66(5) (1988), 77.

[5] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 13.

§4 --Demand

A number of researchers have argued that their evidence confirms that customer "demand" plays a key role in determining the product development priorities of companies. For example, Cooper and Kleinschmidt argued that "product advantage", the extent to which a product is better at solving customer needs than competitors' products, was the most important predictor of the success of new products and further explained that product advantage can be achieved and measured through various criterion such as the uniqueness of the benefits supplied to customers by the product, the level of quality and innovativeness and pricing.[6] While there is no denying the importance of customer demand to successful product development many researchers have argued that the product developers themselves can use marketing and other strategies to "assist" customers in discovering needs that they might not have been able to articulate on their own and which would be susceptible to satisfaction by new products and technologies created by the product developers. Brockhoff and Chakrabarti found that "market-pull" and "technology-push" products are equally likely to be successful in the marketplace and the debate as to which of these approaches to innovation is most effective has persisted in the research community and among top management teams for decades.[7] The reasonable resolution, however, seems to be simply recognizing that markets and technologies are equally important when it comes to product innovation and that successful products are more likely to emerge out of continuous interaction between technology developers and technology users.

§5 --Regulatory and legal constraints

Regulatory and legal constraints, current and actual as well as projected, may sometimes become significant factors for companies and create both obstacles and opportunities. According to Bloch, regulatory and legal constraints can be considered one of the "less malleable requirements" for successful new product development and examples include safety-oriented rules for products and/or manufacturing processes, requirements that product use and disposal must adhere to environmental protection standards and, of course, the well-known clinical testing regimes that must be completed before new

[6] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 14 (citing R. Cooper, "The Dimensions of Industrial New Product Success and Failure", Journal of Marketing, 43(3) (1997), 93; and R. Cooper and E. Kleinschmidt, "New Products: What Separates Winners from Losers?", Journal of Product Innovation Management, 4 (1987), 169.

[7] Miles succinctly explained the two approaches as follows: "One of the oldest schisms in innovation studies is between technology push and market pull accounts of innovation. In the former case, the initiative behind innovation is supposed to lie in research and invention, with inventors creating opportunities to satisfy people's needs (whether or not these have been expressed), often as a result of striving to understand better how things work. In the latter case, the initiative derives from user needs as expressed through market demand and other channels, with these being posed as problems that could do with innovative solutions." See I. Miles, Global Review of Innovation Intelligence and Policy Studies: Demand-Led Innovation (2010), 8.

pharmaceutical products are released for public distribution.[8] Regulatory and legal constraints emerge from a variety of sources and pressures. For example, environmental groups have long pushed lawmakers and regulators to adopt laws and rules that encourage reduced consumption of energy and natural resources. In recent years the attention of lawmakers has turned to points farther up the supply chain as they adopt laws and rules that focus on human rights issues and practices. Companies often proactively respond to regulatory and legal issues by implementing internal procedures to improve product performance, safety and reliability and thus reduce the risk of litigation due to accidents occurring during the use of their products. Globalization of competition and the need to develop products that can be launched and marketed in multiple markets around the world has forced new product developers to incorporate regulatory and legal requirements from a variety of countries into their efforts.

§6 --Patents and other intellectual property rights

Patents and other intellectual property rights such as copyrights, trademarks and trade secrets are often used to create protectable competitive advantages relating to technologies integrated into new products and manufacturing processes.[9] Companies involved in new product development certainly need to be mindful of trends relating to the scope, cost and strength of intellectual property rights, all of which vary from market-to-market and industry-to-industry, and successful companies generally implement technological scanning measures that include monitoring patenting activities of current and potential competitors. In many cases new product development projects must be designed in a manner that avoids conflicts with patent portfolios over third parties unless there is reasonable certainty that licenses can be obtained on reasonable terms. The strength and value of patent protection depends on a variety of factors, not the least of which is the projected life cycle of the products based on the technology covered by the patent. In fact, companies are often counseled not to rely excessively on patents given the time and costs involved with obtaining them and the uncanny resourcefulness that competitors often show in getting around them and it is often suggested that companies are better served by paying less time on trying to create barriers to competition and focusing instead on developing capacities and proprietary process technologies that are safeguarded through trade secret law rather than patents.[10]

§7 --Suppliers

[8] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 15 (citing P. Block, "Seeking the Ideal Form: Product Design and Consumer Response", Journal of Marketing, 59(3) (1995), 16.

[9] For further discussion of intellectual property rights, see "Technology Management: A Library of Resources for Sustainable Entrepreneurs" prepared and distributed by the Sustainable Entrepreneurship Project (www.seproject.org).

[10] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 15-16 (citing P. Adler, H. Riggs and S. Wheelwright, Product Development Know-How: Trading Tactics for Strategy, 31(1) Sloan Management Review 7 (1989); and G. Pisano and S. Wheelwright, The New Logic: High-Tech R&D, 73(5) Harvard Business Review 93 (1995)).

Pina e Cunha is one of the many researchers who have noted the steady increase in influence that suppliers have had on the new product development process.[11] Interest in how connections up the supply chain can improve the speed, efficiency and quality of new product development took off in earnest as more and more attention was focused on Japanese management practices that included strong ties with suppliers who were able and willing to invest in technical skills and resources that could be tapped into to assist their customers in implementing requested product designs. Strong supplier relationships in the form of strategic alliances allow companies to reduce their reliance on internal development and expand their horizons of technological possibilities. In addition, of course, suppliers are crucial contributors to new product development given that their inputs typically represent a significant percentage of the "value added" in the products and can be used as a source of competitive advantage to the extent that the inputs can be customized to achieve efficiencies in the speed of development and cost reductions at the manufacturing stage.[12]

§8 --Market conditions

Various researchers have argued that market conditions are important influences on product innovation and the success or failure of new products with a main, albeit somewhat obvious, conclusion being that a large and growing market is the preferred environment for product launches particularly when entry is early.[13] It should not be assumed, however, that market conditions are necessarily the most important factor and other studies have concluded that there is either no relationship between market competitiveness and product success or if market characteristics are important they are less so than product and organizational factors. Pina e Cunha suggested that the existence of effective "barriers to imitation" is an important element of market conditions and that it is useful and appropriate to study questions such as how long it takes competitors to legally "imitate" new products, whether long imitation response times have a strong influence on the strategic decisions of companies and what are the risks and advantages of acting as a "pioneer" as opposed to a "follower".[14] Presumably some form of "barrier to imitation"—patent protection, high initial investment costs or production capacity—is necessary, or at least strongly preferred, in order for a company to have a reasonable expectation that it will be able to recover its investment in new products through profits before competitors are able to scale the wall and enter the market also.[15]

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[11] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 16.

[12] Id. (citing R. Kamath and R. Liker, A Second Look at Japanese Product Development, 72(6) Harvard Business Review 154 (1994)).

[13] Id. at 17 (citing R. Cooper and E. Kleinschmidt, New Products: What Separates Winners from Losers?, 4 Journal of Product Innovation Management 169 (1987); and B. Zirger and M. Maidique, A Model of New Product Development: An Empirical Test, 36 Management Science 867 (1990)).

[14] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 17.

[15] I. MacMillan, M. McCaffery and G. Van Wijk, "Competitors' Responses to Easily Imitated New Products—Exploring Commercial Banking Product Introductions", Strategic Management Journal, 6 (1985), 75.

§9 --Industry

De Jong and Vermeulen collected and analyzed information on the innovative practices of 1,250 small firms within the Netherlands covering seven industries: manufacturing, construction, wholesale and transport, retail services, hotel and catering services, knowledge-intensive services (e.g., consultants, researchers and engineers) and financial services.[16] Their interest was in determining whether there were variations across industry sectors in the determinants of product innovation, which they measured by reference to whether or not a firm had introduced at least one "new to the firm" product during the last two years and whether or not a firm had introduced at least one "new to the industry" product during the last two years.

As for the firm-level innovative practices that might be relevant De Jong and Vermeulen used three broad categories that they had derived from the literature on determinants of innovation among small- and medium-sized enterprises ("SMEs"): strategy, external orientation and organization.[17] The practices falling into the category of strategy included "managerial focus", meaning that the owner-manager was continuously seeking for and providing support to innovative opportunities, and the existence of a formal document plan that described the renewal ambitions, targets and milestones of the firm.[18] As for external orientation, the interest of the researchers was in the use of external networks (i.e., the firm kept up regular contacts (both formal and informal) with an external network of universities, suppliers and/or knowledge institutes to extend its knowledge base)[19], performance of market research among customers to explore

[16] J. De Jong and P. Vermeulen, "Determinants of Product Innovation in Small Firms", International Small Business Journal, 24(6) (2006), 587. De Jong and Vermeulen did concede certain limitations in their data and survey methods that could be rectified in future research including a relatively narrow range of analyzed innovative activities, just seven; the use of relatively simple measures; the use of broad industry classifications and failure to obtain information from multiple sources. Suggested remedies for future research included including other variables to measure and analyze innovative activities including product, market and innovation process characteristics; obtaining information from employees and/or customers; and using indicators of innovation that incorporate measures of just how successful the innovations were from a commercial aspect. Id. at 604-605.

[17] Id. at 592-594 (citing F. Bougrain and B. Haudeville, "Innovation, Collaboration and SMEs Internal Research Capacities", Research Policy, 31(5) (2002), 735; R. Cooper and E. Kleinschmidt, "Benchmarking the Firm's Critical Success Factors in New Product Development", Journal of Product Innovation Management, 12(5) (1995), 374; H. Ernst, "Success Factors of New Product Development: A Review of the Empirical Literature", International Journal of Management Reviews, 4(1) (2002), 1; A. Hadjimanolis, "An Investigation of Innovation Antecedents in Small Firms in the Context of a Small Developing Country", R&D Management, 30(3) (2000), 235.

[18] See also A. Hadjimanolis, "An Investigation of Innovation Antecedents in Small Firms in the Context of a Small Developing Country", R&D Management, 30(3) (2000), 235.

[19] See also M. Freel, "Barriers to Product Innovation in Small Manufacturing Firms", International Small Business Journal, 18(1) (2000), 60; M. Freel, "Sectoral Patterns of Small Firm Innovation, Networking and Proximity", Research Policy, 32(5) (2003), 751; H. Romijn and M. Albaladejo, "Determinants of Innovation Capability in Small Electronics and Software Firms in Southeast England", Research Policy, 31(7) (2002), 1053; R. Rothwell, "The Characteristics of Successful Innovators and Technically Progressive Firms", R&D Management, 7(3) (1977), 191; and R. Rothwell, "External Networking and Innovation in Small and Medium-sized Manufacturing Firms in Europe", Technovation, 11(2) (1991), 93.

innovative opportunities and better understand customer needs[20] and the intensity of formal cooperation with other firms or institutes to initiate or develop any renewal activity, overcome a lack of resources, spread risk and gain access to complementary knowledge.[21] Finally, relevant organizational practices included involvement of frontline (i.e., sales and service) employees, as well as the owner-managers, in idea generation and implementation of innovations[22] and financial support for employee training and education programs to raise their skill levels[23].

In their analysis De Jong and Vermeulen sought first to determine if the selected firm-level innovative practices were identifiable in the SMEs in their survey group and, if so, whether or not differences existed between the seven industry sectors. Once that process was completed, De Jong and Vermeulen turned to the question of differences across industries in their impact on product innovation. As to their general conclusions, De Jong and Vermeulen emphasized the following results[24]:

- Each of the innovative practices were regarded as meaningful by a significant number of respondents; however, after controlling for variations in the age and size of firms, significant differences across industries remained in the extent to which firms used innovative practices and introduced new products. Firms from the manufacturing, knowledge-intensive and financial service industries did significantly better on most variables and had higher scores with respect to new product introductions in their past two years compared to firms from construction, wholesale and transport, retail services and hotel and catering services.
- There were significant differences between industries as to which innovation practices were most important. For example, while a managerial focus on innovation had a significant impact on development of "new-to-the-firm" products in five of the seven industries it was not significant among firms in the manufacturing and financial services industries where, it was speculated, innovation may simply happen by default in light of overall industry requirements for survival.

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[20] See also A. Hadjimanolis, "An Investigation of Innovation Antecedents in Small Firms in the Context of a Small Developing Country", R&D Management, 30(3) (2000), 235; Y. Kim, K. Song and J. Lee, "Determinants of Technological Innovation in the Small Firms of Korea", R&D Management, 23(3) (1993), 215.

[21] See also E. Brouwer and A. Kleinknecht, "Firm Size, Small Business Presence and Sales of Innovative Products: A Micro-econometric Analysis", Small Business Economics 8(3) (1996), 189; V. Hanna and K. Walsh, "Small Firm Networks: A Successful Approach to Innovation?", R&D Management, 32(3) (2002), 201; A. Hadjimanolis, "An Investigation of Innovation Antecedents in Small Firms in the Context of a Small Developing Country", R&D Management, 30(3) (2000), 235; and B. Tether, "Who Co-operates for Innovation, and Why?: An Empirical Analysis", Research Policy, 31(6) (2002), 947.

[22] See also S. Davenport and D. Bibby, "Rethinking a National Innovation System: The Small Country as 'SME'", Technology Analysis and Strategic Management, 11(3) (1999), 431; L. Hyvärinen, "Innovativeness and its Indicators in Small- and Medium-sized Industrial Enterprises", International Small Business Journal, 9(1) (1990), 64; and C. Martin and D. Horne, "Level of Success Inputs for Service Innovations in the Same Firm", International Journal of Service Industry Management, 6(4) (1995), 40.

[23] See also H. Romijn and M. Albaladejo, "Determinants of Innovation Capability in Small Electronics and Software Firms in Southeast England", Research Policy, 31(7) (2002), 1053.

[24] J. De Jong and P. Vermeulen, "Determinants of Product Innovation in Small Firms", International Small Business Journal, 24(6) (2006), 587, 596-600, 604.

- The presence of formal programs for training and education seemed most common among the knowledge-intensive and financial service firms, even after taking into account that collective bargaining contracts with labor unions in the Netherlands generally called for obligatory training by construction and manufacturing firms.
- Large variations existed among the various service industries, which meant that prior studies of the determinants of product innovation in the service industry that treated it as "uniform" made little practical sense. For example, they found that retail and hotel and catering firms introduced new products less often and made less use of innovative practices while financial services firms scored much better than average on the use of innovative practices particularly documented innovation plans, inter-firm cooperation, formal market research, and training and education programs.

As for the specific industries in their survey, De Jong and Vermeulen found that among manufacturing firms in their survey of Dutch SMEs the most significant drivers of each type of product innovation, both new-to-the-firm and new-to-the-industry, were the use of documented innovation plans and inter-firm cooperation.[25] The researchers were not surprised by these findings given that innovation activities in the manufacturing sector typically were organized as formal projects[26] and cooperation with other firms was a tried and proven strategy to manage and reduce the substantial risks and expense associated with new product development in the manufacturing area[27]. De Jong and Vermeulen also found that manufacturing relied on market research for identifying incremental changes in existing products that would satisfy the unsatisfied needs of customers and address customer evaluations of current product offerings.[28]

Among construction firms in their survey of Dutch SMEs De Jong and Vermeulen found that the most important drivers of both types of new product innovations were a managerial focus to innovation, performance of market research and the creation and use of external networks.[29] De Jong and Vermeulen noted certain characteristics of the Dutch construction industry that supported the findings such as the importance of market research regarding customers' needs in an environment in which many products are put out to tender by governments and project developers. As for new-to-the-industry innovations, these generally took the form of revolutionary building and bridge designs that were conceived and developed in the context of an external network that included not

[25] J. De Jong and P. Vermeulen, "Determinants of Product Innovation in Small Firms", International Small Business Journal, 24(6) (2006), 587, 601.
[26] G. Urban and J. Hauser, Design and Marketing of New Products (2nd Ed.) (1993).
[27] A. Hadjimanolis, "An Investigation of Innovation Antecedents in Small Firms in the Context of a Small Developing Country", R&D Management, 30(3) (2000), 235; F. Bougrain and B. Haudeville, "Innovation, Collaboration and SMEs Internal Research Capacities", Research Policy, 31(5) (2002), 735.
[28] J. De Jong and P. Vermeulen, "Determinants of Product Innovation in Small Firms", International Small Business Journal, 24(6) (2006), 587 (citing also K. Hoffman, M. Parejo, J. Bessant and L. Perren, "Small firms, R&D, Technology and Innovation in the UK: A Literature Review", Technovation, 18(1) (1998), 39.
[29] J. De Jong and P. Vermeulen, "Determinants of Product Innovation in Small Firms", International Small Business Journal, 24(6) (2006), 587, 601.

only customers (e.g., governments and project developers) but also engineers and architects.[30]

Among the firms in the wholesale and transport industries in their survey of Dutch SMEs De Jong and Vermeulen found that they relied strongly on market research and inter-firm cooperation for achieving success with respect to both types of product innovation and that new-to-firm product introductions were assisted by managerial focus on the use of networks.[31] Reliance on inter-firm cooperation and the use of networks was explained as being somewhat predictable given that firms in this section occupied an intermediary position in a longer value chain that thus their ability to remain innovative was heavily dependent on their relationships with manufacturers on the one side and retailers on the other side.[32]

As for the firms in the retail sector in their survey of Dutch SMEs, De Jong and Vermeulen noted that they were not generally expected to develop many innovations on their own and were largely dependent on their suppliers with respect to the product portfolio and pipeline.[33] The results of their survey indicated that the key determinants of innovation in the retail sector were managerial focus, described as a continuous pursuit of new products by retail managers that could provide support for better results with respect to revenues and margins; the use of external networks including, of course, suppliers who served as sources of innovation in their own right; and the involvement of frontline employees engaged in the day-to-day deliver of retail services and thus closer to the customer and able to gauge customer needs and impressions about currently offered products and encourage customers to try and adopt new products. De Jong and Vermeulen observed that while these findings were particularly relevant to new-to-the-firm products the situation was a bit different with respect to new-to-the-industry products and the results suggested that such products were not delivered by supplier but arose out of the retailers own thorough analysis of the unsatisfied needs of the customers, an analysis that often led them to establish ties with new suppliers engaged in product areas that were outside of the retailers' current offerings to their customers.

De Jong and Vermeulen reported that for the firms in their survey of Dutch SMEs involved in hotel and catering services the most significant drivers for new-to-the-firm products were managerial focus and the involvement of frontline employees and that managerial focus was the sole driver of efforts by such service providers to develop and

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[30] V. Hanna and K. Walsh, "Small Firm Networks: A Successful Approach to Innovation?", R&D Management, 32(3) (2002) 201; and B. Tether, "Who Co-operates for Innovation, and Why?: An Empirical Analysis", Research Policy, 31(6) (2002), 947.

[31] J. De Jong and P. Vermeulen, "Determinants of Product Innovation in Small Firms", International Small Business Journal, 24(6) (2006), 587, 601-602.

[32] See also A. Hadjimanolis, "An Investigation of Innovation Antecedents in Small Firms in the Context of a Small Developing Country", R&D Management, 30(3) (2000), 235.

[33] J. De Jong and P. Vermeulen, "Determinants of Product Innovation in Small Firms", International Small Business Journal, 24(6) (2006), 587, 603 (citing, e.g., M. Miozzo and L. Soete, "Internationalization of Services: A Technological Perspective", Technological Forecasting and Social Change, 67(2-3) (2001), 159.

introduce new-to-the industry products.[34] De Jong and Vermeulen speculated that the importance of managerial focus and involvement of frontline employees could be attributable to certain specific features of services identified by Tatikonda and Zeithaml including intangibility, simultaneity, heterogeneity and perishability.[35] Hotels and catering firms are similar to retail firms with respect to their dependence on suppliers[36] and thus it is not surprising that the drivers of innovation in this industry sector were similar to those identified for retailers. Moreover, it is well known that customer satisfaction with the "product" delivered by hotels and catering firms is strong determined by the actions of frontline employees.

De Jong and Vermeulen reported that among the firms in their survey of Dutch SMEs involved in the creation and delivery of knowledge-intensive services both types of innovation were most strongly influenced by managerial focus and market research and that the involvement of frontline employees was also important, but only in the context of new-to-the-firm products.[37] De Jong and Vermeulen commented that knowledge-intensive service providers deliver "high contact" products and thus customer relationships are key factors to their long-term success. This means that customers should be involved in idea generation and implementation of new innovations and that employees of knowledge-intensive service providers should tap into their co-workers' knowledge and invest times in cultivating and executing their own individual innovative behaviors. De Jong and Vermeulen noted that employee involvement, which was essential to the success of new-to-the-firm innovations, was limited or non-existent when it came to new-to-the-industry innovations, a finding that was interpreted to mean that "such (discontinuous) innovations may often be initiated and implemented by the managing partners of the firm".

Finally, according to the results that De Jong and Vermeulen collected from financial services firms in their survey of Dutch SMEs the most significant drivers of new-to-the-firm products were the presence of documented innovation plans, the use of networks and doing market research.[38] De Jong and Vermeulen explained that product innovation in the financial services sector is usually accompanied by process innovation[39] and that this explained the importance of documented innovation plans since careful planning was needed for the new processes accompanying product innovations to be successfully developed. De Jong and Vermeulen also commented that their findings were consistent with other studies that had shown that financial service providers relied heavily on

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[34] J. De Jong and P. Vermeulen, "Determinants of Product Innovation in Small Firms", International Small Business Journal, 24(6) (2006), 587, 603.

[35] M. Tatikonda and V. Zeithaml, "Managing the New Service Development Process: Multi-Disciplinary Literature Synthesis and Directions for Future Research", in T. Boone and R. Ganeshan (Eds), New Directions in Supply-Chain Management (2002), 200.

[36] M. Miozzo and L. Soete, "Internationalization of Services: A Technological Perspective", Technological Forecasting and Social Change, 67(2-3) (2001), 159.

[37] J. De Jong and P. Vermeulen, "Determinants of Product Innovation in Small Firms", International Small Business Journal, 24(6) (2006), 587, 603

[38] Id. at 603-604.

[39] Id. at 603 (citing P. Vermeulen and B. Dankbaar, "The Organization of Product Innovation in the Financial Sector", The Service Industries Journal, 22(3) (2002), 77.

market research as a tool for streamlining new product offerings and designing them in a way that conformed to the actual documented desires and needs of customers.[40] De Jong and Vermeulen also explained that financial service providers are keen to maintain networks outside of their section as a path for exploring new opportunities and noted that product innovations such as the "electronic wallet" began with technology developed in the university research community that eventually was identified as having potential applications in the financial services sector.

The existence of differences among industries has been noted by others including, for example, anecdotal evidence regarding product development processes in the aerospace industry that points to a dominance of the design department over the manufacturing group, meaning that manufacturing engineers have much less to say about design than design engineers and that design engineers have more freedom in the creation process.[41]

§10 --Societal culture

It has often been suggested that societal culture is a fundamental determinant of product innovation and one researcher has argued that societies that are more accepting of uncertainty tend to be more innovative than societies where uncertainty avoidance is strong.[42] Ettlie et al. observed that information collected during their cross-national study of various aspects of the new product development processes used by durable goods manufacturers in five dispersed countries suggested that differences in societal culture influenced the way in which firms approached the processes for concept development and generation of ideas at the earliest stages of product development.[43] For example, they comment that indications that integration of design and manufacturing processes proceeded more smoothly in Germany and Scandinavia than in the US might be attributed to stronger emphasis on technical training (Germany)[44] and greater standardization of design practices (Scandinavia).[45] Other researchers had noted that apprenticeship, believed to be a valuable prerequisite to stronger technical training, was much more prevalent in Germany than in the US, a phenomenon that is often attributed to the conscious decision of Germany policymakers to provide large amounts of government support to work force training.[46]

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[40] U. De Brentani, "Innovative versus Incremental New Business Services: Different Keys for Achieving Success", Journal of Product Innovation Management, 18(3) (2001), 169; and P. Vermeulen and B. Dankbaar, "The Organization of Product Innovation in the Financial Sector", The Service Industries Journal, 22(3) (2002), 77.

[41] J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 150-151.

[42] S. Shane, "Cultural Influences on Rates of Innovation", Journal of Business Venturing, 7 (1993), 29. For discussion of uncertainty avoidance, see "Globalization: A Library of Resources for Sustainable Entrepreneurs" prepared and distributed by the Sustainable Entrepreneurship Project (www.seproject.org).

[43] J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 141, 151.

[44] L. Lynn, Technology and Organizations: Cross-National Analysis, in Technology and organizations (P. Goodman and L. Sproul eds., 1990), 174, 189.

[45] L. Trygg, Engineering Design: Some Aspects of Product Development Efficiency (1991).

[46] J. Lee and N. Wallbaum, "Apprenticeship Training: The U.S. versus West Germany", Operations Management Review, 8 (3/4) (1991), 19.

Ettlie et al. also noted that the parity in the percentage of degreed design and manufacturing engineers at the 100% level in the Germans firm included in their survey was illustrative of what they referred to as the "stereotypical German approach to technical problems—thorough, painstaking, and with high technical standards".[47] In contrast, the much higher percentage of degreed design engineers in relation to degreed manufacturing engineers (90% to 10%, respectively) in the Swedish firm included in the same survey was illustrative of how Swedish firms took a more "creative" approach to product development issues in comparison to, for example, German firms.[48] In the Japanese firm in the survey there was near parity in degreed design and manufacturing engineers at a very higher percentage level (95% and 80%, respectively), a result similar to the German firm and one that Ettlie et al. explained as consistent with the Japanese cultural predisposition of high concern for technical accuracy.[49]

Limprecht and Hayes also identified several different characteristics associated with German firms and their management and human resources practices that would likely influence the way in which they approached and conducted their new product development activities.[50] First of all, senior managers in German firms generally had strong technical backgrounds.[51] Second, the strength of apprenticeship programs in Germany, and the reliance of German firms on the skills disseminated in those programs, created a workforce that was more qualified to understand and efficiently incorporate manufacturing technologies. Third, product strategies favored by German firms focused on creating well-engineered, high quality products that were delivered on time and supported by extensive and excellent service. Finally, German firms take a more long-term view of product evolution and market competitiveness and thus are willing to accept lower profit margins to secure and maintain market share and long-term stability.

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[47] J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 150.

[48] Id. Ettlie et al. noted that the Swedish firm had the same ratio of design to manufacturing engineers found in the German firm in their survey; however, the ratio when presence or absence of a degree was included varied significantly as 100% of both design and manufacturing engineers in the German firm were degreed. Id.

[49] Id. In a similar vein, Cole noted that Japanese perceptions of relatively small quality differences were much more sensitive than in the US. For example, when studying data on, and reactions to, defects per vehicle in the US and Japanese automobile industries Cole found that Japanese technicians would be very concerned if defect measures rose from 1.0 defects per vehicle to 1.6 defects per vehicle while US technicians would consider such an increase to be, as described in Ettlie et al., "very subtle and, therefore, less important". Id. at 142 (citing R. Cole, "U.S. Quality Improvement in the Auto Industry: Close But No Cigar", California Management Review (1990), 71).

[50] J. Limprecht and R. Hayes, "Germany's World-Class Manufacturers", Harvard Business Review (November/December 1982), 137.

[51] Ettlie et al. also observed that the relative abundance of technically trained managers in Germany was likely to influence the new product development process, particularly the design approach, among firms in that country. J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 142. With regard to the influence of professional orientation on organizational culture and practices generally, see also J. Van Maanen and S. Barley, "Occupational Communities: Culture and Control in Organizations", in Research in Organizational Behavior (1984), 287.

The raucous level of competition between American and Japanese firms over the last several decades has generated a great deal of interest in comparing product innovation practices used in those two countries. Ettlie et al. noted that Hellwig had identified considerable differences between US and Japanese companies with respect to "product genesis", or the "evolution of an idea into a manufactured and marketed product".[52] In the US, for example, there was a strong tendency toward maintaining the process as strictly proprietary, an approach which also extended to applied and basic research. In contrast, Japanese product development was often done on a cooperative basis that extended through prototyping and which was open to foreign participants, an act of inclusion almost never seen in the US. Japanese companies have also been noted as keen learners of technologies originally developed elsewhere, particularly in the US. While US companies have generally not shown the same level of curiosity, some of them have reached out to Japanese counterparts in certain industries such as automobiles.[53] Cole observed that while US firms tended to carry out technology adoption and development in parallel to manufacturing productivity enhancement and product development Japanese firms incorporated new technology as part of their continuous improvement programs.[54] Mansfield found that the "time-to-market" for new products among Japanese firms was faster than among US firms.[55]

Another aspect of new product development that may be influenced by societal culture is planning, which is obviously relevant when new products are being vetted, selected, developed and commercialized. Variations among countries and societal cultures with respect to formalization of planning have been identified and researchers such as Schneider and DeMeyer have observed differences among societal cultures with respect to how strategic planners interpreted risks.[56] In addition, researchers have found that planning can lead to different types of successful outcomes and that variable patterns can be observed across cultures. For example, Hagerty and Hoffman found that better planning among Anglo firms translated into higher returns on sales while the better planners among German firms realized the value of planning through higher returns on assets and the better planners among Nordic firms enjoyed higher sales growth.[57]

Ettlie et al. suggested that the influence of societal culture for creating variations in the manner in which firms conducted the product development process could be best

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[52] H. Hellwig, "Differences in Competitive Strategies Between the United States and Japan", IEEE Transactions on Engineering Management, 39(1) (1992), 77.

[53] J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 151.

[54] R. Cole, "U.S. Quality Improvement in the Auto Industry: Close But No Cigar", California Management Review (1990), 71.

[55] E. Mansfield, "The Speed and Cost of Industrial Innovation in Japan and the United States: External vs. Internal Technology", Management Science, 34 (1988), 1158.

[56] S. Schneider and A. de Meyer, "Interpreting and Responding to Strategic Issues: The Impact of National Culture", Strategic Management Journal, 12 (1991), 307. For discussion of cross-cultural differences in attitudes regarding strategic planning and strategic planning practices, see "Strategic Planning: A Library of Resources for Sustainable Entrepreneurs" prepared and distributed by the Sustainable Entrepreneurship Project (www.seproject.org).

[57] W. Hagarty and R. Hoffman, The Relationship between Strategic Planning and Performance Among Three Cultures, Proceedings, Academy of Management (1990), 106.

observed by distinguishing between high-tech and low-tech industries.[58] They hypothesized that high-tech and low-tech industries had different patterns of cultural influence through the various stages of the product development process. They noted, for example, that "[i]n high-tech industries, it could be argued that early stages of product development—like the preconcept and concept development stages—are less likely to show cultural influences because science dominates".[59] They want on to further hypothesize that "when basic research is an integrated part of corporate product development . . . cultures converge into similar forms of work routines" even if, as is the case with the US and Japan, scientific work communities in the various cultures work differently.[60] In contrast, Ettlie et al. hypothesized that since the early stages of product development in low-tech industries is less science driven they are more likely to be subject to cultural influences. As for two of the later stages in the product development process—product design and process design—Ettlie et al. hypothesized that for both high-tech and low-tech industries the influence of culture would be "low" with respect to product design but "high" with respect to process design. They explained these hypothesizes by arguing that product design is normally driven by customer requirements and thus should be less influenced by the culture of the provider and that process design, being more downstream in the process, would be influenced by plant conditions that are subject to culturally-driven factors.

§11 Organizational context and product innovation

Pina e Cunha mentioned that there is a significant amount of research literature devoted to the general topic of "organizing for product innovation" including not only processes and procedures for continuously scanning the external environment, discussed elsewhere in this Part, to identify new opportunities but also the use of new forms of organizational structures to stimulate innovation (e.g., new venture units, cross-functional teams, multiple horizon organization and improvisational approaches).[61] Pina e Cunha

[58] J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 151-153.

[59] Id. at 152 (also citing R. Osborn and C. Baughn, "Societal Considerations in Global Technological Development of Economic Institutions: The Role of Strategic Alliances", in Research in the Sociology of Organization (1993), 113). Ettlie et al. noted that Gomez-Mejia had suggested the following dimensions or characteristics for distinguishing high-tech firms from traditional companies: incorporating cutting edge technology in products; shorter product life-cycles, typical of the electronics, computer and chemical industries; higher rates of innovation; relatively high research and development intensity (e.g., more than 6%-10% of sales invested in research and development); a higher proportion of research and development employees with high personnel turnover in the technical ranks; high rates of growth accompanied by greater mortality; and higher, but more variable, profits. See L. Gomez-Mejia, Features Distinguishing High Technology from Traditional Firms (1991).

[60] J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 152 (citing, with respect to actions of scientific work communities in the US and Japan, S. Traweek, Beamtimes and Lifetimes: An Ethnography of the High Energy Physics Community in Japan and the US (1988)).

[61] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 18 (citing C. Bart, "New Venture Units: Use Them Wisely to Manage Innovation", Sloan Management Review, 30(4) (1988), 35 (new venture units); M. Hitt, R. Nixon, R. Hoskisson and R. Kochhar, Activation, Process and Desintegration of a Cross-Functional New Product Design Team (1996) (cross-functional teams), S. Brown and K. Eisenhardt, Product Innovation as Core

suggested that the organizational context for innovation includes the key factors associated with managing the overall innovation process and that it was necessary to understand and study how companies acquired all the inputs and resources from their external environments that they needed in order to develop new products; how companies processed those inputs once they had been acquired, a question that could only be answered by looking at various factors such as strategy, organizational structure and internal group processes, leadership activities, organizational power and politics and organizational knowledge management; and, finally, how companies manage the actual commercial launch of their new products.[62] Still another factor in the organizational context for product innovation is the availability, use and effectiveness of design tools and methods. Also, while not discussed in detail below, it is reasonable to expect that the level of dependence on export sales will influence product development activities since exporting requires attention to technical and regulatory requirements in various foreign jurisdictions during the new product design process.[63] Finally, motivation to participate in innovation-focused activities can be created through the thoughtful and strategic use of compensation tools.[64]

§12 --Acquisition of inputs and resources for new product development

As with any other activity that a company may engage in new product development requires certain inputs and resources such as cash, physical assets, intangible assets and human resources. In some cases companies may have some of the necessary resources already, such as working capital generated from previous projects and experienced scientists and engineers recruited and hired to support the development of existing products; however, the typical situation is that the development of new products cannot proceed in earnest until new inputs and resources have been acquired from the company's

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Capability: The Art of Dynamic Adaptation (1995) (multiple horizon organization); and D. Bastien and T. Hostager, "Jazz as a Process of Organizational Innovation", Communication Research, 15 (1988), 582 (improvisational approaches)).

[62] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 17-34.

[63] The potential for differences in product development activities due to variations in export intensity was illustrated by the group of durable goods firms in five countries that Ettlie et al. studied in the early 1990s. At one extreme was the Hungarian firm, which exported in excess of 90% of its output, and the percentages for the firms from other countries were as follows: Japan (70%), Germany (60%), Sweden (a little over 50%) and the US (10%). J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 144-145.

[64] Quinn and Rivoli speculated that the decision of Japanese firms to rely on a "share plus wage system" contributed to growth rates of new products and firm research and development in Japan during the 1960-1987 period that were more than double the comparable rates found for US firms during the same period. See D. Quinn and P. Rivoli, "The Effects of American- and Japanese-Style Employment and Compensation Practices on Innovation", Organizational Science, 2 (1991), 323. However, while this may be evidence for the argument that compensation and incentive systems influence product development activities, Ettlie et al. cautioned that other factors may be in play such as the rapid and extensive internationalization of markets that occurred during the 1960-1987 period and that warned that transferring compensation and incentive systems across cultural borders may have unintended negative consequences. See J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 141-142.

external environment. For example, companies may need to turn to their external environment to raise capital from investors to finance internal development of other necessary resources such as technology or the technology itself may be imported from outside through licensing arrangements or other strategic alliances.

One important "input" from the external environment that was not mentioned above is information on developments in that environment, such as competitors' actions and changes in customer requirements, which can be expected to require some sort of strategic response by the company. Access to this information comes from the use of effective environmental scanning techniques which seek to identify and understand "ideas and fields of knowledge that competitors have missed".[65] Environmental scanning includes the collection of information about external threats and opportunities, internal diagnosis to identify the company's own strengths and weaknesses and, finally, establishing a strategy to align the company's organizational strengths with market opportunities to establish a pipeline of new products that have high product visibility, high perceived potential and a high likelihood of damaging competitors' market position. While the steps of environmental scanning are well-known the process is most effective when companies are able to rely on "gatekeepers", which Pina e Cunha described as "high-performing individuals that communicate more often with people outside their specialty" and "import information from outside sources and disperse that information throughout [product development teams]".[66] Effective environmental scanning also requires attention to multiple sources of information including competitors, customers and sources outside of the specific industry such as universities and related industries.[67]

§13 --Organizational strategy

Organizational strategy is strongly linked with new product development since the long-term success of a company's strategy depends on its ability to set and achieve new

[65] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 18 (citing R. Burgelman and L. Sayles, Inside Corporate Innovation: Strategy, Structure and Managerial Skills (1986)).

[66] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 18-19. The activities of "gatekeepers" are sometimes referred to as "boundary spanning" and Pina e Cunha described the findings of various researchers on boundary spanning and noted that the quality, rather than quantity, of outside communications appears to be most important to improving new product development performance and communications with outsiders can increase a company's absorptive capacity and promote better decision making with respect to finding solutions to problems that may arise during the product development process. Id. at 19 (citing R. Katz and M. Tushman, "An Investigation into the Managerial Roles and Career Paths of Gatekeepers and Project Supervisors in a Major R&D Facility", R&D Management, 11 (1981), 103; D. Ancona and D. Caldwell, "Bridging the Boundary: External Process and Performance in Organizational Teams", Administrative Science Quarterly, 37 (1992), 634; and W. Cohen and D. Levinthal, "Absorptive Capacity: A New Perspective on Learning and Innovation", Administrative Science Quarterly, 35 (1990), 128; and R. Daft and R. Lengel, "Organizational Information Requirements, Media Richness and Structural Design", Management Science, 32 (1986), 554).

[67] See, for example, S. Ghoshal and D. Westney, "Organizing Competitor Analysis Systems", Strategic Management Journal, 12 (1991) 17 (competitors); E. Von Hippel, "Lead Users: A Source of Novel Product Concepts", Management Science, 32 (1986), 791 (customers); and M. Porter, Competitive Strategy (1980) (universities and related industries).

product development goals and manage its overall product portfolio. Cooper explained that corporate strategy influences new product development strategies and that those development strategies influence new product performance and, ultimately, the overall results achieved by the company. Time and space does not permit a full exploration of organizational strategy; however, notice should be taken of two approaches to organizational strategy discussed by Pina e Cunha—normative and process—and what they teach regarding management of new product innovation.[68]

The normative approach to studying organizational strategy is based on the assumption that it is possible to identify and describe an array of possible strategic scenarios, that companies choose and implement one of these strategies and that the choices made can predict how companies set and carry out their new product strategies. Cooper provided an example of the normative approach by analyzing 122 industrial product manufacturing firms and identifying the following five major strategic types from among that group[69]:

- Technology-driven strategy, which was typified by technological sophistication, state-of-the-art development technologies, a strong orientation toward research and development ("R&D") and pro-active processes for generating new product ideas; however, firms following this strategy had the lowest rates of new product success of all of the five strategy types perhaps because of their deficient marketing orientation and failure to identify and seek to exploit lucrative markets.
- Balanced focused strategy which, as the descriptor implies, sought to compliment the technological orientation of firms following the technology-driven strategy with a higher degree of market orientation, thus leading to the best performance with regard to new product success among all of the five strategy types.
- Technologically deficient strategy, which was associated with companies that took a reactive approach to the marketplace, were passive in their idea searches, entered unfamiliar markets and lacked technological sophistication and which led to poor product development programs and a low proportion of sales from new products.
- Low budget diverse strategy, which was associated with companies that had relatively low investments in R&D and focused on launching "me-too" products and products that were synergistic with the company's existing product base and which could be managing in ways that were operationally efficient.
- High budget diverse strategy, which was associated with companies that did invest large amounts in R&D but failed to reach the level of technological sophistication associated with the technology-drive strategy and also failed to achieve the desired new product success due to a lack of focus and dispersion of efforts into too many areas that led to weaknesses in production, sales and distribution.

[68] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 19-23.

[69] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 20-21 (citing and describing results summarized in R. Cooper, "Overall Corporate Strategies for New Product Programs", Industrial Marketing Management, 14 (1985), 179).

As for the process approach to organizational strategy with respect to new product development Pina e Cunha highlighted the research that had been conducted regarding "product champions" and the role that they can play in pushing a new product idea that originally emerged informally to the point where it is formally adopted by the company.[70] Studies have shown that new product development can have elements of both "top-down" and "bottom-up" approaches when product champions are involved.[71] For example, product champions, often at lower levels of the organizational hierarchy yet closer to sources of important information available in the external environment (e.g., customers, suppliers and other industry participants), can initiate new proposals and conduct initial assessments to demonstrate their potential value. The work of the product champions can then be adopted by so-called "organizational champions" at higher levels in the hierarchy, such as managers in the R&D or marketing functions, who are better positioned to get the proposals included in the company's strategy. Once the product and organizational champions have succeeded in their efforts to change company strategy a shift to a "top-down" approach occurs as senior managers responsible for strategy implementation assign resources and responsibilities for the formal product development plan that has emerged from the sometimes informal and messy ideas first conceived by the product champions.

Admittedly the discussion above suggests that companies should work to encourage product-championing activities and empower mid-level managers to serve as organizational champions and that top managers should be willing to recognize and incentivize intrapreneurial efforts by incorporating worthwhile ideas into company strategies and allocating resources to implement those ideas. However, whether or not such an approach is successful may depend on the applicable societal culture. Studies have shown that persons in high uncertainty avoidance societies were less open to "innovation champions" (i.e., persons looking to gain support for a new product or idea) and preferred that efforts to promote innovation were carried out through formal channel, rules and procedures and in accordance with existing organizational norms. In contrast, in societies where uncertainty avoidance was lower there was greater acceptance and endorsement of radical innovation championing activities that included, if necessary, violation of existing organizational rules and regulations.[72] Also, studies have provided support for the proposition that people working within organizations in large power distance countries prefer that innovation champions seek the approval of those in authority through formal review channels rather than trying to generate support from the "bottom up" by mobilizing among members working at lower levels in the hierarchical

[70] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 21-22 (citing R. Burgelman, "Corporate Entrepreneurship and Strategic Management: Insights from a Process Study", Management Science, 29 (1983), 1349; and R. Burgelman, "Intraorganizational Ecology of Strategy Making and Organizational Adaptation: Theory and Field Research", Organization Science, 2 (1991), 239).

[71] See, e.g., M. Hutt, P. Reingen and J. Ronchetto, "Tracing Emergent Processes in Marketing Strategy Formation", Journal of Marketing, 52(1) (1988), 4.

[72] S. Shane, "Uncertainty Avoidance and The Preference for Innovation Championing Roles", Journal of International Studies, 26 (1995), 47. For discussion of uncertainty avoidance, see "Globalization: A Library of Resources for Sustainable Entrepreneurs" prepared and distributed by the Sustainable Entrepreneurship Project (www.seproject.org).

structure of the organization. As power distance gets smaller, however, there is greater cultural acceptance and tolerance of proactive innovation efforts by persons at any level in the organizational hierarchy.[73]

§14 --Organizational structure and internal group processes

Pina e Cunha argued that the research indicates two main approaches to studying the role that organizational structure plays in effective product innovation: the so-called "best structure" approach which attempts to identify the best organizational structure for innovation given certain contingency factors and various "particularistic" approaches that focus on specific structural effects such as communication, culture, interfunctional relations and intrapreneurship perspectives.[74] In addition, of course, the study of organizational structure and innovation includes efforts to develop new forms of organizational structures thought to stimulate innovation such as creation of new venture units and reliance on cross-functional teams.

Pina e Cunha commented that the organizational structure question was presumably fairly easy for companies with just a single product and in that situation it could be expected that an organic structure would be used during the early stages of development in order to facilitate innovation and flexibility and a more mechanistic structure would emerge later when the new product design was ready for production.[75] However, since most companies have, or hope to have, more than one product it is necessary to learn more about how best to manage development and commercialization of multiple products. In order to learn more about this specific and important problem reference can be made to the work of Donaldson, who creatively constructed and tested a theoretical model based on the findings of contingency theory which attempted to provide insight into the "best" organizational structure for innovation for a company managing a portfolio of multiple and diverse products with different products in different phases in the product life cycle.[76]

Donaldson's model assumed that multiproduct companies chose their organizational structures from among three alternatives: product divisions, project teams within a functional structure or a product-functional matrix structure. Donaldson further argued that the choices made by companies depended on two dimensional measures of their product portfolio: the life cycles of their products and the degree of product relatedness. Pina e Cunha explained the choice of these dimensions as follows: "the product life cycle stage directly influences the level of product and process innovation of an organization;

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[73] S. Shane, S. Venkataraman and I. MacMillan, "Cultural Differences in Innovation Championing Roles", Journal of Management, 21 (1995), 931. For discussion of power distance, see "Globalization: A Library of Resources for Sustainable Entrepreneurs" prepared and distributed by the Sustainable Entrepreneurship Project (www.seproject.org).

[74] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 23-29.

[75] Id. at 23.

[76] The discussion of the Donaldson model included below is adapted from M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 23-25 (citing and referring to L. Donaldson, "Organization Design and the Life-Cycles of Products", Journal of Management Studies, 22 (1985), 25).

product relatedness matters because organizing by function tends to prevail when there is a high level of product relatedness, while organizing by product tends to occur when there are several unrelated lines of business".[77]

The model created by Donaldson considered the cases of both single and multiproduct companies and attempted to take into account differences among companies with respect to product life cycle and product diversity. With respect to product life cycle, an analysis of each of the company's products would be required to determine where they fell on a continuum that ranged from "early", meaning in the innovation stage, to "mature", meaning in the production stage. Once that was done an overall descriptor for the product life cycle status of the company's entire product line would be selected from the following alternatives: "all early", "mainly early", "mainly mature" and "all mature". Product diversity, of course, was only relevant for multiproduct companies and they were classified as either "related" or "unrelated" on that dimension. Finally, for both types of companies Donaldson distinguished between "slow" and "rapid" changes in the overall product mix with companies in the "slow" category assumed to have products falling into all four of the product life cycle descriptors mentioned above and companies in the "rapid" category assumed to have products that were either in the "early" stage or in the "mature" stage.

Pina e Cunha argued that organizational structure decisions, at least with respect to product innovation, would appear to be fairly straightforward in certain clear cut cases: when products are related and the level of innovation is low a functional structure is presumably most appropriate and when products are unrelated and the level of innovation is high a product structure is presumably most appropriate.[78] However, when a company's situation does not fall into either of these cases the ideas generated by the Donaldson model provide some insights into how it might proceed and the tables below summarize the optimal organizational structures suggested by the model in a wide array of situations. When reviewing the tables the following key should be used for determining the prescribed organizational structure in each instance[79]:

F: Functional
PD: Product division
M: Matrix
P: Project
Fp: Functional with projects
o: Organic
m: Mechanistic

Single Product Companies[80]

[77] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 23-24.
[78] Id. at 24.
[79] Id.
[80] Adapted from M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 24 and L. Donaldson, "Organization Design and the Life-Cycles of Products", Journal of Management Studies, 22 (1985), 25, 31.

Slow Product Changes	**Structural Type**
All Early	Fo
Mainly Early	Non-Assigned
Mainly Mature	Non-Assigned
All Mature	Fm
Rapid Product Changes	**Structural Type**
Early	Fo
Mature	Fo

Illustrating the prescriptions offered to single product companies those firms with a product in the early stage of development—the so-called innovation stage—are advised to use a "functional organic" based approach ("Fo") regardless of the speed to product changes required by the industry in which they are operating. When the product is in the more mature stage of development (i.e., production) "Fo" remains appropriate when product changes are rapid but "Fm" ("functional mechanistic") is best when product changes are slow.

Multiproduct Companies[81]

Slow Product Mix Changes	**Related**	**Unrelated**
All Early	PDo	PDo
Mainly Early	PDo-m	PDo-m
Mainly Mature	Fpm-o	PDm-o
All Mature	Fm	PDm
Rapid Product Mix Changes	**Related**	**Unrelated**
Early	Mo	Po
Mature	Mo	Po

The prescriptions for multiproduct companies are necessarily more diverse and the table above makes it clear that the "best structure" for product development and innovation, if one can really be uncovered, depends on a variety of situational factors and is likely to change for a specific company as time goes by and adjustments are made in the company's product portfolio and industry factors (e.g., product life cycles and/or degree of innovativeness) evolve.

As for the various "particularistic" approaches to the relationship between organizational structure and product innovation several schools of thought have achieved attention. For example, several researchers have focused on the role of communication as a fundamental variable for understanding new product development and there has been

[81] Id.

particular interest in the so-called "information processing view of new product development" which Pina e Cunha summarized as "the more a development team communicates the higher performing it will be".[82] The "cultural" perspective has been championed by the works of researchers and commentators such as Peters and Waterman, who argued that a certain type of organizational culture should be established in order to stimulate innovation and create and disseminate organizational values that are customer-focused and which encourage the internal cooperation and coordination necessary for complex new product development.[83] The "interfunctional relations" perspective takes a hard look at integration between functions, particularly R&D and marketing.[84] Finally, the literature and research on "intrapreneurship" emerged out of the desire of larger companies to "act like" smaller, presumably more creative and flexible, companies with respect to dexterity and speed of new product development.[85]

One of the most common deployed practices for increasing designing-manufacturing integration during the new product development process is the formation of teams.[86] Not surprisingly, researchers have been interested in cross-national differences in the use of teams for carrying out new product development activities.[87] For example, Hull and Azumi observed that teamwork comes into play much earlier in the product development process in Japanese firms than is the case in US firms.[88] In their cross-national survey of new product development processes of durable goods firms Ettlie et al. found that the Japanese firm consistently created teams to help with coordination during the product development process.[89]

Internal group dynamics often determines whether or not the formal organizational structure selected by top management is effective since lines on a piece of paper are not sufficient to generate the level of communication, collaboration and cooperation necessary for a complex activity such as new product development to proceed smoothly.

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[82] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 26. For further discussion of "communication" perspective see, for example, P. Adler, "New Technologies, New Skills", California Management Review, 29(1) (1986), 9; and S. Brown and K. Eisenhardt, "Product Development: Past Research, Present Findings and Future Directions", Academy of Management Review, 20 (1995), 343.

[83] T. Peters and R. Waterman, In Search of Excellence: Lessons from America's Best-Run Corporations (1982).

[84] For discussion of "interfunctional relations" perspective see, for example, P. Adler, H. Riggs and S. Wheelwright, "Product Development Know-How: Trading Tactics for Strategy", Sloan Management Review, 31(1) (1989), 7 and D. Dougherty and T. Heller, "The Illegitimacy of Successful Product Innovation in Established Firms", Organization Science, 5 (1994), 200.

[85] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 29. See also R. Burgelman, M. Maidique and S. Wheelwright, Strategic Management of Technology and Innovation (2nd Ed.) (1996).

[86] J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 149.

[87] J. Ettlie, Concept Development Effort in Manufacturing, in Integrating Design and Manufacturing for Competitive Advantage 103 (G. Susman ed., 1992).

[88] F. Hull and K. Azumi, Teamwork in Japanese and U.S. Labs, Research and Technology Management 21 (November/December 1989).

[89] J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 150.

The level of cohesion among members of R&D teams has been shown to be positively related to the performance of those teams and various strategies for improving internal group dynamics have been suggested and attempted such as cross-functional teams staffed by persons with diverse backgrounds and coming from a wide range of functional areas.[90] The impact of these strategies can be measured in a number of ways and depends on a variety of factors including their efficacy in processing and disseminating information and the manner in which they resolves sensitive internal political issues such as allocation of resources and multiple reporting channels.[91]

§15 --Leadership

Given the central role that new product development plays in the overall strategies of companies, as well as the recognized duties and responsibilities of organizational leaders with respect to articulating and driving those strategies, it is not surprising that researchers have found that the role of leaders (i.e., senior managers) of companies is of primary importance for successful new product development.[92] The range of leadership roles with respect to new product development is diverse and includes establishing a clear and explicit organizational vision with respect to the product portfolio and establishing and monitoring boundaries for group autonomy within the organizational structure. While much of the emphasis in the leadership area is focused on the top of the organizational hierarchy, "heavyweight leaders" at intermediate levels also play an important role in coordinating the work of teams working on development projects and collecting information "from the field" on potential product concepts and molding them into more concrete ideas that can be shared with top management and ultimately incorporated into the company's overall new product development strategies and operating plans.[93]

§16 --Organizational politics

An interesting, and somewhat provocative, way to look at new product development and innovation activities is to focus on the organizational politics that go into making decisions about innovation strategies and how organizational resources are allocated among competing ideas and development projects. Dougherty and Hardy studied product innovation activities among fifteen "bureaucratic" organizations and found that power in those organizations was generally used to impose and maintain stability and conformity

[90] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 30 (citing R. Keller, "Predictors of the Performance of Project Groups in R&D Organizations", Academy of Management Journal, 29 (1986), 715).

[91] S. Brown and K. Eisenhardt, "Product Development: Past Research, Present Findings and Future Directions", Academy of Management Review, 20 (1995), 343.

[92] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 31 (citing A. Gupta and D. Wilemon, "Accelerating the Development of Technology-Based New Products", California Management Review, 32(2) (1990), 24; and B. Zirger and M. Maidique, "A Model of New Product Development: An Empirical Test", 36 (1990), 867).

[93] For further discussion of "heavyweight leaders" see K. Clark and T. Fujimoto, Product Development Performance (1991) and K. Imai, L. Nonaka and J. Takeuchi, "Managing the New Product Development Process: How Japanese Companies Learn and Unlearn", in R. Hayes, K. Clark and C. Lorenz (Eds.), The Uneasy Alliance: Managing the Productivity-Technology-Dilemna (1985), 337.

rather than to stimulate innovation.[94] Specific difficulties were observed with respect to efforts to integrating departmental activities and link hierarchical levels. In rare instances "personal power" enable individuals in these organizations to overcome the institutional obstacles; however, Dougherty and Hardy advised that this was a risky proposition and that the type of problem solving needed for effective and continuous product innovation is best achieved by creating systems to develop and complete innovative projects.

§17 --Organizational knowledge management

Pina e Cunha cited Dougherty for the important assertion that "[i]f they intend to renew themselves through product innovation, companies need to continuously create and exploit the organizational knowledge necessary for developing viable new products".[95] A number of researchers have emphasized that organizational knowledge management is a critical success factor and this means creating processes and systems to permanently acquire new information, disseminate it throughout the organization, interpret it wisely and efficiently and incorporate it into new products and/or technologies that be used to create improved methods for producing existing products.[96] The arguments of these researchers have been reinforced by evidence that one of the main causes of product innovation failure is shortcomings in the capacity of companies with respect to organizational learning.[97] Pina e Cunha suggested that companies must develop "knowledge strategies" that not only promote acquisition, application and retention of new knowledge but also strike the proper balance between the breadth of the knowledge base and the company's core competencies.[98] One element of organizational knowledge management is the use of "benchmarking" for new product development practices, something that researchers have found to be relatively common among US companies.[99]

§18 --New product launch

Success and efficiency with acquisition and processing of the inputs necessary for new product development may not be enough if a company is not able to overcome the hurdles associated with launching the new product into the marketplace. Launch activities are a natural extension of the initial stages of the development process and are important for a number of reasons including the need to communicate the unique and superior characteristics of the new product to the market, using the diffusion process as a

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[94] D. Dougherty and C. Hardy, Powering Innovation: Beating Bureaucracy (1995).

[95] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 32 (citing D. Dougherty, "A Practice-Centered Model of Organizational Renewal Through Product Innovation", Strategic Management Journal, 13 (1992), 77).

[96] G. Huber, "Organizational Learning: The Contributing Processes and Literatures", Organization Science, 2 (1991), 88; and I. Nonaka, "The Knowledge-Creating Company", Harvard Business Review, 69(6) (1991), 96.

[97] T. Adler and B. Zirger, Organizational Learning and the Virtual Technology and Product Development Organizations (1995).

[98] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 33.

[99] J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 149 (citing J. Ettlie and M. Warner, Managing Design Systems in Manufacturing (1991)).

means for learning more about the market and the customers therein, the ability to use information gained during the diffusion process to improve the initial version of the new product and the role that launch activities play in overall product portfolio management.[100] The information gathered during the launch process regarding the decisions of potential customers about whether or not to adopt the new products can, and should, influence the actions taken by the developer with regard to prospective product development projects.

§19 --Design technology

Availability, use and effective of design technology is also an important factor in the product innovation process. Ettlie et al. observed that the lack of access to computer-aided design technologies among firms from Eastern and Central European countries in the late 1980s and early 1990s likely influenced the way that they approached and completed new product design and new product development activities generally.[101] A questionnaire survey on utilization of various tools and methods in the product development process of Japanese manufacturing industries conducted by Fujita and Matsuo revealed that the most popular choices included patent retrieval, literature surveys, design review meetings, 2D and 3D CAD systems, brainstorming, numerical analysis/simulation, Total Quality Management/Total Quality Control, benchmarking and commercial CAE software.[102] The researchers noted that these results highlighted that methods for facilitating team communication and gathering information were, in general, the most widely used and that while CAD systems and simulation techniques were well introduced, other tools and methods such as quality function deployment and life-cycle assessment which should provide value in the early phases of the design process were not widely utilized as of the time of the survey. The researchers also noted that tools and methods that were widely known were often not implemented due to the perception that they would require too much effort to introduce and that a relatively small number of surveyed firms had gone to the trouble of systemizing their product development processes by establishing guidelines on which tools and methods should be utilized at individual phases of product development process respectively.

Fujita and Matsuo also carried out some comparative analysis as part of their survey. They first looked at utilization rates of various tools in Japan in comparison to firms in the UK and New Zealand and found that while the Japanese had a much higher rate of usage for quality function deployment and the "Taguchi method", not necessarily surprising given that those tools both originated in Japan, they lagged behind the UK and New Zealand when it came to using techniques such as design for assembly and design for manufacturing. Moving to a comparison of differences in utilization of tools and methods among industries the researchers found, for example, that companies in both the

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[100] M. Pina e Cunha, Determinants of Product Innovation in Organizations: Practices and Performance in the Portuguese Financial Sector (1998), 34.
[101] J. Ettlie, C. Dereher, G. Kovacs and L. Trygg, "Cross-National Comparisons of Product Development in Manufacturing", The Journal of High Technology Management Research, 4(2) (1993), 139, 142.
[102] K. Fujita and T. Matsuo, Utilization of Product Development Tools and Methods: Japanese Survey and International Comparison (2005).

automotive and information equipment industries in Japan had a much high level of utilization than other industries, a finding that the researchers attributed to the severe competition within those predominantly global industries. They also found differences among industries with respect to which methods were more effective: product planning and conceptual design methods were more effective in the automotive, electric and electronic consumer appliances industries while companies in the machine components industry derived more value from fault tree analysis and design for assembly.