

INNOVATION WITHIN OVERSEAS SUBSIDIARIES

Kathryn Rudie Harrigan

Robert Vernon's product-cycle model, developed in 1966, made a substantial contribution to the understanding of patterns of world trade. Although the underlying concepts of the model regarding the locus of innovation appear to continue to hold true, there is increasing reason to question whether both the geographical pattern of diffusion and the time horizon over which the diffusion takes place remain accurate in 1984.

The product-cycle model [45] has provided valuable insights into the process of international trade and investment. Though less rigorous than the Ricardian or Heckscher-Ohlin models, it has been useful due to its explicit consideration of the role of changing technology, scale economies, and risk and uncertainty in the trade and investment process. But eighteen years have passed since the introduction of the model, and its efficacy must be questioned. To what extent does Vernon's 1966 model explain patterns of trade and investment in 1984 or in years to come? What are the implications for strategists of necessary changes in the model?

The International Product Cycle

The international product-cycle model [45] assumes that as products evolve through the product life [29], their marketing and production needs change. Consequently, the international trade and investment patterns of these products evolve over time as well. Thus, a product's present stage in the international product-cycle model helps to explain why it is manufactured at one location and sold at another. The international product-cycle model suggests that innovations are more likely to occur near the potential market for the innovation [23, 45]. Support for this proposition comes from both supply and demand factors. Briefly, on the

supply side, innovators are more likely to recognize the preferences and needs of their home environments' markets, and they will direct their energies toward fulfilling these needs. (Risk-averse innovators operating within a corporate reward system are also more likely to direct their attentions close to home because they perceive the exploitation of local markets to be less risky than the attempted exploitation of remote ones.) On the demand side, the price elasticity of demand for new products is generally low [36]. Thus, cost considerations may be less important than persuading consumers to adopt the product at this early stage [20]. Instead, the need for frequent and effective communication between the producer and the market is paramount at this phase of development. Furthermore, product traits must evolve toward those attributes that represent the best trade-off between cost and differentiation as time passes. A ten-year-old product is rarely a replica of its first prototype due to experience curve factors, changing tastes, and the nature of competition. Different markets make diverse demands on a product and on competition.

Vernon's product-cycle model [45] argued that the domestic corporate base (in Vernon's examples, the United States) would be the primary innovator and manufacturer of labor-saving products that would appeal to a mass market with high disposable income. In 1984, however, it would appear that Vernon's model applies better to the old image of U.S. (domestic-based) innovation patterns, for it misses questions concerning product innovation and process

Kathryn Rudie Harrigan is an Associate Professor at the Graduate School of Business, Columbia University.

innovation that are key to effective strategy formulation now. In his schema, as products mature, many forces would push cost reduction closer to the foreground of competitive needs. First, as more information about market needs becomes available, more opportunities for standardization become feasible (although concessions to the stylistic preferences of each market must also be made). Second, competitive pressures force firms to seek ways of increasing consumer value by lowering costs. Finally, as the bulk of purchases are made by the group that Rogers [36] calls "early majority," rather than the "innovators," consumer price elasticities increase. As the maturing process occurs, products would progress to Stage II of the Vernon product cycle and international activity would increase.

The forces that would lead an innovating firm to set up production facilities overseas are quite predictable.

Few exports from the domestic-based firm to other Organization for Economic Cooperation and Development (OECD) countries would be likely to occur very early in the life of the products. But as time progresses and the firm's experience increases, its volume of exports would grow. Ultimately, the model suggests, this growth would lead to a decision to expand the firm's scope of manufacturing operations. Often, production facilities would be set up in key foreign markets after marketing facilities had proven successful. This decision is the watershed between Stage I and Stage II in the Vernon product-cycle model.

The forces that would lead an innovating firm to set up production facilities overseas are quite predictable. Growing export volume in its domestic market eventually reaches the level where production operations at minimum efficient scale could take place at another site. Even where the opportunity to produce at minimum efficient plant scale is not attractive enough to induce a decision to locate manufacturing sites overseas, the desire to preempt potential competitors may be a strong motivation [31]. Local governments may decide to erect tariff barriers or other trade barriers to protect local employment goals, balance of payments, economic growth, or other objectives from import competition. These barriers can serve as an added inducement for timely investments in the local market, because soon after the innovating firm decides to produce abroad, the odds are very high that its rivals will try to follow in short order [28]. If the barriers can be erected to protect the innovating firm's plant from out-

siders (or would-be followers), they constitute an inducement for the firm's foreign direct investments.

As products progress through Stage II, cost considerations often increase in importance to the firm. Newly industrializing countries appear increasingly attractive as sites for manufacturing facilities if their labor costs (and political risks) are relatively low. The decision to locate production facilities in newly industrializing nations which may not consume the output of their factories is the watershed between Stage II and Stage III in the Vernon product-cycle model, and several factors may affect the probability and timing of the transition from Stage II to Stage III [45]. The most likely candidates to enter Stage III include products which require significant labor inputs; products which have high price elasticities of demand; products whose manufacturing processes do not rely heavily on external economies; products which can be inventoried without fear of obsolescence; and products whose values are high compared to their weight or bulk, for these products may be transshipped in firms' global distribution networks. During Stage III, the firm's domestic base (in this example, the United States) usually becomes a net importer of the product. Eventually, the other OECD countries become net importers of the product, as well. The propositions contained in the Vernon product-cycle model survived empirical tests by Wells (consumer durables), Stobaugh (petrochemicals), and others. But other developments challenge the model's validity.

Innovation and Scarcity

The international product-cycle model suggested that innovations are a response to a relative scarcity or abundance of factor endowments in a particular location [45]. In essence, "necessity is the mother of invention" [23, 17, 15], and there is abundant historical evidence to support this contention. Innovations in Europe, an area which is relatively resource-poor, have tended to be resource-conserving devices [15], and the British "energy crisis" in the 1890s is of particular interest. If one reads the popular economic literature of England during the 1890s, including the writings of Jevons, one realizes that the entire industrial revolution was threatened by the coal shortage [37]. The British feared they had come close to exhausting all of the deposits of coal close to the surface. Their redeeming innovation was new mining technology that permitted the recovery of deeper coal deposits. (Several analogies in the U.S. oil industry may be found in the twentieth century.)

Wartime history provides clear examples of innovational response to resource shortages. During the

Napoleonic Wars, when France was cut off from Spanish alkalis, the French invented the Leblanc process for creating synthetic alkalis. When the Germans were cut off from Chilean nitrates during World War I, they developed the Haber process for Chilean nitrates [47]. The United States developed synthetic rubber in response to wartime threats to U.S. supplies of natural rubber, and the U.S. ethical pharmaceuticals industry began its intensive research and development efforts (which resulted in sulfa drugs and other miraculous cures) only after being severed from German parent firms during wartime [20].

The relative scarcity of labor in the United States made it a fertile ground for the innovation of labor-saving devices [45]. During the 1970s, U.S. concerns regarding resource scarcity shifted from labor to energy, and the demand for energy-saving devices and processes stimulated innovation activity in the area of alternative forms of energy, including biomass, solar, and photovoltaic processes. For some innovators, the energy glut of 1984 is merely a temporary aberration in the consumption of a finite resource whose reserves are clearly declining. The implications of energy scarcities for the geographical pattern of innovation and for future movements through the international product cycle are particularly noteworthy. In Europe, where experience in developing resource-saving innovations far outpaces that of the United States, there has been a keen recognition of Europe's historic dependence on petroleum, and corresponding efforts at conservation date back at least to the 1950s [15]. Efforts to prevent an interruption of supplies have included numerous government-backed efforts in oil exploration, pipeline construction, and state-owned enterprises. ENI, for example, which is owned by the Italian government, was directed by the government to pioneer ownership arrangements with Third World suppliers of petroleum. Thus, ENI set up an equity joint venture with the National Iranian Oil Company in a move that had far-reaching implications for the structure of the global oil industry [16]. Similarly, the Japanese, who are even more dependent on outsiders for energy supplies than the Europeans are, have undertaken innovative business arrangements to supplement their weaknesses [49, 43]. The ramifications of their willingness to accommodate the desires of local partners in order to achieve their objectives will have far-reaching effects on the structure of other global industries and on the locus of innovative activity.

Given their historical experiences, it is likely that the infrastructures of European and Japanese research and development facilities would be more conducive to the development of energy-saving products and processes. Using the logic of Vernon's argument [45] regarding the location of innovation, it follows that one would

expect to see energy-saving innovations developed in Europe or Japan and then moved to the United States via export initially, and subsequently through local manufacture (foreign direct investment). This pattern of geographical development and diffusion has already been witnessed in small automobiles, and soon may occur in consumer electronics and other industries [34]. (Smaller-sized appliances and consumer products have been exported to the United States successfully because local manufacturers ignored these sizes or product configurations in their product lines.) In summary, there is good reason to believe that a new pattern in trade and investment will emerge for a significant range of products. Innovation will occur in Europe or Japan. At first, the new products will be exported to the United States and later they will be manufactured in the United States under license, through joint ventures, or by the subsidiaries of European and Japanese multinationals, as well as by the overseas affiliates of U.S. firms [25, 32, 48].

Innovation and Affluence

Another characteristic of the United States market that Vernon cited [45] as being significant in shaping innovative behavior and thereby shaping patterns of trade was the presence of a large high-income market. No other national market in the OECD matches the United States for sheer size, but by 1984, median income levels for the Japanese and for many European markets had been level with the United States for a good length of time. This income parity has existed long enough that the "portfolio" of consumer goods in many Japanese or European households is far more similar to that of U.S. households than was the case fifteen years earlier. In some consumer electronics products, in fact, maturity and market saturation occurred in Japan before it occurred in the United States (thus spurring exports of those products from Japan to the U.S.).

Accordingly, if the patterns of innovation described by Vernon [45] continue to hold, there is ample reason to believe that the United States is no longer the primary site of innovations designed to appeal to a mass high-income market. One might expect the Japanese and Europeans to share more equally in this type of innovating activity, and substantial industry evidence suggests this is indeed the case. For example, the Michelin radial tire was developed in France but is now widely in use in the United States. Several years ago, Michelin began manufacturing radial tires in a South Carolina subsidiary. Thus, radial tires may be considered an example of a Stage II product which originated in a domestic market and spread overseas [45]. Videotape recorders were invented for professional use by Ampex, but were developed for the consumer electron

ics market in Japan (by Sony and Matsushita). Videotape machines are manufactured by U.S. and European firms under licenses from the innovators (or, the innovators act as sources for private-brand labeling if a U.S. firm's sales volume is too low to manufacture the VTRs in-house). Sony has a West Coast manufacturing facility now, and several other Japanese consumer electronics firms have renovated U.S. manufacturing facilities after acquiring them. To be sure, the United States will continue to have a share of the innovations aimed at high-income consumers, but the key point is that the almost exclusive U.S. dominance in this sector of innovation, which was cited by Vernon in 1966 [45] has eroded substantially. Furthermore, there is reason to believe that this position will continue to erode.

Innovation and Industrial Policy

Having discussed some changes in patterns of factor scarcity and income which may alter the geographical pattern of product innovation and diffusion as the Vernon product cycle [45] proceeds, it is necessary to explain herein how changes in the role of government could substantially modify the model's predictions, either in its original form or the modified form suggested here. Changes in U.S. industrial policy, for example, could modify the predictions of any international trade or investment model based on purely economic criteria. These policies could include support for local R&D efforts, relaxation of antitrust laws to facilitate joint innovative effort, legislation of local content quotas or other efforts designed to stimulate local innovation behavior [1, 5, 33, 38, 44]. Much has been written about the active involvement of the Japanese MITI in the stimulation of key research-based industries, and some policymakers advocate a similar role of resource allocation for some U.S. entity. It is useful to recall the relative magnitude of existing U.S. government subsidies to industry when comparing them to other nations' R&D expenditures.

Proportionately, the role of the U.S. government in the overall innovative efforts by U.S. industry is substantial. Over 50 percent of expenditures on innovation by U.S. industry has come from government sources [47]. The proportional role played by European governments in the innovative efforts of local industry has been comparable; however, that still leaves the European efforts far short of U.S. efforts in absolute terms. The purpose of mentioning these statistics is to demonstrate the importance of government policy in determining the geographical pattern of innovation and the diffusion of innovations across national boundaries. (U.S. government policy toward innovation involves defense policy, energy policy, and other questions concerning the allocation of the federal budget, and at-

tempts to explain or predict such a complex process are beyond the scope of this article.) Given the importance of federal government policy, it is worthwhile to identify some apparent forces that appear to be shaping trends in government research and development spending because awareness of these forces will allow strategists to focus their attentions on determining the implications of these forces for federal R&D policy.

There are many indications that the U.S. government will place increased emphasis on research and development in the future. The present mood of the U.S. Congress, accentuated by the conflict in Lebanon and the crisis in Grenada, makes increased military expenditures a near certainty for the next fiscal year. Furthermore, there has been a growing nationwide concern over increasing Soviet military strength after the destruction of a civilian Korean airliner. The anti-military feeling that achieved such prominence during the Vietnam war years is clearly receding. Current complacency concerning energy supplies has permitted an antinuclear movement to strengthen, but its effect does not lessen federal interest in funding research to accelerate military innovations. Increased military innovations are likely to have spreading effects into the civilian sector, and since many firms that were heavily dependent on military expenditures in the 1960s have shifted their emphasis to consumer markets, it is likely that these firms will continue to seek civilian applications for future military innovations they may develop.

Transcending government spending on defense is of general concern to the United States over its decline as a world power. Manifestations of this perceived decline include reduced U.S. technological innovations, and obsession with all things Japanese, and increased attention to the need to improve product quality. This concern represents a change in the pendulum's swing, for during the late 1960s and early 1970s, many Americans were looking inward to the correction of social inequities and corruption in government. These themes appear to have lost their momentum in recent years as attention refocuses on the space shuttle and global weapons deployment programs. Government-guided emphasis on research signals that public support for technological leadership will mean an increasing role for federal policies in shaping future technologies [12]. The implications of this role for trade patterns and foreign investment need to be monitored carefully, for they will mean a significant variance from the predictions of the international product cycle model. As U.S. firms develop strategies for sharing ideas, technological innovations, and other assets which give them competitive advantage, federal industrial policy could have significant effects upon the structures of many domestic industries which are becoming global [2, 4, 9, 11, 13, 14, 18, 24, 26, 27].

Shorter Product Lives

The second significant change in the product cycle process described by Vernon [45] is a shortening of the time frame in which products pass through the product cycle. The forces which compress this time frame are changes in the strategies and structure of modern business enterprise, particularly the multinational corporation and the development of global industries [35]. Competitive strategy has become more concerned with experience curve and appropriability concepts, and these concepts limit the applications of the Vernon product cycle. Finally, the way in which multinational enterprises develop innovations and diffuse them across national boundaries is affected by their organizational structures. The effects of these forces on the product-cycle model are developed below.

Experience Curves and the Product Cycle

The experience curve concept (sometimes called dynamic economies to scale by economists) relates how unit costs of production decrease from the first prototype to present-day volumes. Because the increasing base for doubling volumes reduces the speed with which incremental cost improvements are enjoyed as firms progress down a particular curve, the sharpest declines in unit production costs are realized in the early phases of experience [22]. The implications of this concept for competitive strategy should be clear. If firms pioneer promising products subject to steep experience curves, they could seize large market shares by pricing low and expanding production facilities rapidly. This is the strategy of a low-cost producer who preempts potential entrants, and firms that choose the strategy of racing quickly down their experience curve with an innovation will export their products or manufacture overseas more rapidly than firms that are skimming their markets or exploiting a niche of the market. Their exports will be motivated by their desire to expand the market, thereby increasing their cumulative production volume rapidly. The rapid inception of overseas manufacturing would likely be the result of firms' desires to obtain an experience curve advantage through the shared experience of overseas production. This would be especially likely if the knowledge accumulated within the innovating plant cannot be quickly or effectively transferred from the domestic plant. As in the transitions from Stage I to Stage II previously discussed, the erection of barriers to trade or the need to preempt competitors may serve as a catalyst to using this competitive weapon. Such catalysts are likely to be activated earlier in the case of an innovating firm that wishes to exploit the experience curve effect aggres-

sively for a straightforward economic reason. Cost considerations would lead innovating firms to establish foreign manufacturing facilities when the average unit cost of foreign manufacture is less than the delivered cost shipped from the home country plant (manufacturing costs plus transportation costs and tariffs). Firms that rush aggressively down the experience curve will more likely build foreign markets rapidly to the size where the cost calculation sketched above makes foreign manufacturing most economic. (The catalysts mentioned above will also remind management it needs to make periodic cost calculations to compare plant location policy with new alternatives.)

Appropriability and the Product Cycle

In the time since Vernon's product cycle was first introduced [45], the problem of "appropriability" has received increasing attention from strategists as well as academicians. (Appropriability refers to those characteristics of a new product or process innovation that determine the costliness of emulating the innovation.) If innovations are difficult, time-consuming, and costly to copy, they have high appropriability (i.e., innovators can appropriate a large portion of the monopoly profits emanating from their innovations for themselves). If innovations are easily, quickly, or cheaply copied, they have low appropriability, and innovators must move preemptively to seize as many monopoly rents as possible before rivals copy their ideas.

New products have played an increasingly important role in the strategies of many firms as their industries became subject to shorter product lives. The percentage of sales accounted for by the new products (those less than four years old) of machinery firms, for example, virtually doubled between 1960 and 1970 [40], and in the consumer sector the percentage of sales attributed to new products similarly doubled during this period. Exhibit I shows the increasingly important role of new products in international arenas. One strategic response multinational firms have used to cope with these increasing pressures for new products is to focus their innovative efforts upon products with high appropriability [30, 8]. However, some multinational firms are involved, to a substantial degree, in product lines whose innovations have low appropriability, and they continue to innovate in these products as a part of their historical corporate strategies. The low appropriability products may be complementary to the production of other high appropriability products, they may be by-products, or they may be part of an integrated global system and thus should be evaluated as part of a total-strategic system (rather than on the locus competitors may be using to formulate strategies). Alternatively, firms may face exit barriers [19]. Firms may continue

EXHIBIT 1
Frequency of First Foreign Production Within One and Five Years
of U.S. Introduction: By Period of U.S. Innovation

Period of U.S. Innovation	Number of Innovations	Percent Produced in Foreign Markets	
		Within One Year of U.S. Introduction	Within Five Years of U.S. Introduction
1945-1950	161	5.6%	22.0%
1951-1955	115	2.6%	29.6%
1956-1960	134	10.4%	36.6%
1961-1965	133	24.1%	55.6%
1966-1970	115	37.4%	60.1%
1971-1975	75	38.7%	64.0%

A sample of forty-four large U.S. firms was selected on the criterion of broad representation across product sectors. On the basis of extensive library research and in-depth interviews with company executives, a list was developed of new products introduced by each company between 1945 and 1976. These products were then screened for commercial and technical significance. Only those with cumulative sales in excess of \$10 million were included. In addition, knowledgeable persons were asked to categorize new products in terms of technical significance.

Each product was then traced from its initial introduction in the United States to all foreign markets in which the product had achieved sufficient sales volume to warrant the establishment of local manufacturing, assembly, packaging, or distribution operations through a licensing arrangement or direct investment.

to lavish attention on low appropriability products because they have recently invested in machinery, they have invested heavily in campaigns to build brand awareness, or they wish to hold the product in their full-line portfolio as a block against potential entrants seeking a toehold investment.

If firms pursue a strategy of innovation for products or processes of potentially low appropriability, how could they exploit their transitory competitive advantage? Assuming that innovators seek to maximize sales revenue in the short run while minimizing investment exposure (and assuming constant costs or increasing returns to scale), a short-run monopoly price should be charged to reflect the brief period when they possess exclusive advantages. Since innovating firms do not build overseas subsidiaries around the world for the purpose of manufacturing low appropriability products, basic research efforts should be combined with a skillful mixture of timely export, licensing, or joint-venture agreements to minimize their asset investments while maximizing market penetration and short-run profits. Thus, they develop new, high appropriability products while maximizing profits on low appropriability products before emulators can reduce profits.

The implications of the appropriability example for the Vernon product cycle [45] are similar to those for an aggressive experience curve strategy. One would expect a low appropriability product to pass quickly from Vernon's Stage I to Stage II and even to Vernon's

Stage III (global transshipment from low-cost manufacturing sites). Thus, this corporate strategy imperative also creates a temporal compression in the Vernon product cycle [45]. As Exhibit 1 indicates, the international product cycle has been compressed with respect to time. From 1971 to 1975, almost 40 percent of all U.S. innovations included in the sample were produced within one year of their U.S. introduction. This statistic stands in sharp contrast with a 10 percent rate from 1956 to 1960. From these corporate strategies—"racing down the experience curve" and "quick exploitation of low appropriability innovations"—and by incorporating other contemporary realities, a more powerful application of the product cycle may be developed. The key variable that best seems to explain the time compression of the product-cycle model is multinational organizational structure, and the next section explains how skillful use of structural changes have enabled firms to manipulate their global strategies more effectively.

Corporate Strategy and Structure

Several researchers have substantiated the linkages between changes in strategy (to accommodate or preempt changing environments) and changes in organizational structure (to accommodate the new strategy). The adaptation process is sometimes painful and complex, but it becomes inevitable once strategy changes have been

EXHIBIT 2
Years to First Foreign Production by Organizational Stage of Innovator

Organizational Stage at the Time of Innovation*	Total Number of Innovations	Years to First Foreign Production					More Than 10
		0	1	2	3-5	6-10	
Domestic Function Divisions	104	4	6	5	11	27	51
a. Without international division	79	1	3	1	7	21	46
b. With international division	25	3	3	4	4	6	5
Domestic Product Divisions	242	21	18	27	62	66	48
a. Without international division	95	5	3	9	26	27	25
b. With international division	147	16	15	18	36	39	23
Global Product Division	18	6	6	4	2	0	0
Global Area Divisions	6	2	1	1	2	0	0
Global Matrix	19	5	7	2	5	0	0

* The sample used in this exhibit is limited to those parent firms for which historical data exist on successive organizational stages and years of organizational transition. Innovations are tabulated according to the organizational stage of the firm at the time the innovation was introduced in the U.S. For definition of organizational stages, see J.M. Stopford and L.T. Wells, Jr., *Managing the Multinational Enterprise: Organization of the Firm and Ownership Subsidiaries* (New York: Basic Books, Inc., Publishers, 1972).

realized [3, 7, 10, 39]. If the strategy change is a related diversification, firms may use their existing facilities or trained and highly skilled personnel to develop new lines of business. Stress will plague their management systems unless accommodations are made for new ways of transferring some information across shared facilities rather than along functional lines. Furthermore, new product responsibilities (encompassing the "make and sell" tasks) must be delineated to accommodate changing markets and ways of competing across geographical boundaries, and control systems must parallel these new realities. Finally, the divergent time and goal orientations of managers must be reconciled in firms' planning systems.

Stopford and Wells [41] found a fairly predictable pattern of strategy and structural development in multinational enterprises which echoed Chandler's [7] findings. Although a firm's initial involvement in foreign markets often arises through unsolicited export orders or requests by local customers for foreign shipment, as such requests are repeated the firm seeks formal distribution arrangements in foreign markets and begins to develop international capabilities [42]. As its export business grows, the firm may create a slot within its marketing organization for export managers, and these individuals maintain a vested interest in continuing (and expanding) the firm's involvements in foreign markets. As export volumes increase further, distribution and sales arrangements which sufficed in the past are transcended by the firm's own sales and service offices overseas [46]. If sales volumes warrant further investments, the firm may enter into licensing agreements with local producers or build its own overseas manufacturing facilities to obtain local supplies of

their products. As firms become more involved in foreign markets, their organizations (and ways of conceptualizing the coordination of international activities) necessarily undergo changes. Whether international operations are centralized in a division which administers export sales, licensing arrangements, and facilities overseas or are integrated into product-line responsibility, the changes sketched above in the product-cycle model suggest a need for new ways of thinking about introducing new products.

In an emerging multinational organization, innovations developed in domestic markets are exploited there first, and international units are often given second priority. If the foreign managers are aggressive in their marketing strategies (and if the products are appropriate or easily adaptable for their markets), development of foreign markets can occur more rapidly where a free hand is given to these representatives. As foreign operations assume a greater role in overall corporate activities and the focus of corporate strategy becomes global, firms that have developed corresponding global organizations have the opportunity to match product innovations with market opportunities almost immediately *wherever they may occur*. The more effective global systems would permit rapid matching of local product needs with innovations, and where the specific products needed are not immediately available, centralized resource allocators could "hire" the innovating unit within the corporate family that is best suited to develop products to be its supplier. Priorities would be established according to market attractiveness measures, experience curve and appropriability criteria, and other dimensions deemed crucial to global strategies in order to ration scarce research

monies. Subsidiary area managers would coordinate with product divisions in order to coordinate product introduction campaigns, and this process would balance divisional priorities with the priorities of area managers to exploit those opportunities offering the greatest relative merit.

Exhibit 2 suggests a general trend toward faster responses for firms using globalized organizational structures. These data suggest that as multinational firms advance through the structural evolutions described above, their time frame within which innovations pass from Vernon's Stage I to Stage II shrinks considerably [8]. Thus, firms with international divisions manufacture new products abroad more rapidly than similar firms without divisions of commensurate status. In the case of functionally organized firms, 40 percent of the innovations from firms with some form of international division were manufactured overseas within two years or less, but only 6 percent of the innovations of functionally organized firms without international divisions were diffused abroad rapidly. For firms organized along product lines, the analogous figures were 33 percent for firms with international divisions and only 18 percent for firms without divisions of commensurate status. About 80 percent of all products innovated within globally integrated organizations were manufactured abroad within two years or less, and every innovation in this sample for that subgroup was diffused globally within five years or less.

The implications of these data for the Vernon product cycle [45] are also straightforward. As the struc-

tures of multinational firms evolve (in response to their global strategies), the time frame in which the Vernon product cycle [45] progresses is compressed substantially. Briefly, in a world populated by multinational firms with globalized matrix structures, questions of the geographical location of innovation (a key factor in the Vernon product cycle [45]) have virtually no place in explaining patterns of trade. As global systems become crucial as a means of competing for competitive advantage, innovations must be developed in multiple locations, refined in other sites where value can be added, and adapted to local markets where opportunities seem most attractive. Rapid product lives and low product appropriability will exacerbate firms' needs for coordinating mechanisms to accelerate information exchange and enhancing innovative activity. In some settings, these mandates will be achieved by forming coalitions with a variety of domestic industry participants [21]. In other settings, firms will have to break down insular viewpoints and parochial loyalties to surmount national boundaries and a "not invented here" syndrome which can taint innovative organizations. Greater autonomy and status equalization may also be necessary to incubate the type of corporate setting where overseas subsidiaries receive commensurate attention and opportunities to innovate in the interests of their global family. Although the precise balance of these trade-offs will differ from firm to firm, it is no longer safe to rely upon a unidimensional innovation strategy within global industries.

REFERENCES

1. M. Baldrige, "Testimony: On Government Policies to Promote High Growth Industries Based on New Technologies and to Increase U.S. Competitiveness," Committee on Finance, U.S. Senate, January 19, 1983.
2. H. Banks, "Partners of Necessity," *Europe*, November-December 1981, pp. 31-33.
3. C.A. Bartlett, "MNCs: Get Off the Reorganization Merry-Go-Round," *Harvard Business Review*, March-April 1983, pp. 138-146.
4. P. Beamish and H.W. Lane, "Need, Commitment and the Performance of Joint Ventures in Developing Countries," working paper, University of Western Ontario, July 1982.
5. J.F. Brodley, "Joint Ventures and the Justice Department's Antitrust Guide for International Operations," *Antitrust Bulletin*, Summer 1979, pp. 337-356.
6. J.F. Brodley, "Joint Ventures and Antitrust Policy," *Harvard Law Review*, May 1982, pp. 1523-1590.
7. A.D. Chandler, *Strategy and Structure: Chapters in the History of the American Industrial Enterprise* (Cambridge, Mass.: The MIT Press, 1962).
8. W.H. Davidson and R.S. Harrigan, "Key Decisions in International Marketing: Introducing New Products Abroad," *Columbia Journal of World Business*, Winter 1977, p. 19.
9. H. Davies, "Technology Transfer Through Commercial Transactions," *Journal of Industrial Economics*, December 1977, pp. 161-175.
10. S.M. Davis, "Trends in the Organization of Multinational Corporations," *Columbia Journal of World Business*, Summer 1976, pp. 59-71.
11. J.L. Duncan, Jr., "The Causes and Effects of Domestic Joint Venture Activity," unpublished doctoral dissertation, University of Florida, 1980.
12. K.P. Ewing, Jr., "Joint Research, Antitrust, and Innovation," *Research Management*, March 1981, pp. 25-29.
13. R.W. Ferguson, Jr., "The Nature of Joint Ventures in the American Manufacturing Sector," unpublished doctoral dissertation, Harvard University, 1981.

14. T.A. Flaim, "The Structure of the U.S. Petroleum Industry: Concentration, Vertical Integration and Joint Activities," unpublished doctoral dissertation, Cornell University, 1977.
15. L.G. Franko, *The European Multinationals* (London: Harper & Row, Publishers, Inc., 1976).
16. W.G. Friedmann and J.P. Beguin, *Joint International Business Ventures in Developing Countries* (New York: Columbia University Press, 1971).
17. R. Gilpin, *Technology, Economic Growth, and International Competitiveness*, U.S. Congress, Joint Economic Committee, Subcommittee on Economic Growth, 94th Congress, 1st Session, 1975.
18. S.O.O. Gullander, "An Exploratory Study of Inter-Firm Cooperation of Swedish Firms," unpublished doctoral dissertation, Columbia University, 1975.
19. K.R. Harrigan, *Strategies for Declining Businesses* (Lexington, Mass.: D.C. Heath & Co., 1980).
20. K.R. Harrigan, *Strategies for Vertical Integration* (Lexington, Mass.: D.C. Heath & Co., 1983).
21. K.R. Harrigan, "Strategies for Joint Ventures," unpublished book-length manuscript in process, Columbia University, March 1983.
22. B. Henderson, "The Experience Curve . . .," Boston Consulting Group, 1974.
23. S. Hirsch, "Location of Industry and International Competitiveness," unpublished doctoral dissertation, Harvard Business School, 1965.
24. J.D. Hlavacek and V.A. Thompson, "The Joint Venture Approach to Technology Utilization," in *ILEE Transactions on Engineering Management*, Vol. EM-23, No. 1, February 1976, pp. 35-41.
25. A. Hughey and M. Kanabayashi, "More U.S. and Japanese Companies Decide to Operate Joint Ventures," *The Wall Street Journal*, May 10, 1983, p. 33.
26. J.P. Killing, "How to Make a Global Joint Venture Work," *Harvard Business Review*, May-June 1982, pp. 120-127.
27. J.P. Killing, "Technology Acquisition: License Agreement or Joint Venture," *Columbia Journal of World Business*, Vol. 15, Fall 1980, pp. 38-46.
28. F.T. Knickerbocker, *Oligopolistic Reaction and Multinational Enterprises* (Boston, Mass.: Harvard Business School, 1973).
29. P. Kotler, *Marketing Management: Analysis, Planning, and Control*, 2d ed. (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972).
30. S.P. Magee, "Information and the Multinational Corporation: An Appropriability Theory of Direct Foreign Investment," in J.N. Bhagwati, ed., *The New International Economic Order* (Cambridge, Mass.: The MIT Press, 1977), pp. 317-340.
31. I.C. MacMillan, "Preemptive Strategies," *The Journal of Business Strategy*, Fall 1983, pp. 16-26.
32. P. Mariti and R.H. Smiley, "Co-operative Agreements and the Organization of Industry," *Journal of Industrial Economics*, June 1983, pp. 437-452.
33. D.B. Merrifield, "Forces of Change Affecting High Technology Industries," *National Journal*, Jan. 29, 1983, pp. 253-256.
34. C.K. Orski, "The World Automotive Industry at a Crossroads: Cooperative Alliances," *Vital Speeches*, Nov. 15, 1980, pp. 89-93.
35. M.E. Porter, *Competitive Strategy: Techniques for Analyzing Industries and Competitors* (New York: The Free Press, 1980).
36. E. Rogers and F.F. Shoemaker, *Communications of Innovations* (New York: The Free Press, 1971).
37. W.W. Rostow, *World Economy: History and Prospects* (Austin, Texas: University of Texas Press, 1977).
38. F.M. Rowe, "Antitrust Aspects of European Acquisitions and Joint Ventures in the United States," *Law and Policy in International Business*, pp. 335-368.
39. R. Rumelt, *Strategy, Structure, and Economic Performance* (Boston, Mass.: Division of Research, Harvard Business School, 1974).
40. F.M. Scherer, *Industrial Market Structure and Economic Performance* (Chicago: Rand McNally & Co., 1980).
41. J.M. Stopford and L.T. Wells, *Managing the Multinational Enterprise* (New York: Basic Books, Inc., Publishers, 1972).
42. C.L. Suzman, "The Changing Export Activities of U.S. Firms With Foreign Manufacturing Affiliates," unpublished DBA thesis, Harvard Business School, 1969.
43. Y. Tsurumi, *The Japanese Are Coming* (Cambridge, Mass.: Ballinger Publishing Co., 1976).
44. U.S. Department of Justice, Antitrust Division, "Antitrust Guide for Joint Research Programs," *Research Management*, March 1981, pp. 30-37.
45. R. Vernon, "International Investment and International Trade in the Product Cycle," *Quarterly Journal of Economics*, May 1966, pp. 191-207.
46. R. Vernon, *Sovereignty at Bay: The Multinational Spread of U.S. Enterprise* (New York: Basic Books, Inc., Publishers, 1971).
47. R. Vernon, *Storm Over the Multinationals* (Cambridge, Mass.: Harvard University Press, 1977).
48. N. Vitorovich, "How Companies Learn to Love Their Competitors," *The Wall Street Journal* (Europe), March 15, 1983, p. 23.
49. M.Y. Yoshino, *Japan's Multinational Enterprise* (Cambridge, Mass.: Harvard University Press, 1976).