

Published in 1985 for the Royal Commission on the Economic Union and Development Prospects for Canada (the Macdonald Commission), Richard Harris's background study on trade and industrial policy appeared at a critical juncture in the country's postwar development. The Canadian economy had enjoyed a sustained period of economic growth from the late 1940s to the early 1970s, but experienced two major recessions in the following decade. Both employment and inflation remained at stubbornly high levels during this period, with little agreement on appropriate policy responses to these problems (Campbell 1991). Equally challenging was the dramatic change to the competitive position of a broad cross section of the manufacturing economy, arising from the emergence of competitors among newly industrializing nations and increased protectionism in the US economy. The first stirrings of a far-reaching technological revolution were at the core of these changes, driven by the introduction of microelectronics technologies embedded in semiconductors and microprocessors that would gradually disrupt virtually every sector of the economy over the coming decades.

While the economic benefits delivered by the signing of the Auto Pact with the US in 1965 were still continuing to flow to the central Canadian economy, other traditional industrial sectors, including textiles, shipbuilding, and food processing were undergoing major structural changes and the government was struggling to help these sectors adapt to the more competitive global environment that they faced (Atkinson and Coleman 1989). In the early 1980s, the federal cabinet went through a wrenching internal debate over the benefit of adopting an industrial strategy that became known as the "mega-projects strategy," based on using the anticipated development of the Mackenzie Valley pipeline and other western energy projects to support the development of key industrial sectors in Central Canada (Doern 1983). While the more interventionist of the proposals had been rejected in the cabinet debate, the issue of how to facilitate Canada's adjustment to the new competitive international environment remained unsettled.

During the 1970s and early 1980s, the domestic debate over economic policy directions became polarized between a strongly trade-oriented approach to economic adjustment, identified with the views of the Economic Council of Canada, and a more interventionist approach that supported an industrial strategy to promote Canada's technological sovereignty, associated with the views of the Science Council of Canada. The trade and market-oriented approach of the Economic Council advocated the elimination of trade and investment barriers between Canada and the US to allow market forces to effect a more efficient continental rationalization of Canadian manufacturing that would increase productivity and promote the international competitiveness of that sector. Following rapidly on the heels of a failed negotiation of sectoral trade agreements with the US, a comprehensive free trade agreement with Canada's leading trade partner was viewed as the most effective way to achieve this goal. Standing in sharp contrast were the views of the Science Council of Canada, which argued in favour of an expanded role for the state and government policy, not a greater reliance on market forces. The Science Council advocated the adoption of a form of industrial strategy that would promote the growth of indigenous manufacturing firms with greater capabilities in scientific research and industrial innovation, leading to its preferred outcome of greater technological sovereignty for Canada (Williams 1994, 139).

### **<1> The Context**

Richard Harris's monograph was published in the context of this policy maelstrom in 1985. Harris at the time was regarded as one of the most innovative of a new generation of trade economists, regularly consulted by the federal and provincial governments as a critical source in the design of trade policy. His work was best known for the integration of key insights from the literature on industrial organization into theories of international trade to develop a sophisticated and original model for assessing the broader economic impacts of trade liberalization on the Canadian economy. His work was more closely associated with the Economic Council side of the policy

debate. An earlier study carried out for the Ontario Economic Council was a widely cited contribution to the field (Harris and Cox 1983).

Harris's study was part of one of the most comprehensive and far-reaching analyses ever undertaken of the Canadian economy and the suitability of its governance institutions to meet the emerging challenges they faced. The Macdonald Commission research program resulted in the publication of seventy-two volumes of background studies, while its public consultations were the most extensive undertaken to that time by a Royal Commission. On both counts, the Macdonald Commission far outstripped the activities of the two predecessors to which it is often compared, the Royal Commission on Dominion-Provincial Relations (Rowell-Sirois) in the 1930s and the Royal Commission on Canada's Economic Prospects (Gordon) in the 1950s (Bradford 1998, 112–17). From this perspective, the Macdonald Commission represented the “largest social science research program in Canada” (Inwood 2005, 6); but what proved to be most remarkable was the fact that the bulk of the research program was overlooked or dismissed by the Commissioners in their final report. The principal exception was the research on free trade, which provided the foundation for the Commission's most enduring legacy.

Richard Harris's contributions constituted a critical part of the Commission's body of research. He was the author of a chapter in the volume about Canada-US free trade that summarized his larger study, undertaken with David Cox, for the Ontario Economic Council in 1983. His studies on trade liberalization, completed by the time of the Macdonald Commission's work, had led him to the conclusion that a free trade agreement between Canada and the US was the best available policy option for Canada. However, he was concerned that the framework of those studies, and virtually all of the cost-benefit analysis done on trade policy at the time, dealt with the level of technology between countries as an exogenous factor, something that was not uncommon in most economic models at the time. He believed that the broader impact of increased trade on economic growth could not be explained without properly taking into account the role of technological change. His concern with filling this gap in the literature and the prevailing analytical models led to the study reproduced here. The great irony is that it was the original

Harris-Cox general equilibrium model that was the most widely cited source of evidence in support of free trade by the commission's economists. This model's appeal to both the staff economists and the commissioners themselves lay in its prediction of productivity increases and gains to real income from a potential free trade agreement. For this reason, the Harris-Cox findings exerted a strong influence over the commission's final report and its recommendations (Inwood 2005, 211).

The volume reproduced here in the Carleton Library Series, intended as it was to complement the analysis presented by the econometric modelling, met with more skepticism in the commission's report. This study was designed to provide the commission with a sweeping review of the current state of the literature on international trade theory, industrial organization, and technological innovation in order to shed light on the broader implications of adopting a free trade agreement for the Canadian economy. The resulting monograph was surprising to many on both sides of the policy debate for its penetrating and nuanced analysis of the multiple factors influencing the patterns of industrial organization and competitive strategy adopted by firms in the Canadian economy. As John Whalley correctly predicted in his preface to the volume, "Some of his conclusions – that free trade and an active industrial policy are complements, not substitutes, and that picking winning industries to promote is both viable and desirable – will be controversial" (xv).

The central concern motivating Harris's monograph was the changing global context for Canadian firms, particularly those in the manufacturing sector. During the 1970s and 1980s the process of rationalization and economic restructuring accelerated across the industrial economies. Rapid rises in unit labour costs during the previous decades had altered the cost-benefit calculus of investment in newly industrializing countries and adoption of labour-saving technology. The competitive challenges faced in these decades were in part a consequence of the emerging "new international division of labour" sparked by the shift of production activities to sites in the "newly industrializing countries" (NICs) of Latin America and East Asia. The increasing technical specialization of the labour process meant that the production of even relatively complex

electronic components, such as semiconductors, could be broken down into tasks simple enough to be performed by less-skilled labour in these countries. Improvements in the computerization of transportation and communications technologies made it easy to exercise centralized managerial control over production facilities spread throughout the Pacific Rim. The attractiveness of production locales in the Third World was also increased through the creation of free-trade zones in which governments assured the availability of labour and subsidized much of the costs of relocation through the servicing of industrial sites (Dicken 2011).

Harris was equally concerned about the economic consequences of the microelectronics revolution, which was gaining momentum as he wrote. Many of the economic changes described above were made possible by the advent of this revolution, which began with the invention of the transistor in 1947 and accelerated over the next two decades with the widespread use of integrated circuits and microprocessors in a growing range of industrial applications. The microelectronics revolution is based on three related developments in semiconductor technology: first was the invention of the solid state transistor at Bell Laboratories in 1947, which reduced the size and energy consumption of active electronic components; second was the demonstration of the integrated circuit by Fairchild Semiconductor in 1959, which compressed large numbers of electrical components onto a single chip, accelerating the trend towards miniaturization; and third was the production of the first microprocessor by Intel, then Texas Instruments in 1971 incorporating all the components of a complete processing unit onto one chip (Castells 1996, 41–2). The cumulative effect of these innovations led to multiple applications in numerical control, computerized numerical control, robotics, automated handling systems, computer-aided design and computer-aided manufacturing, and flexible manufacturing systems. The key feature of these new forms of programmable automation was the potential for their application across all three spheres of production – design (comprising the R&D function), manufacture (the shop floor), and coordination (the office function). By the 1980s, rapid advances in the technology and further reductions in cost led to the integration of these technologies into all aspects of the production process (Kaplinsky 1987, 27–30). Harris astutely recognized the disruptive potential of these new

technologies and suggested that the “computer on a chip” made possible by their cumulative effects presaged a dramatic change in manufacturing industries and equally far reaching consequences for world trade in industrial products (7).

While Harris’s study was one of the few in the commission’s extensive research program to consider the implications of technological change for Canadian industry (McFetridge 1985), it was not alone in identifying the growing challenge that new technologies posed for traditional patterns of Canadian investment in industry and international trade. In fact, it touched on similar themes found in some of the analyses presented in background studies for the Science Council of Canada in the previous decade. Particularly noteworthy was the study by John Britton and James Gilmour entitled *The Weakest Link: A Technological Perspective on Canadian Industrial Underdevelopment* (1978). Britton and Gilmour’s main argument was that the underperformance of Canada’s industrial economy could best be explained by firm behavior with respect to their investments in innovation and technology development and by the role of foreign direct investment in the Canadian economy. The low level of technological sophistication and the relative lack of innovative behavior were directly attributable to the choices made by individual firms operating in the Canadian economy. Britton and Gilmour showed that Canadian subsidiaries of foreign firms largely depended upon the transfer of mature industrial and product technologies from their parent companies. As a consequence, Canada was a recipient in the international technology transfer system and, for the most part, domestic firms depended on this imported technology or were imitative of it. Small domestic firms in the Canadian economy were constrained by their limited capacities and the lack of support they received from public purchasing or procurement and investment. An additional consequence of these factors was the overreliance of the Canadian economy on the production of manufactured goods that depended on mature product technologies.

Britton and Gilmour’s study suggested that Canada could improve its innovative performance by investing more in scientific research and development, but this, on its own, would be insufficient to overcome the technological deficit that the country was facing. Given the limited

incentives for technological development offered by the marketplace in Canada, improving the overall technological performance of major industries would require much more. The failure of Canadian firms to respond to market incentives alone inferred the need for government action to regulate the technology imports and strengthen the bargaining power of Canadian firms when purchasing technology from abroad. The concluding chapter of the study suggested that technology policy in Canada required attention to both the demand and the supply side of what has subsequently been called the Canadian innovation system. Canadian policy has traditionally concentrated on increasing the supply of research and development as a necessary prerequisite for industrial innovation in products and processes. However, the impact of this approach was limited to fewer than 500 firms at the time. More importantly, these policies were never coordinated into a coherent industrial strategy. The traditional policy approach focused on the generation of new knowledge without considering the full range of linkages required to stimulate demand for new products or strengthen the connection between innovation and broader economic goals. While Harris would disagree with Britton and Gilmour's emphasis on the critical role of foreign direct investment in limiting Canadian technological development, his approach shared a common concern with the impact of broader market conditions and industrial structure on the innovative performance of domestic Canadian firms, especially smaller and medium-sized ones.

Beyond Canada's borders, another range of new studies published in the 1980s also formed a significant part of the context in which Harris' thinking was framed. Endogenous growth theory as formulated by Paul Romer was recasting the role of knowledge creation and innovation in macroeconomic theory from a residual or external factor to a central part of the equation. At the same time, organization theorists and management experts like Michael Spence and Michael Porter were linking ideas in economic theory to strategic thinking about industrial organization and business strategy. Spence's work in the late 1970s emphasized the fact that barriers to entry in existing industries were created through a mix of structural and technological factors with additional obstacles, such as investment in excess capacity (Spence 1977). This led to what Harris called the theory of strategic pre-emptive investment which could create competitive advantages

for first-movers or oligopolistic firms who could realize scale economies in production or R&D. Porter's work in the early 1980s linked different types of multinational enterprises with the relation between firm location, firm strategy, and market structure (1980). Porter's analysis led Harris to the conclusion that the future of manufacturing in small open economies was quite disadvantaged without the prospect of integration into a larger regional economy. However, economic integration without an analysis of the potential source of the smaller economy's competitive advantage in the new trading environment, and the policy support that would be needed to create and sustain that competitive advantage, could be a recipe for trouble. These concerns led him to focus on the need for an "industrial policy" to complement the impending prospect of tighter economic integration into the North American economy.

### **[1] The Argument**

In the context of these developments and the challenges they posed for the competitiveness of Canadian firms, Harris set out to examine a number of issues that he deemed critical to the future development of the Canadian economy. An important question for the study was what kind of industrial structure the government should seek to promote. To what extent should governments rely on the market system to frame the contours of the industrial structure and what consequences should increasing international free trade have in determining the nature of this structure? Finally, and most significantly, he asked if there was a role for industrial strategy in promoting the growth of certain industries deemed to be important for the future of the Canadian economy. His central concern was with the interplay of the microeconomic aspects of international trade and the resulting need for structural policies to offset or balance the less desirable consequences of increasing Canada's openness to those competitive forces through free trade agreements. He maintained that a more open and liberal trading environment was essential for bringing about the greater rationalization and efficiency needed to improve productivity and increase real incomes, but recognized that unrestricted free trade, introduced into a small, open trading economy such as



Canada's posed significant innovation challenges for domestic firms, especially smaller, indigenous ones – a point largely lost on the majority of his colleagues.

The monograph begins with a clear statement of preference for a strong reliance on free markets and a belief that government intervention should only occur in cases where the consequences of a market failure can be identified, or where intervention is justified based on strong social and economic justice concerns. However, he adds the qualification that there may be situations where neoclassical analysis is inadequate in the investigation of a potential problem and that there is justification for increased reliance on government policy to promote or drive structural change (3). As noted above, an underlying assumption of the study was the impact that emerging trends in microelectronic and information technology were likely to have on the traditional manufacturing industries in Canada and the implications of this technological revolution for world trade in industrial products. A major consequence of these technological changes would be the displacement of low-skilled labour by computer-based equipment and the introduction of a host of new products and process innovations that would have dramatic effects on the structure of existing industries (7). With the benefit of thirty years of hindsight, it is striking how prescient his insights were with respect to the dramatic and sweeping effects these changes have had on employment and skill requirements (Brynjolfsson and McAfee 2011; 2014), which makes its republication all the more timely and relevant.

The analysis begins with the standard view in orthodox economics that patterns of trade and investment are best explained by the doctrine of comparative advantage and that free markets are the most effective mechanism for realizing the benefits of trade and exploiting the opportunities that arise from comparative advantage. However, he immediately departs from this approach by suggesting that most economists would admit that these assumptions do not accurately reflect the dynamics of economies operating in the real world. This brings into question the value of these assumptions in understanding the implications of global competition for Canadian economic development, as it is Harris's opinion that "the strict paradigm of neoclassical trade theory is not useful or accurate in its description for a substantial part of world trade and

investment patterns” (12). In contrast, he prefers a more eclectic framework drawn from literature in the field of industrial organization, which is more concerned with imperfect market structures and with the inner workings of product markets, individual firms, and broader industries. His alternative framework draws from a diverse range of sources that recognize the impact of the economics of information and the potential for market failure in a variety of settings, including the case of private funding of basic research identified by Kenneth Arrow (1962). He goes a step further in arguing that many markets are oligopolistic or monopolistic in their structure. Recognition of this fact is of considerable value in explaining trade and investment patterns in Canada and their overall impact on the Canadian economy (14). The introduction presages the analysis to follow, stating that “a coherent industrial policy for Canada based on selected and limited forms of government action is crucial to sustaining long-term growth and employment while keeping the social risks of such policy within acceptable limits” (14–15).

The subsequent chapters present key insights for understanding the competitive dynamics of the Canadian economy, derived from his review of the literature. The second chapter reviews comparative trade theory, focusing on a number of contradictions that arose in the 1950s and 1960s between the predictions of formal theorizing and the findings of empirical tests. The need to explain these paradoxes, combined with the intellectual and policy impact of the “Sputnik” moment in 1957, led to an increased focus on the importance of technology in explaining economic growth and the related importance of the technological composition of international trade. Some of the insights generated by this new generation of theorizing and empirical testing became formalized in the 1960s with the exposition of the product cycle theory, which identified the link between technological innovation, the increasing technological intensity of US exports, and the growth of foreign direct investment by US multinationals (23). The reconstruction of the German and Japanese economies in the postwar period, combined with the global orientation of US multinationals, led to a rapid acceleration in the pace of technology transfer, with new technologies introduced in competing markets after much shorter lead times. Another significant development in the 1970s was the emergence of high-growth nations in the developing world and

the expansion of their manufacturing capacity. These newly industrializing countries (NICs) began to exploit competitive advantages in product markets not covered by the traditional version of the product cycle model.

By the 1980s the relationship between world trade, international investment, and competitive dynamics had changed significantly. The rise of the NICs, in conjunction with the convergence of wage rates in the industrialized countries and economies of scope and flexibility made possible by the microelectronics revolution, meant that the starting point for new product cycles would no longer necessarily be located in more industrialized countries like the United States, and by extension, Canada. Drawing from Joseph Schumpeter's theories of technological innovation, Harris anticipated that the microelectronics revolution would trigger a race for technological advantage, and considering the resources required to succeed in this race, governments and multinationals would be the leaders. The key limiting factor in how the benefits of the technological race would be distributed across nations was the ability of firms or governments to contain the spillover of intellectual property and proprietary knowledge generated through this innovation process and prevent it from leaking abroad through the export of high-technology products by multinationals to competitor firms and nations. The competitive nature of this technological race gave countries a strong incentive to retain within their own borders as many of the benefits from technological leadership as possible. The major benefits of innovation would accrue to those firms or countries able to capitalize on the higher prices generated by the technological or "Schumpeterian" rents that can be collected as a result of the innovative nature of new products and processes. The costs involved in generating these innovative new products and the superior rents that accrue to them are significant enough that governments would need to be large-scale investors in developing the technologies (30) (Janeway 2012; Mazzucato 2013).

The outcome of this emerging race for the control of trade in high-technology products was far from predetermined. Harris suggests that the likely result would be a trade surplus of high-technology products in those countries with strong public support for research and innovation

and strong inducements for multinationals to retain the manufacturing of the products in the countries where the research was done. This would be matched by a growing deficit in middle-technology standardized products and in labour-intensive, low-skill products characteristic of older or more traditional industries (30). He expected that there would also be an increase in the relative importance of the NICs as exporters of high-technology products. While he was correct in this prediction, one development neither he nor most observers fully anticipated was the speed with which China would integrate into the global economy and emerge as a major force in the production of technology-intensive products and as a funder of R&D following the reforms introduced in 1979. He recently observed that had the accession of China to the world stage been more accurately predicted, it might have created a wider basis of acceptance for the arguments in favour of industrial policy (private communication).

The monograph proceeds to examine the implications of this theory for Canada. It highlights the fact that empirical tests of the theory of comparative advantage strongly reinforce the point that Canadian exports and the factor content of those exports is biased in favour of raw materials and natural resources. In addition, the factor content of Canadian goods imports tends to be more intensive in skilled and professional labour with a strong technical and scientific orientation. He then analyzes one of the key deficiencies of the factor proportion theory of comparative advantage, namely its inability to provide a satisfactory explanation for the lack of resource processing that occurs in Canada. Despite numerous policy recommendations to increase the value-added in the resource sector as a way of exploiting Canada's comparative advantage in natural resources, the revealed comparative advantage in trade suggests otherwise, since there has historically been a relatively small amount of domestic resource processing (47). The analysis concludes that the factor proportion-comparative advantage theory of international trade can be misleading if used as the basis for policy prescriptions in a regionally diverse country such as Canada. Using the national comparative factor abundance as the criteria for determining an economic development strategy encourages the fostering of resource-intensive industries at the expense of large-scale manufacturing industries, which may offer greater potential for increasing

exports in technologically-intensive industries. This failure can thus exacerbate regional disparities across the country.

The next chapter reviews the literature on economic integration, examining some of the concerns over the potential economic impact on the Canadian economy of tighter integration into the North American economy. As traditional locational factors, such as transportation costs and distance to market receded in importance, the most important factors influencing the location of economic activity in Central Canada remained the strength of its economic infrastructure and a highly skilled labour force. These factors are vulnerable to external shocks in the form of technological innovation and the competitive impact of low-cost producers. The combined effect of this vulnerability necessitates greater attention being focused on product market structures and the determination of factor prices in regional markets (61). While free trade creates advantages in terms of reaping greater benefits from external economies, it also increases the potential to lose some mobile firms in these industries. Harris recognizes that relying on traditional macro-scale policy instruments might prove an inadequate response in these circumstances and that the complexity of the relevant economic factors would require a “more pragmatic, piecemeal approach to industrial policy,” based on a more cooperative bargaining approach between the government and private firms as a way to induce the desired forms of economic behaviour (74).

The analysis then reviews the challenges of entry barriers and competition for small open economies. In the case of small open economies such as Canada’s, the operation of free market forces may lead to an imperfectly competitive market structure. He reviews the work by Canadian economists on the effect of the domestic tariff in producing a suboptimal industrial structure in Canada. This research concludes that “the revealed comparative advantage of Canada in resources, and the net deficit on manufactured products during the 1970s, was due in large part to the tariff induced inefficiency of the manufacturing sector” (77). Other research suggests that the presence of scale economies may create entry barriers in export markets, with the consequence that even after domestic tariff barriers have been reduced, domestic firms from a small open economy may still face significant challenges in gaining entry to foreign markets. Entry to foreign markets is

particularly difficult in industries where scale economies are significant, with the result that the world industry in these sectors is highly concentrated, especially sectors closely linked to the US defence industry. The question of firm size is a critical factor in many industries. Without the presence of a sufficiently large firm, the chances of successful entry are limited. This poses a significant challenge for the crafting of government policy: governments may either promote the merger of small firms to increase the prospects of successful competition in larger global markets, or subsidize small firms to increase their ability to compete in more concentrated overseas markets.

He then proceeds to consider the optimal policy approach for a small open economy under these circumstances. In Canada, trade and industrial policies should be focused on maintaining as open a market as possible in the US. At the same time, positive industrial policies should be adopted to promote those industries with the potential to provide dynamic economies that are embodied in labour. In the long run, the existence of static entry barriers means that the gains from free trade for a small open economy can be substantial; conversely, in the short run, the presence of static and dynamic entry barriers may create an impediment for domestic firms from the small economies in gaining access to larger export markets. Therefore, positive adjustment policies are needed to assist the entry of domestic firms into these international markets. He maintains that these positive policies should be biased towards those industries with the greatest potential for realizing economies from learning by doing. In addition, positive industrial policy should also be concentrated where the potential dynamic gains are attributable to the acquisition of high skill levels by labour and management, rather than through substantial investments in physical capital (91–2).

Theories linking international trade with technological innovation contend that shifts in leadership are not randomly distributed across industrial sectors or between countries. From this perspective, Harris argues that much of technological competition tends to be cumulative and the nature of that competition also tends to be pre-emptive and produce irreversible results. There are substantial advantages to being first. Trying to adapt industrial and technology policy in order to

catch up to the technological leaders may prove difficult. The initial advantages that accrue to the technological leader in an area allow leading firms in that country to retain their lead for a period of time and to undermine the efforts of competitors to catch up and overtake them. The benefits of technological leadership allow a firm to recover its research and development costs, as well as realize a higher than average return on its investment. In effect, “success breeds success,” or “being successful today raises the probability of success in the future” (99). This may greatly reduce the need to compete later on, which opens an important gap between the technological leaders and laggards. It also leads to significant differences in national incomes between the two types of economies and a substantial trade surplus or trade deficit in high-technology products. This analysis has proven to be strikingly prescient with respect to a subsequent tradition of policy-related research on economic development and industrial policy: “specific technologies and specific sectors and products matter because they entail different learning opportunities and also different income elasticities of demand. Thus, today’s specializations influence tomorrow’s productivity growth, chances to innovation, and demand potential” (Cimoli, Dosi, and Stiglitz 2009, 3).

The problems that Canada faces are compounded by the bias in small open economies against Schumpeterian or technology-based industries. The entry barriers associated with technological innovation affect smaller firms to a greater extent than large ones. And to the degree that smaller economies are characterized by a larger number of small indigenous firms, the entire economy is at a disadvantage with respect to technological competition, since “the Schumpeterian industries in small economies suffer from a relative disadvantage in industrial structure.” As a consequence “*the social incentive to subsidize Schumpeterian industries is greater in a small open economy than in the large closed the economy*” (105). The relatively smaller size of firms in smaller economies leads to a suboptimal industrial structure for competition in Schumpeterian-based industries. However, subsidizing R&D in small firms does not automatically ensure that they will grow to sufficient size to overcome the barriers to world markets. Nonetheless, Harris insists that changing the R&D base of firms in the small open economy is

necessary for effective competition in a technologically intensive global economy. He also warns against viewing investment in domestic R&D versus support for technology transfer from MNCs as a trade-off; rather, they should be viewed as complements in helping domestic firms develop new products that incorporate elements of existing technologies. Technology policy needs to be designed to help firms in the small open economy overcome market failures in the industrial R&D process within Schumpeterian industries.

The conclusion argues the need for industrial policy in Canada, particularly in those sectors with a greater potential to achieve future growth in international market shares. He maintains that there is nothing particularly new in this approach; targeting selected industrial sectors, such as aerospace, has long been a mainstay of federal economic policy (and continues to be to the present). Furthermore, it is important to recognize that Canada is not the only country pursuing these kinds of policies. He distinguishes between three kinds of industrial policies: reactive, parallel, and differentiated. A successful policy approach for Canada requires a mix of the latter two. A *parallel* industrial policy would imitate certain policy approaches, particularly broader framework-setting policies adopted by its larger trading neighbour, while the *differentiated* approach would emphasize strategic specialization in niches where the small open economy stands the best chance of capturing a significant international market share. Such policies need to be designed with a focus on industries where scale economies do not represent a significant barrier to entry for firms in the small economy and where product differentiation can afford them the greatest opportunity to establish successful bases in export markets. Policy should also provide substantial support for small and medium-sized enterprises, given the greater innovativeness of these firms. In Harris's view, the most effective policy instruments to achieve these goals are greater support for R&D through tax incentives, direct subsidies, loan guarantees or government procurement, and the explicit subsidization of lower-cost loans in capital markets (106, 138). He concludes with an explicit statement that greater access to world markets through free trade is not enough: "An industrial policy which emphasizes positive adjustment in the face of world competition and technological change should be actively pursued" (151).



Not surprisingly, the recommendations presented in this study were not endorsed by the members of the Royal Commission. The rather unconventional argument concerning the need for industrial policy as a necessary complement to free trade proved too much for the staff and the commissioners to accept. The relevant volume of the final report considered the need for industrial policies at great length (summarizing the lengthy results of its own research program on comparative industrial policies) before rejecting this option out of hand. At a certain point, the final report explicitly references Harris's study and its support for "the use of the so-called 'strategic' or targeting approach to industrial policy" (Royal Commission 1985, 225). However, the reference is found in the section of the report that deals with competition policy and the main conclusion of the commission is that a pursuit of the policies advocated by Harris would inevitably lead to a suppression of competition in the domestic market. The factors behind the broad policy recommendations of the Macdonald Commission have been explored at length in two excellent studies: one by Gregory Inwood that analyzes the outcome of the commission's unprecedented research program and extensive cross-country hearings in light of the bureaucratic structure of the process that determined which recommendations were pursued and which were rejected (2005); and one by Neil Bradford that analyzes the outcome of the commission process in terms of the broader social and political factors that shaped its policy direction (Bradford 1998). Governments in Canada have pursued a broad mix of science, technology, and innovation policies in the intervening thirty years since the Macdonald Commission, and there have been many additional studies and strategies formulated to promote Canadian competitiveness in technology-based industries. Nonetheless, these efforts have fallen far short of what Harris and subsequent analysts have determined is required both in terms of support for R&D and the focused and strategic approach recommended in Harris's study (de la Mothe 2003, 175; Smardon 2014).

## **[1] The Implications**

The failure of the Macdonald Commission and the Canadian government to accept Harris's argument stands in sharp contrast to the experience of some of our leading economic competitors. There has been a growing acceptance over the past three decades that industrial policies are an integral component of the policy agenda of most industrial and industrializing countries, not least of all our main trading partner, the US. Studies conducted for the National Research Council of the National Academies over the past decade and a half describe the extensive role of federal government agencies in funding the basic research that underlay much of the information technology revolution that Harris foresaw in this monograph. They document the flexibility of federal support and a recognition of the need to evolve as new technologies emerged and were successfully commercialized. Most often that support took the form of grants or contracts awarded to researchers through a broad range of agencies from the National Science Foundation to the Advanced Research Projects Agency of the Department of Defense, NASA, and the Department of Energy. Federal funding for this research tended to complement, rather than substitute for research undertaken by private firms and there was frequently "a complex interweaving of fundamental research and focused development" (National Research Council 2003, 12).

Other studies demonstrate the critical role that procurement played in financing the early growth and development of two of the essential components of the information technology revolution: the integrated circuit and the microprocessor. In the process, this helped to build Silicon Valley into the most successful technology cluster in the US and the central locus of its information technology industry (Leslie 2000). Government intervention was not limited to the hardware side of the new IT revolution – it also laid the ground for the Internet economy and supported the establishment of the academic discipline of computer science, the basis for the modern software industry, which is increasingly recognized as the source of real value and competitive advantage in information technology (Mowery and Langlois 1996; Mowery and Simcoe 2002).

More importantly, there has been a growing recognition that the role of government policy in shaping and directing the emerging technology paradigm has gone well beyond the funding of

basic research. As Linda Weiss documents in her comprehensive analysis of the the postwar US government's interventions to support the development of high-technology industries, the full spectrum of its activities went well beyond funding R&D. They included "procuring new technology; providing assured demand for resulting innovations; devising the technology problem sets for industry to work with; generating public inventions/intellectual property for private firms to exploit; taking equity positions in innovative firms; (and) devising with industry new technology standards to outflank foreign competitors" (Weiss 2014, 8). The crux of Weiss's argument is that the full extent of the technology and industrial policy implemented by the US government has been underestimated because of the prevailing rhetoric about the role of the state in American politics and the often unconventional forms that the interventions took. The complex of agencies and programs that provided support to high-technology firms and sectors was a central player in the pattern of economic development across broad sectors of the American economy throughout the postwar period. And while Weiss's study is the most recent, it is merely one of many that have documented the full dimensions of US technology and industrial policy (Mowery and Rosenberg 1989; Branscomb and Keller 1998; Block and Keller 2011; Mazzucato 2013). Taken together, the overwhelming conclusion of these studies is that "[t]hrough an extensive array of public-private alliances and innovation hybrids, technology development programs and investment funds, the United States has created not a liberal, but a hybrid political economy – one that is shaped by a national security state deeply entwined with the commercial sector" (Weiss 2014, 195).

The American case is far from unique in its deployment of public policy instruments to support the growth of its high-technology sector. Japan has long been seen as the country where the most explicit use was made of an industrial policy to promote the growth of its high-technology industries in the decades following the Second World War (Johnson, Tyson, and Zysman 1989), but it was not alone in this respect. Japan served as a model for many other East Asian countries as they deployed variations on this strategy to chart their own path to more advanced forms of industrialization, particularly in high-technology sectors of the economy (Wade 1990;

Woo-Cumings 1999). The follower countries frequently became more sophisticated in their development of a unique set of agencies and policy instruments to achieve these ends.

While the traditional approach of imitation and relying on borrowed technology provided an initial start for many Asian (and more recently, European) countries, sustainable success in what Dan Breznitz calls rapid innovation-based (RIB) industries requires the creation of an institutional capacity to innovate within the state itself. Policies and institutional patterns diverged among the countries, but the underlying cause for success in RIB policy was the fostering of a broad set of technological capabilities within the private sector and the collaboration of private actors with the state in a process of technological learning and capacity building. This new model for the role of the state differs significantly from the traditional model of the developmental state. Rather than targeting strategic industries or focusing on specific product niches or markets, contemporary RIB policy emphasizes the creation of more broadly defined technological capabilities within the national economy, then adopts a set of policy instruments designed to motivate private firms to collaborate with state agencies to develop these capabilities. States working in this manner often use a very different model of operation than the traditional Weberian conception of a public sector bureaucracy – a model that is more pluralistic and networked, but also one that is scientifically and technologically literate and one that is able to work with private industry in a collaborative manner, rather than in the traditional command and control fashion (Breznitz 2007, 29–32; Cooke and Morgan 1993; Wolfe 1997).

Recognition of the highly differentiated ways in which states intervene across a wide range of economies at different stages of economic development and technological capacity has led to a new understanding of the need for what Dani Rodrik calls “the return of industrial policy (2010).” But this is not industrial policy as it is traditionally depicted in much of the literature; rather it is a highly flexible model adapted to the increasing globalization of the world economy, the modularization of production networks, and the rise of multiple new sites not only for high-technology production, but more importantly, for research and development. Fundamentally, twenty-first century industrial policies are ones that focus on institution-building in order to shape

technological and organizational capabilities, or what Cimoli, Dosi and Stiglitz have recently referred to as “the political economy of capabilities accumulation” (Cimoli, et al. 2009).

Authors working in this perspective concur with Breznitz that the successful pursuit of strategies promoting capabilities accumulation requires the support of new governance models. Writing for the World Bank, Yevgeny Kuznetsov and Charles Sabel identify a number of similar characteristics that are essential for what they term “open economy industrial policy.” They argue that the emphasis in effective industrial policy must be on shifting the focus away from the one-time selection of potential winners in terms of firms, sectors, or industries, towards developing a policy process that is governance-based and focuses on learning from past errors to improve the selection process. This policy approach starts from the basis of existing institutions in the national economy and focuses on building more effective linkages among the better performing segments within both the public and the private sector. Programs can often start with small budgets and be housed in organizations or agencies at the periphery of the traditional bureaucratic structure. In linking up better performing segments of existing national institutions, the goal is to reshape the overall institutional framework. The essential feature of this approach is its promotion of strategic collaborations between private actors and public sector agencies with a focus on improving the overall process for selecting the most effective policy instruments to promote technological capabilities (Kuznetsov and Sabel 2011; Breznitz and Ornston 2013).

There is little recognition of this new line of thinking about industrial policy in recent discussions of the state of Canadian science and technology capabilities and the innovative performance of the economy. Diagnoses of Canada’s technological underperformance have focused on the mismatch between broader support for public research and the R&D performance of Canadian firms. Foremost among these analyses have been the biannual reports of the federal Science, Technology and Innovation Council (2009; Science Technology and Innovation Council 2010; 2012). Canada’s technological performance has also been reviewed in a series of studies by the Council of Canadian Academies, which are summarized in an report entitled *Paradox Lost* (2013). The report highlights the considerable research strengths that Canada displays on the

supply side of the innovation system, which is not surprising in light of the substantial public resources that have been poured into supporting that system over the past three decades. However, the paradox referred to in the title is the continuing weakness of Canada's business innovation performance, which the Council attributes to the relative weakness (and declining share) of the manufacturing sector in the national economy, particularly since the end of the tech boom in the early 2000s; the lack of specialization of Canada in high-technology, R&D-intensive industries, compared to other industrial economies, particularly the United States; and the lack of emphasis by Canadian firms on innovation-focused business strategies, due to Canada's continuing reliance on imported technology from the US. This technological dependence, originally identified in the Science Council studies of the 1970s, has been enabled by our integration into a continental North American economy, the relatively smaller size of the domestic market in Canada, and the commercial success achieved by Canadian business in its chosen niche – staple-based export sectors. In the words of the Council: “With little motivation to change a successful formula, many firms have settled into a ‘low-innovation equilibrium’ that has conditioned Canadian business habits and ambitions. Canadian business behaviour cannot be expected to change unless the conditions that have sustained its profitable, low-innovation equilibrium change first” (Council of Canadian Academies 2013, 7).

In words that echo the tone if not the precise substance of this monograph, the authors of the CCA report argue that these conditions are changing rapidly, due to the continued growth of industrializing countries in the global economy, the increasing environmental constraints on resource-based development, and the accelerating pace of innovation in a wide range of fields, from information and communications technology to genomics and nanotechnology. The fundamental challenge confronting the Canadian economy remains essentially the same as that identified thirty years ago: the need to establish a strategic policy framework to shift the focus of Canadian firms out of their low-innovation equilibrium in the staple-exporting and traditional manufacturing sectors of the economy, into those that concentrate on providing an expanding number of markets with a broader range of innovation products and services.

Discussions of how to respond to this challenge in Canada would benefit from greater attention to recent developments in critical policy thinking about the basis for twenty-first-century industrial and innovation policy. The great virtue of this monograph is the way it draws on many of the streams of conventional economic thinking familiar to policy makers to reach unconventional conclusions that go against the grain of that thinking. It is all too rare in policy related research that we can return to something written thirty years ago and find that its analytical insights and policy prescriptions are as relevant today as they were then. In 2015, the price of oil has plummeted to less than fifty dollars a barrel in both the US and Western Europe, oil dependent currencies are plunging, long-term investments in high cost energy extraction projects are being scaled back, and the limitations of Canada's carbon-intensive economic development strategy are being exposed. In this competitive economic environment, Richard Harris's arguments and policy prescriptions are as relevant as when it was originally published. Hopefully, its timely publication in the Carleton Library Series will reopen the policy debate in Canada about the future direction in which we need to go.

David A. Wolfe  
Innovation Policy Lab, Munk School of Global Affairs

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