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S W I T C H



The Political Economy of Federal Research



and Development Policy since 1960



BRUCE SMARDON

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## INTRODUCTION

# The Canadian Federal State and Domestic Technological Development

For two and a half decades after the Second World War, new domestic and international structures were developed that underlay a “Golden Age” of capital accumulation in the leading capitalist nations. Central to these new structures of accumulation was the creation of a variety of technological capacities. Under the impact of productivity missions sent from various countries to observe American industrial practices, the defeat of domestic opposition by workers to the introduction of more intensive Taylorist approaches to production, and a range of demand-and-supply conditions that supported mass-production industries, the Fordist technological practices developed earlier in the twentieth century by US capital were established in various European economies.<sup>1</sup> As I discuss in chapter 3, the extension of Fordism to Europe occurred as part of a wider restructuring of industry in which a range of new research and development (R&D) and original innovative capacities were developed in countries such as Britain, France, Sweden, and West Germany.

A similar extension of technological capacities occurred in the Japanese economy. A cluster of factors – export-driven accumulation under the impetus of US support for Japanese exports to the US market, American purchases of Japanese supplies in the Korean War, and a particular set of class relations leading to the formation of company unions and a more restricted domestic market – brought about systematic changes in the domestic ability of Japanese capital to engage in original innovation.<sup>2</sup> Also discussed in chapter 3 is the move of Japanese industry, gradually over the 1960s and then rapidly over the 1970s, away from its heavy reliance on technology transfers from other countries, particularly the United States.

When combined with the intensive further development in the United States of industrial research and original innovation in the period after 1945 to the late 1960s – discussed in chapter 3 – the result was a significant change in the level of domestic technological capacities in various advanced economies and new international structures of competition marked by a more rapid pace of domestic innovation.<sup>3</sup> Although, as Mowery notes, domestic structures of innovation and

forms of “cross-border technology transfer” existed in the late nineteenth and early twentieth centuries, as well as in the period leading up to the Second World War, the breadth and intensity of domestic innovation and its connection with international processes of technology transfer increased considerably in the two and a half decades after the war.<sup>4</sup>

This trend only intensified with the unravelling of the Fordist “Golden Age.” The disruptions and crises that started in the latter part of the 1960s and continued through the 1970s led to the abandonment of the Keynesian welfare state doctrines that had informed policy-making in the advanced economies and to the development of a new global architecture of neoliberal development.<sup>5</sup> Central to this architecture was an intensification of globalized production, trade, and investment as transnational corporations continued to restructure and develop their operations in various countries.<sup>6</sup> The movement to greater global integration did not, however, remove the importance of nationally based institutions in managing domestic economies: forms of territorially based geopolitical competition were not eliminated, even though, as discussed in chapter 1, the manner in which national states managed their economies was very much informed by global political economic structures. As Lacher notes, “Capital *is* becoming increasingly globally integrated, though it remains enmeshed in national institutions, networks, cultures and traditions.”<sup>7</sup> Neoliberal globalization was thus characterized by a dual movement encompassing both global forms of integration and national forms of differentiation.

Within these new global structures of national competition, “supply-side strategies of ‘liberal-productivism’ for each firm, region or country” became dominant approaches to understanding how “to win a place in the competitive battle for world market shares and to solve the unemployment crisis.”<sup>8</sup> In contrast to the focus on maintaining domestic aggregate demand in the previous Keynesian era, growth strategies were defined in terms of how to promote greater “international competitiveness” and “flexibility of industry” by improving capacity to move into new areas of production or restructure existing operations. In all of these strategies, a key means of promoting “competitive strength” was the expansion of the technological capacities of industry. The ability of domestic capital to innovate and to integrate new technologies into production received increasing attention as a primary way of gaining a competitive edge within the world economy. Strategies of growth through technological innovation were presented as “win-win” outcomes in which all sectors of society would share in the gains by virtue of higher growth rates, higher employment, and higher incomes. As I review in chapter 1, there was a proliferation of literature promoting innovation-based strategies, particularly in approaches stressing national and regional systems of innovation, over the three decades from the 1980s to the first decade of the twenty-first century, and this emphasis was reflected in state policy. A range of programs and policies were developed in various countries within the Organization for Economic Co-operation and Development (OECD) with the goal of promoting the level of innovation in their domestic industries.<sup>9</sup>

A central part of these domestic innovation strategies involved the level of industrial R&D. Various states implemented incentive programs intended to boost the original science and technology capabilities within their domestic industries and to increase the rate of technological innovation in comparison with other



economies. The methods employed by states to boost R & D and innovation varied over the decades, ranging from “strong government leadership of economic growth and development through extensive funding of technology programs during the 1960s and 1970s,” through a gradual process of withdrawal from direct involvement in structuring innovation processes in the 1980s, to a neoliberal posture in the 1990s in which “governments increasingly moved to assume enabling and regulatory roles, emphasizing freedom of choice for consumers in product and factor markets alike.”<sup>10</sup> Throughout these different periods, the stress on innovation-based strategies and expanded domestic R & D to promote growth and development remained a constant. Even in the face of the austerity measures implemented by various states after the major increase in deficits brought on by the financial crisis of 2008–09, state funding for R & D and innovation remained stable or grew in a number of economies, leading to an overall increase within the OECD area when government budget appropriations and outlays for R & D were measured as a proportion of gross domestic product (GDP).<sup>11</sup>

#### THE FEDERAL STATE AND INDUSTRIAL R & D: FORTY YEARS OF ACTIVE PROMOTION

A focus on promoting domestic R & D and innovation can certainly be seen in the Canadian case and, from the beginning, has been informed by the need to increase the commitment of Canadian industry to R & D and innovation in relation to industry in other economies. As I discuss in my review of federal R & D and innovation policy in part 2 of this book, it was during the 1960s that the federal state became committed to developing more domestically based research-intensive industries as a central policy objective and began to fund industrial R & D on a broad basis through direct grants and tax incentives. In chapters 5 through 7, I discuss how, under various governments including the Diefenbaker Conservatives, the Pearson Liberals, and the Trudeau Liberals, the federal state established several new programs: the Defence Industrial Research program; the Industrial Research Assistance Program, which was housed in the National Research Council (NRC); the Program for the Advancement of Industrial Technology; and the Industrial Research and Development Incentives Act program.

The commitment of the federal state to expanding domestic sources of industrial innovation extended throughout the 1970s and grew larger in terms of overall cost under the Trudeau Liberals, as I review in chapter 9. On top of a restructured grant program, called the Enterprise Development Program, major new tax credits for industrial R & D were added in 1977. These incentives quickly grew to become the core source of federal support for R & D in Canadian industry. Another major federal initiative that was designed to promote expanded technological capabilities in the 1970s was the “make-or-buy” program, which was established in 1971 and focused on contracting out federal research needs to the private sector.

R & D and innovation continued to receive a lot of attention in the 1980s and 1990s, and more initiatives were implemented at the federal level. As I discuss in chapter 11, under the Trudeau Liberals the Industrial Regional Development Program (created as part of the new department of Regional Industrial Expansion) replaced the Enterprise Development Program and led to expanded funding in the early to mid-1980s. The ill-fated Scientific Research Tax Credit led in the same period to more federal money being focused on tax incentives. In chapter 12, I

discuss the initiatives undertaken by the Mulroney Tories after they came to power in 1984, including the InnovAction initiative in 1987, which led to a new focus on “research networks” and to the Networks of Centres of Excellence program (involving networks of research connections between industry and the universities) in the latter part of the 1980s; and a new federal department called Industry, Science and Technology Canada, which was formed to manage the promotion of R & D and innovation in Canadian industry.

The focus on promoting domestic technological capacities continued into the early 1990s, when the Mulroney Tories established the Prosperity Initiative. Reflecting a movement away from grant-based forms of assistance in the post-free trade period, grants and contributions to industry from the NRC and from the newly formed Industry, Science and Technology Canada declined in the latter part of the 1980s and remained at a lower level in the early 1990s. But they were compensated for by rising levels of spending on R & D contracts with industry. The Conservatives also sustained the commitment of the federal state to R & D tax credits. Although the Tories eliminated the Scientific Research Tax Credit in the face of widespread abuse, they created the broader Scientific Research and Experimental Development tax credit, which, as discussed below, was among the most generous in the advanced capitalist world in the 1980s and the 1990s.

The focus on R & D and innovation did not change when the Chrétien Liberals formed the government in 1993. In his budget speech in February 1994, Finance Minister Paul Martin focused on the need to promote greater domestic research and innovation as a central priority and stated, “Our challenge is to take existing resources and redirect them towards the creation of a national system of innovation.”<sup>12</sup> In the same budget speech, an extensive policy review called the Science and Technology Review – another in a long line of federal reviews, starting with the Glassco Commission report in 1963 and continuing through to the Tories’ Prosperity Initiative in 1992 – was announced. After the review, the Chrétien Liberals established the Technology Partnerships Canada program in 1996. The program was created and received expanded funding, even though the Chrétien Liberals cut funding significantly in a number of other areas after the 1995 budget. Indeed, as I discuss in chapter 13, R & D grants and contributions to the business enterprise sector rebounded from their lower level in 1995–97 to levels higher than in the period before the 1995 budget.

A range of other new initiatives built on the Tories’ earlier emphasis on research networks and reflected the increased influence of “systems of innovation” thinking. These included the “Partnerships in Knowledge” program; the Synergy Awards program; the creation of Industrial Research Chairs; Strategic Projects for pre-competitive research involving universities and industry; and Research Partnership Agreements among universities, industry, and government organizations. In addition to these initiatives were various sectoral strategies, such as the Canadian Biotechnology Strategy<sup>13</sup> and “new program and spending initiatives” undertaken by the Chrétien Liberals in the latter part of the 1990s, ranging from the creation of the Canadian Foundation for Innovation, which provided funding for new research infrastructure projects in university and non-profit institutions, to expanded funding for existing programs, such as the Networks of Centres of Excellence. The extent of support provided by the Chrétien Liberals for research and innovation led one commentator to observe that “the combined impact of the four budgets

from 1997 through 2000 represented one of the most significant investments in s & T [science and technology] spending in many decades.”<sup>14</sup>

Through these various programs and initiatives over a forty-year period, the federal state spent substantial sums of money in pursuit of the goal of expanded industrial R & D and greater domestic technological capabilities, particularly through the creation of R & D tax incentives that provided higher levels of funding than in other advanced capitalist countries. A study conducted in 1994 found that federal tax incentives were higher than in the United States, Japan, and Western Europe. When provincial incentives for R & D were added into the calculations, the study found that Canadian tax incentives were the highest in the world.<sup>15</sup> These findings were unchanged from those of previous studies done in the early and late 1980s.<sup>16</sup> Canadian levels of assistance for R & D through the tax system in this period were thus unequalled in the world. Indeed, they were high enough to compensate for the very high levels of direct subsidization of R & D that existed in other countries.

During the 1980s, with the development of the Scientific Research Tax Credit, the level of tax assistance for R & D more than compensated for the levels of direct subsidization of R & D that existed in other countries. As the Macdonald Commission pointed out in 1985, “Had the Scientific Research Tax Credit remained in force as originally established, the Canadian system would be generous by any standard.”<sup>17</sup> Even without the SRTC, the Canadian level of assistance was much closer to the levels provided in other countries if state-funded R & D contracts were viewed as less than a 100 % subsidy.<sup>18</sup> Because the state usually retains the rights to the technology developed under R & D contracts, the assistance provided through these contracts is not as beneficial as that provided by subsidies or tax credits that give the company full property rights in the resulting technology. On this basis, the Macdonald Commission concluded that, if research contracts were not regarded as a full subsidy, the overall level of Canadian support for R & D compared quite favourably with other countries. This situation did not change in the 1990s. The Scientific Research and Experimental Development tax credit, along with provincial credits, provided higher levels of tax incentives than in other countries and was augmented by the major new investments made by the Chrétien Liberals.

#### CANADIAN INDUSTRIAL R & D: ACHIEVING A BREAKTHROUGH?

The federal state was thus engaged from the early 1960s to the end of the 1990s in promoting a more innovative Canadian economy through substantial levels of financial support, and an upward movement in the relative position of Canadian industry seemed to occur, particularly in the 1980s and 1990s. Some commentators were led to argue that Canadian innovation had either reached a breakthrough or was on the verge of one. Reviewing the Canadian national system of innovation at the turn of the twenty-first century, Niosi claimed that, after an initial period of state-led encouragement of R & D and domestic innovation both through “horizontal policies,” such as tax incentives and grant programs, and the targeting of specific industries, the Canadian national system of innovation could, by the 1990s, sustain itself on “automatic pilot after an energy-intensive take-off”; that is, “only horizontal policies to keep incentives operative” were needed.<sup>19</sup> De la Mothe echoed the claims of Niosi concerning the shifting position of Canadian industry when he stated, “It can be documented that since 1993 – indeed, the period probably began



in 1986 – Canada’s relative innovative performance has improved across a wide variety of fronts... Despite still ranking fourteenth in the OECD, Canada experienced the fastest growth in R & D intensity over the 1981–2000 period... In patenting, Canada achieved the fastest rate of growth in the G7 in terms of patent applications.”<sup>20</sup> Finally, after reviewing the various initiatives by the Chrétien Liberals in the latter part of the 1990s, Wolfe stated that “many of the essential elements for the enhancement of Canada’s innovative capacity are currently in place.”<sup>21</sup>

It is ironic that, when these claims were being made, Canadian R & D and innovation was already beginning to move in the direction of significant decline. Over the first decade of the twenty-first century, there was a major deterioration in the relative position of Canadian industry with respect to its commitment to domestic R&D. Business enterprise expenditure on R & D (BERD) as a percentage of GDP declined consistently after 2000, from 1.15 % (75 % of the OECD average) to 0.93 % (58 % of the OECD average) in 2010.<sup>22</sup> This returned the ratio to levels reached almost twenty years earlier, in 1993/94.<sup>23</sup> The pattern was quite different in the wider OECD region. From 2000 to 2008, the OECD average increased in every year until the financial crisis of 2008/09 hit all of the OECD economies, leading to some decline between 2008 and 2010 (from 1.63 % to 1.58 %).

However, the decline was not as great as in Canada (from 1.04 % to 0.93 %), which in combination with the earlier decreases led to a steep drop (from 75 % to 58 %) in the Canadian BERD: GDP ratio as a proportion of the OECD average over the decade. Industry-financed gross domestic expenditure on R & D (GERD) as a percentage of GDP peaked at 1.03 % in 2006 (72 % of the OECD average) and then declined rapidly to 0.84 % in 2010 (58 % of the OECD average).<sup>24</sup> In the latter part of the 2000s, BERD at 2005 prices and purchasing power parity declined absolutely by 15 % between 2006 and 2010.<sup>25</sup> Moreover, preliminary figures for 2011 showed further deterioration. The BERD: GDP ratio declined to 0.89 % – and thus to levels previously reached in 1992 – while the industry-financed GERD: GDP ratio fell to 0.81 % and the level of BERD declined by another 1.76 %.<sup>26</sup>

The falling commitment to R & D in the private sector pulled down the overall level of spending in the Canadian economy. After peaking at 2.04 % in 2005, the GERD: GDP ratio declined over the rest of the decade. Reporting in 2012 on the situation in Canada, the OECD noted that “GERD in constant dollars has declined by 1.2 % a year during the latter half of the past decade to USD 24 billion and 1.74 % of GDP in 2011. It fell sharply in 2008 and again in 2010.”<sup>27</sup> By 2011, the GERD: GDP ratio had moved back to the levels that existed in the latter part of the 1990s and was much closer to the levels that had historically existed in the Canadian economy. From the latter part of the 1960s to the mid-1990s, this ratio had “stubbornly remained around the 1.5 % level.”<sup>28</sup> The deterioration in the first decade of the twenty-first century, particularly as it gathered momentum in the last half of the decade, returned Canadian R & D as a proportion of the Canadian economy to levels marginally higher than this, while eliminating a large part of the gains made in earlier periods. Moreover, there was a growing gap between Canada and other OECD economies. The OECD average consistently increased over the 2000s, from 2.20 % in 2000 to 2.41 % in 2009, and did not follow the Canadian pattern of persistent decline after 2005. The limitations on R & D spending created by the economic crisis of 2008/09 led to some reduction in the GERD: GDP ratio in the wider OECD area (from 2.41 % to 2.38 % between 2009 and 2010), but not to the same extent as in Canada. As a result, be-

tween 2005 and 2010, the GERD: GDP ratio in Canada declined from 91 % of the OECD average to 77 %.<sup>29</sup>

The shifting relative position of Canadian industry in the first decade of the twenty-first century reflected the fact that, contrary to the views of various commentators on Canada's innovation situation, the growth years of the 1980s and 1990s, and the new innovation policies, programs, and frameworks implemented at the federal level, were not successful in altering fundamental dimensions of Canada's domestic technological capacities. The growth experienced in specific areas in the 1980s and 1990s, such as with the expansion of Nortel and JDS Uniphase in information and communications technologies, masked underlying structural weaknesses and led to the mistaken impression that Canadian innovation had moved to a qualitatively different level. The underlying vulnerabilities in the system were quickly revealed, however, with the major fall in R & D spending when these core companies began to struggle after the [dot.com](#) meltdown in 2000. The Canadian system was neither extensive enough nor diversified enough to accommodate these losses without going into steep decline.

At the centre of the inability of the Canadian economy to absorb the loss of key firms was a highly concentrated structure of R & D and innovation in which research-intensive companies were the exception rather than the rule in Canadian production. This resulted from a deeply ingrained pattern of development in which Canadian industry consistently relied on technological innovation in other countries, particularly the United States. As detailed in chapters 2 through 4 of part 1, Canadian industry followed a dependent model of technological development defined by limited levels of R & D within the Canadian subsidiaries of transnational capital, relatively few domestic networks focused on the development of new technologies, and consistently high levels of imports in key areas of capital-goods production.

Contrary to Niosi's claims concerning the "energy-intensive take-off" of the Canadian innovation system, the dependent model was not removed in the period from the 1960s to the 1990s. In the 1990s, when the Canadian innovation system was supposedly on "automatic pilot" and had attained self-sufficiency, clear differences remained in trade patterns, in the extent of reliance on imported technology, and in the structural composition of the Canadian economy, particularly in relation to the US economy. In their comparison of the Canadian and American economies in the 1990s, Howse and Chandler pointed to "startling" differences between the two with respect to both their share of exports in the "high-intensity research and development" category and their reliance on domestically produced technology.<sup>30</sup>

These differences extended beyond the US economy to OECD member countries more generally, and were reinforced with the decline in R & D and innovation in the Canadian economy in the first decade of the twenty-first century. As noted in the concluding chapter, in that period several reviews of Canadian innovation pointed clearly to the relatively low capacities of Canadian industry in a variety of areas. One review (after comparing the relative situation of Canadian industry across a range of indicators, including business R & D intensity, triadic patent families, venture-capital investment as a proportion of GDP, and the proportion of value-added represented by high- and medium-high technology manufacturers) concluded that "our performance in innovation is stunningly poor. We rank 14th out



of 17 countries, the fourth from the bottom.”<sup>31</sup> Despite all of the federal support for R&D and innovation in the Canadian economy, Canadian industry in the first decade of the twenty-first century remained mired at the bottom of the advanced economies in its innovation capacities and, far from improving, continuously spent less on R&D as a proportion of GDP from 2001 to 2010. This decline was not reversed by the high level of federal support for R&D and innovation throughout the decade, particularly through R&D tax credits. As noted by Phillips and Castle, in 2009/10 the federal state provided, through its various programs, a quarter of all the funds spent on R&D in Canada. This funding was in addition to the Scientific Research and Experimental Development tax credit, which in 2008 “was the second most favourable among the G7 countries for large firms and the most favourable for small and medium sized firms, with implicit subsidies of about 18 % and 32 % respectively.”<sup>32</sup>

#### THE STRUCTURAL BASIS OF TECHNOLOGICAL DEPENDENCY

The major reversals in industrial R&D and the failure of the Canadian federal state to promote a restructuring of Canadian capital that could sustain a higher level of R&D and innovation in the Canadian economy raise a central question: Why has this dimension of the Canadian economy not fundamentally changed despite all of the attention that has been focused on it by the federal state for so many years? Answering this question provides the central organizing principle of this book, which is structured into two main parts. In part 1, I detail the entrenchment of dependent technological development as a core feature of the Canadian economy. I begin my discussion of this process in chapter 2, where I examine how the particular approach of Canadian industry to dependent accumulation was first established. I argue that this dimension grew out of the development of the Canadian economy, specifically the region of southern Ontario, as the earliest example of the systematic extension of Fordism outside of the United States. Canadian industry was at the forefront of the advanced economies in incorporating the institutions and practices of American Fordism by the end of the first decade of the twentieth century. A specific approach to economic development was introduced that was supported by both manufacturing capital and the Canadian state, and built on the emerging forms of US Fordist capital in the latter part of the nineteenth and early twentieth centuries. As part of this framework of development, the expansion of the Canadian economy was tied closely to sustaining flows of technology from the heartland of Fordist development in the United States. From the beginning, technological dependency was incorporated into the specific version of Canadian Fordism and its associated ways of structuring growth.

In chapter 3, I argue that this approach continued with the reconstruction of another version of Fordism after the Second World War. In what Jenson has termed “permeable Fordism,” all of the previous core dimensions – resource extraction, imports of capital and technologies from the United States, infrastructural investments by the federal state, “government oversight of the actions of firms and unions in private collective bargaining relations,” and the growth of mass consumption – were combined once again in the Canadian economy.<sup>33</sup> As part of this discussion, I provide a comparison of the Canadian version of Fordism with the versions established in other advanced economies in the United States, Europe, and Japan. This comparison illustrates the specific dimensions of the Canadian

path of development and shows how structures of dependent technological development distinguished the Canadian economy from other advanced economies.

I also argue in chapter 3 that the particular approach to accumulation represented by Canadian Fordism came under strain with the extension of this form of capital to other advanced economies outside of the United States. Even though the second period of Canadian Fordism maintained a high relative standing in terms of various economic indicators such as productivity and per capita income, important tensions emerged that undermined the integrity of this model of development and were related to the reliance of the Canadian manufacturing sector on a domestic market that could not support Fordist accumulation in the same way as in the past – especially in relation to the United States and to the Japanese and leading European economies, which were undergoing their own US-led Fordist development after the war. I discuss the Auto Pact as a moment of transition between the earlier model of Fordist development, with its reliance on the Canadian domestic market, and a new form of accumulation that began to dominate the approach of manufacturing capital and the federal state, which was premised on expanding scales of production and productivity by moving in the direction of continental rationalization.

In chapter 4, I discuss how the initial trends established with the Auto Pact were amplified in the period of post-Fordist neoliberal restructuring leading up to and after the 1987 Canada–United States Free Trade Agreement. The movement toward continental rationalization accelerated, and Canadian manufacturers abandoned their historic focus on the Canadian domestic market along with their support for tariff protection and domestically centred accumulation strategies. A pattern of accumulation was established that combined staple production and technological dependency with new forms of export-oriented manufacturing growth. I argue that, while removing the problems associated with relying on the more restricted Canadian domestic market, the new growth strategy created another set of difficulties. For various reasons, the new pattern of Canadian accumulation within a restructured regional space was no longer able to maintain the same relative levels of manufacturing development in research-intensive areas vis-à-vis other advanced economies. The processes of transfer and catching up that underlay the ability of Canadian industry to follow American developments and establish Canadian versions of production in new areas of research-intensive production in the earlier periods were attenuated. In addition, the Canadian economy was opened up to international trade without having the innovative capacities to compete in key areas of research-intensive production. The result was an overall deterioration in the condition of manufacturing in the Canadian economy, leading to declining export shares, rising import shares, and falling relative productivity.

I also argue that, because of differences in how Fordism was integrated into the European and Japanese economies, the impact of post-Fordist regional restructuring did not lead to the same reduced presence of research-intensive advanced manufacturing in those economies. A different basis of Canadian accumulation, still marked by a lack of development of original technological capacities, was established in which dependent relations and advanced manufacturing development were no longer articulated in the same way, and levels of productivity growth in the Canadian economy were more limited in comparison with those in other advanced economies.

Part 1 of this book thus provides an overview of the integral role of dependent technological development in three key periods of Canadian manufacturing, beginning in the first decade of the twentieth century and ending in the first decade of the twenty-first, which defined the approach of Canadian industry to domestic R & D and innovation. It provides an alternative view of the political economy of Canadian development, which is a complex story in itself, but one that is essential to an understanding of the evolution of federal industrial R & D and innovation policy. Part 2 builds on the foundation established in part 1 by discussing the political economic situation as it related to the formation of policy over the different eras of development, and by referencing the broader structures of Fordism and post-Fordism where that is appropriate. This part of the book explores the history of federal R & D policy over the forty-year period from 1960 to 2000. Comprising eight chapters (5–13), it starts with the approach of the Diefenbaker Conservatives in the 1960s to promoting R & D and innovation and concludes with the policies and initiatives implemented by the Chrétien Liberals in the 1990s. By organizing my analysis of R & D policy along these lines, I depart from standard innovation policy analysis, which typically discusses policy developments without examining how they are connected to wider political-economic structures or the broad sweep of change across historical eras. As a result, key determinants of the content and impact of policies, and of what can be accomplished by state-based initiatives, have until now been largely ignored.

#### THE “TRANSFORMATIVE STATE,” THE GLASSCO FRAMEWORK, AND PRIVATE CAPITAL

Certainly, the pattern of interpretation described above has characterized the large literature that exists concerning the role of the state in technological development, particularly in scholarly work on national and regional systems of innovation. In chapter 1, I examine this literature, which places at the centre of its analysis the institutional capacities of states to either lead or support transformative projects that restructure the technological capabilities of domestic industries. Major emphasis is placed by writers informed by this theoretical framework on the development of a “transformative state” that is able to implement a range of policies leading to new forms of state–business linkages, intensified training and skills development, higher levels of investment by the state and business in R & D, and new forms of cooperation or alliances among different firms in the development of new technologies. All of this discussion has been conducted in a manner that neglects the crucial role of political economic structures in determining the feasibility of transformative projects.

As I show in the Canadian case, the transformation of the economy involved much more than the existence of a state with a commitment to establishing appropriate forms of technological infrastructure. It also involved challenging the organization of the underlying structures of the Canadian economy that lay at the heart of low domestic technological capacities, and that dated back to the early part of the twentieth century. In my discussion of federal R & D policy, I draw out the implications of this situation for the extensive series of programs that were implemented by the federal state. I argue that the transformative intentions of the various programs came up directly against, first, the legacy of Canadian Fordism that had governed Canadian industrialization since the first decade of the twentieth



century and, then, with the development of neoliberal restructuring in the 1970s, the new form of post-Fordist accumulation that was established. These various measures were not capable of shifting the underlying dynamic of accumulation in the Canadian manufacturing sector which, growing out of an historical process of technological borrowing, was systematically structured away from the kind of innovation-based growth that was being promoted by the federal state, especially when the programs were framed by the assumptions of what I term the “Glassco Framework.”

Within this framework, which was first enunciated in the Glassco Commission report on government organization in the early 1960s, the basic assumption of federal programs was that a transformation in the commitment of the private sector to creating domestic technological capacities could be generated by increasing various subsidies to private capital, shifting a greater proportion of federal science expenditures to the private sector, or creating greater instances where federal scientific activities were coordinated with private sector R & D – while leaving untouched the specific context of dependent technological development that governed how private capital organized R & D and original innovation in the Canadian economy. A number of initiatives were followed, including increased marketization of federal research expenditures; greater subsidies to specific firms on a project-by-project basis; expanded tax incentives, which gave firms maximum control over how they spent the federal incentive money; and new programs promoting “partnerships” between private capital and federal science institutions. These various incentives, while providing considerable benefits to Canadian industry, were not sufficient to outweigh the fundamental forces structuring the commitment of private capital to R & D and original innovation in the Canadian economy. Specific projects were supported, and particular industries, such as the defence and space industries, were linked in a major way with federal assistance programs, but there was no broad process of transformation.

I argue that the context of dependent technological development had another important impact: it was central in shaping the response of private capital to the various incentive programs and informing the views of the representatives of private capital concerning what should be done. Because of the historical legacy of dependent technological development, Canadian domestic capital did not, for the most part, have a substantial connection to the domestic creation of new technologies. With specific exceptions, such as Nortel and Research in Motion, it avoided entering fields of manufacturing production involving heavy new expenditures on innovative capacities. As a result, domestic capital in the manufacturing sector was not oriented toward using the various federal incentive programs as a means of building industries that rested on novel technologies. There was also little support within domestic capital for federal strategies that moved outside the Glassco Framework and altered the dominant position of American transnational capital in research-intensive areas, or were focused on forms of state-led restructuring of the organizational context of innovation in the Canadian economy.

Instead, the various recommendations submitted to the federal state by the representatives of private capital concerning the development of the incentive programs, and the positions taken by these representatives in the advisory task forces created to assist the federal state in the formation of policy, argued for the approach identified as the Glassco Framework. The primary thrust of their posi-

tion was to call for measures that would expand the financial resources available to firms – whether by receiving greater federal subsidies for specific R & D projects, gaining more research money by shifting a greater proportion of federal science expenditures to the private sector, or reducing the amount of taxes paid to the federal state by means of higher tax deductions and credits for a given level of R & D expenditures – without challenging the dominant ways of organizing accumulation in the Canadian manufacturing sector. The dependent framework of technological development and its associated set of class interests, particularly the role and position of American transnational capital in research-intensive industries, were systematically not confronted in this policy discourse.

#### FEDERAL POLICY AND TECHNOLOGICAL DEPENDENCY

The strength of the Glassco Framework was reinforced by the way in which it fit with the dominant approach of the federal state to industrial development. Strategies promoting greater domestic technological capacities that moved outside the Glassco model and targeted major aspects of the organizational context of private sector decision-making went against the grain of key federal commitments in the area of industrial development. An open-door policy toward American transnational investment was a central part of how economic growth was constructed in the Canadian economy in the two Fordist periods, and state policy relied explicitly on a model of development that did not emphasize domestically controlled sources of technology creation. In the period of neoliberal restructuring, these trends continued, as there was increased emphasis on entering new trade agreements to create an environment attractive to foreign investment. Core aspects of potential state-led industrial strategies that targeted the domestic operations of American capital and focused state support on building domestic technological capacities were prohibited under these agreements. Within this policy context at the federal level, the principles of the Glassco approach that emphasized forms of cooperation and coordination with private capital and worked within the structural parameters governing Canadian technological dependency were highly attractive.

The strength of the commitment to the Glassco approach was illustrated at different moments when more targeted strategies that were concerned with the structural context of R & D and innovation were put forward in the federal state. I discuss several instances when strategies of this sort were raised, including Walter Gordon's proposals as Minister of Finance in the period 1963–65 and the recommendations of the Watkins Report in the latter part of the 1960s; the proposals made in the early 1970s by both Herb Gray, as Minister of Industry, Trade and Commerce, and Maurice Lamontagne, who headed the Senate Special Committee on Science Policy; and the further set of state-led restructuring proposals that were presented by Herb Gray in the early 1980s.

These various initiatives all ran up against the hostility of business organizations in the private sector and the opposition of business Liberals in various Liberal governments, who regarded them as deeply disruptive to the structures of private investment and growth in the Canadian economy. I argue that, in these instances, the various strategies could not be carried forward in the face of the determined opposition generated by senior state officials and business organizations. A key moment of opposition occurred in the latter part of the 1960s and early 1970s, when momentum was building both within the federal state and on the part of



various social forces, including women's organizations, peace groups, worker unions, and nationalist movements, for challenging the role of American capital in the Canadian social formation. This momentum was broken for a number of reasons, including the economic restructuring that took hold in Canada, as in other advanced capitalist economies in the latter part of the 1970s and early 1980s; the growing strength of neoliberal views that rejected nationalist forms of state intervention; the limitations of the "social vision" of unions and the Left in Canada, arising from their continuing commitment to the Keynesian welfare state institutions of the postwar Fordist accommodation; and growing divisions within various organizations that had supported social change at the beginning of the decade. All of these changes undermined the level of popular support for more structuralist initiatives. The moment of challenge passed away without leading to any fundamental alteration in the approach of Canadian industry to R&D and innovation.

I also argue that the particular circumstances in which new programs were developed provided a further source of support for the principles of the Glassco approach. Key moments of R&D policy formation occurred when economic growth was flagging in the Canadian economy and tensions existed in the relationship between the state and the "business community." The new incentive programs provided a means of building better relations with private-sector interests by acting upon their recommendations and, at the same time, allowed the federal government to argue that it was promoting growth by creating a more innovative and competitive economy. This dynamic was particularly appealing to state officials in the lead-up to election campaigns, when there was a concerted attempt to build bridges with business interests and an urgent need to increase public support. Several instances of R&D policy formation followed this pattern: the initial creation of R&D incentive programs by the Diefenbaker Conservatives in the early 1960s; the ending of federal grants under the Industrial Research and Development Incentives Act program and the creation of major new tax incentives by the Trudeau Liberals in the latter part of the 1970s; and the development of the Scientific Research Tax Credit by the Trudeau Liberals in 1983–84. At these moments, federal policy was not based on an analysis of the structural sources of low R&D and original innovation in the Canadian economy, or indeed on any broad analysis of the R&D situation in Canada, but was shaped in response to a set of specific political needs that moved the federal state in a direction that supported the principles of the Glassco approach.

I argue that the dominance of this framework was further sustained by the malleability of its underlying assumptions, which allowed its principles to continue to be followed even though the same themes of relatively low domestic R&D and innovation continued to resurface at different times. There was always some deficiency that could be pointed to and some modification that could be supported as a way of improving the operations of the programs – incentives could be converted from grants to tax incentives, as occurred in the latter part of the 1970s, or tax credits could be expanded, as was done in the latter part of the 1970s and early 1980s. Another frequent explanation was that more coordinated approaches involving the state and private capital should be pursued, or that federal programs were too "firm-centric" and should be changed in favour of an "innovation systems" approach, as was done by the Mulroney Conservatives with the creation of Industry, Science and Technology Canada in 1987 and the "strategic technologies" initiatives

in the latter part of the 1980s, and by the Chretien Liberals in 1996 with the Technology Partnerships Canada program. Or it could be argued that federal science programs and expenditures were inefficiently organized and emphasized forms of research remote from the stages of development and commercialization, and should be systematically reviewed with an eye to either shifting resources away from the state to private-sector research organizations or making federal research organizations more closely aligned with private-sector research needs – an argument that was made repeatedly throughout the entire period from 1960 to 2000.

With each change of government, the relatively low level of industrial R & D and original innovation was noted and another round of new initiatives in this area was launched, but the point was never reached where a sustainable transformation in the domestic technological capacities of Canadian industry could be established. In a striking way, federal programs and policies returned again and again to the same themes of cooperation and coordination with private capital, and to the need to promote greater commercially oriented innovation through expanded federal assistance based on grants or tax incentives or state-business partnerships, without challenging the underlying context of the forces that governed technological dependency in the Canadian economy. In this regard, although the strategic thrust by the federal state to increase the amount of collaboration with private capital did have important consequences, particularly in leading to a growing emphasis in federal research organizations and in the universities on attracting private money to finance research projects, the minimal focus of Canadian private capital on creating domestically centred R & D and innovation capacities limited the extent to which this project could be realized.<sup>34</sup> I note in the concluding chapter that the level of collaboration by private capital in both the public and private areas was one of the lowest in the OECD area in the first decade of the twenty-first century.

However, the failure on the part of the federal state to realize its projects, both in the specific area of research collaboration and in promoting domestic technological capacities more generally, did not lead to any fundamental questioning of its approach. Not only was the Glassco model reasserted over time, but it became ever more dominant as more targeted strategies calling for changes in the structural sources of technological dependency became less and less politically relevant, particularly with the new environment of policy-making in the 1980s and 1990s that was reflected in and reinforced by both regional and global trade agreements. In the 1990s, arguments for a structural transformation of the technological capacities in Canadian industry were still present in the federal state, such as the studies done for Industry Canada by Lipsey and Carlaw and by Gibbons that called for targeted forms of state support for specific domestically based industries through state-led industrial strategies.<sup>35</sup> These studies were done as part of a wider initiative, taking shape in 1993 and led by Industry Canada, that continued the long tradition of federal reviews and strategies in the area of innovation policy. This policy evolved over time in a more structuralist direction until “its maturation in the 2002 Innovation White Paper,” where it became more concerned with “embedding innovative behaviour within the larger fabric of society,” although it never took on the interventionist dimensions of earlier approaches, such as the two sets of proposals put forward by Herb Gray in the early 1970s and early 1980s.<sup>36</sup>

#### TRANSFORMING R & D? FEDERAL POLICY AT THE TURN OF THE CENTURY



However, as was illustrated by the minimal impact of the White Paper after its announcement, transformative policy initiatives, even of the more limited sort put forward by Industry Canada, were deeply out of step with the dominant policy norms in the federal state and the prevailing context of R & D and innovation in the Canadian economy at the turn of the twenty-first century. On the basis of the new innovation strategy, the Chrétien Liberals argued for much higher levels of R & D and original innovation in Canadian industry, but the entire exercise had an unreal quality, particularly with respect to the goal it set for R & D expansion. As noted by Kinder, in that strategy “the Chrétien government... made a commitment to improve Canada’s performance in research and development (R & D) so that by 2010 it [would] rank among the top five countries in the world in that policy area. Given that R & D performance by the private sector accounts for over half of all R & D conducted in Canada, this goal, regardless of its merits, is not likely to be reached unless massive new investments are made by business and industry.”<sup>37</sup> The figures on R & D that I presented earlier show how unrealistic that goal was. Far from moving to the top five countries in 2010, R & D in Canadian industry was in steep decline, and the gap between Canada and other OECD countries was growing.

The failure of the innovation strategy to achieve its goal for R & D expansion illustrated the impasse in federal R & D and innovation policy – one that was firmly entrenched by the turn of the twenty-first century. By 2000, any meaningful tensions between structuralist initiatives and the Glassco Framework were gone as the forces, both inside and outside the state, supporting federal policies and programs that took seriously the sources of dependent technological development were weakened over the 1980s and 1990s – a process that I discuss in chapters 12 and 13. As the orthodox position of the Glassco Framework became ever more dominant, the underlying parameters governing federal R & D and innovation policy were solidified. The period 1960–2000 was thus crucial, as it was during this time that key tensions in the R & D and innovation policy area were settled in favour of the Glassco approach.

By the turn of the twenty-first century, the contradictions of federal R & D and innovation policy were also at their height. Based on the growth in R & D in the Canadian economy, particularly over the 1990s, and the seeming effectiveness of the innovation systems framework that shaped the major investments made by the Chrétien Liberals in that decade, there was a sense that Canadian R & D and innovation had turned a corner. As one science policy commentator stated, “The impressive progress made by the government since 1993 was not a mere happenstance or a case of serendipity. It shows strong evidence of a framework that was, over time, utilized by major departments and agencies. Although the results have not been uniform in all areas of policy, the innovation systems framework has proven to be both robust analytically and effective in action.”<sup>38</sup> As noted earlier, this was precisely when Canadian R & D and innovation began to go into decline as key Canadian firms struggled after the bursting of the [dot.com](#) bubble in 2000. At the very point that federal support for R & D and innovation had gone through another period of expansion, and federal policies and programs seemed to be working by following the prescriptions of the innovation systems approach, a process of significant decline was getting underway. Even at the best of times, the underlying sources of relatively low R & D and innovation in the Canadian economy were not changed.

Over the ensuing decade, the Martin Liberals and Harper Conservatives continued to support R & D and innovation, although with less belief on the part of the Tories concerning the potential for transforming this aspect of the Canadian economy. Optimism began to erode. By the end of the decade – reflecting the deterioration that had occurred – the same concerns were being raised about the poor innovation performance of Canadian industry. Writing in 2010, Phillips and Castle stated that “most individuals and groups involved in science, technology and innovation policy agree that Canada can and should do better in terms of innovation. Many studies critical of Canadian science and technology innovation have focused on different problems within the innovation system and its implications for productivity, global competitiveness, drivers of commercialization, and the productivity gap.”<sup>39</sup>

Discussion had moved away from how Canada's national system of innovation had reached a point of “take-off,” to once again emphasizing the weaknesses of Canadian innovation and how that was having a negative impact on productivity and economic growth. But this situation was a direct outgrowth of the vulnerabilities that had remained in Canada's national system of innovation ten years earlier and were not removed by the “Golden Age” of Canadian innovation. I thus focus my study on the period 1960 to 2000 both because it covers the crucial moments when core tensions between structuralist initiatives and the Glassco Framework continued to define the R & D and innovation policy area or, by the end of the period, were resolved by the dominance of the Glassco approach, and because it covers the underlying sources of low R & D and innovation that continued to exist in Canadian industry even in the period when they supposedly had undergone major change. The R & D situation as it proceeded into the first decade of the twenty-first century was defined by this period, and it underpinned the marked deterioration by the end of the decade.

In the concluding chapter, I briefly review R & D policy developments up to 2010 as part of my discussion of the federal policy impasse in the current period. I will also discuss the issue of why low R & D and innovation is important as part of a broader consideration of the manufacturing situation in Canada and the deterioration in manufacturing value-added and employment. I present evidence concerning the serious decline in manufacturing over the first decade of the twenty-first century and discuss why that decline has important ramifications for the broader services sector. I argue that any claims that manufacturing can safely be ignored in favour of the larger services sector, in terms of a knowledge-based services sector, is misguided. I also argue that the provinces do not represent a viable alternative to the federal state in the area of promoting R & D and innovation because of their grounding in political economic contexts that support similar Glassco-based approaches, the level of resources that the provinces can devote to this purpose, and because of key policy instruments that are controlled at the federal level.

#### DISTINCTIVE CONTRIBUTIONS

My explanation of both the development and the impact of federal innovation policies has several distinctive dimensions. I depart significantly from the established ways of understanding the political economy of Canadian economic development. Within the standard interpretations of this process, there has been no recognition of the status of Canada as an early adopter of the frameworks and social relations



of American Fordism, or of the way in which Canadian development occurred within shifting configurations of the international organization of Fordism, or of the unique combination of dependency and advanced development in Canadian Fordist industrialization. Explanations of development have either argued for a process of limited industrial development quite unlike the American one, or have located Canadian development within a nationally contained framework similar to the path followed in other advanced economies, including the United States.<sup>40</sup> In addition, because the specific version of Canadian Fordism in the two earlier periods has not been adequately theorized, there has been insufficient analysis of how previous patterns of economic development came apart in the neoliberal era and new patterns of post-Fordist accumulation were established that rested on a different basis. I thus provide a different framework for understanding the actions of the state and manufacturing capital in defining Canadian economic development. I also provide a different explanation for how and why technological dependency was established and sustained in the Canadian economy.

There are a number of further contributions. I provide an alternative conception of the political economy of Canadian economic development and integrate that framework into an explanation of federal state policy concerning industrial R & D and original innovation over the forty-year period from 1960 to 2000. Surprisingly, given the extensive commitment of the federal state to promoting greater domestic R & D and original innovation in this period, there has been no detailed attempt to examine the history of policy development in this area, and no attempt to link that history to the broader context of the Canadian political economy. There has also been little recognition of the importance attached by the federal state to promoting innovation-based exports. The various programs created by the federal state represented a significant long-term commitment to altering the export orientation of Canadian industry by changing its original technological capacities – a commitment that has been neglected within the Canadian political economy literature, which has traditionally placed the promotion of resource staples at the centre of federal export policies.<sup>41</sup>

I also review in chapter 1 the established views of the role of the state in technological development – ranging across “national systems of innovation” theory, institutionalist theory and the “developmental state” literature – and argue that these various analytical models have neglected the important role of political economic structures in determining both the outcomes of industrial strategies and the feasibility of state-led transformative projects in the area of technological development. I make a similar argument about the “varieties of capitalism” literature, which, while shifting the focus to firm-level structures, also does not sufficiently consider the role of political economic structures in shaping the paths followed in different capitalist economies. These various literatures have not been addressed under one review, even though they share similar themes.

Finally, my work addresses the feasibility of innovation-based industrial transformations in Canada – a question that has generally not been considered in the various proposals to pursue a Canadian “progressive competitiveness” strategy.<sup>42</sup> A lot of attention has been focused on the characteristics of an economy with greater domestic technological capacities; much less attention has been paid to the specific social and political contexts in which this type of economy would be developed and sustained. Various writers have called for state action to reorient the Canadian



economy toward higher levels of indigenous R & D, a greater emphasis on technological innovation, and faster rates of productivity growth.<sup>43</sup> But they have consistently neglected crucially important questions surrounding the feasibility of their strategies within the dominant structures of the Canadian political economy.

In my discussion of the ability of the state to implement high tech strategies, I depart from traditional approaches to analyzing public policy that distinguish between three sources of policy development: ideological positions, such as those deriving from class-based interests; ideas that inform the parameters of debate about policy issues; and institutions that shape both the capacities to act in particular ways and the manner in which approaches to policy are formed. As stated by one analyst of public policy: "Three mutually interacting influences shape and constrain policy formation: powerful ideas, powerful institutions, and powerful interests act as gatekeepers to the process of agenda setting."<sup>44</sup> In my arguments, social forces, particularly class interests, are given central importance, while ideas and institutions are seen more as outcomes of how these dominant forces shaped, in different historical periods, the hegemonic ideas or approaches to understanding the relationship of the state to the economy, and the institutional structures that were put into place to regulate and manage capitalist accumulation. This is particularly the case in how I explain the ongoing debate over the role of the state in "picking winners" and engaging in state-directed strategies for transforming economies. In part 2, I claim that this contending set of policy ideas, and the institutional forms of organization that shaped the debate, were defined by the contexts of political economic forces in which they developed.

I also argue that a core source of support in Canada for ideas that denied the efficacy of the state in "picking winners" and opposed state-directed industrial strategies in R & D and innovation derived from the class-based forces in the Canadian economy and state, which saw no purpose in using state institutions in this way as a means of developing greater domestic technological capacities, and reinforced those federal programs and policies that supported the Glassco Framework. Policy debates over the appropriate role of the state, and about institutional evolution, were thus part of one overall process connecting class-based interests with ideas and institutions. I return several times to different historical conjunctures in which policy choices, or ideas, and the development of institutions, were informed by the structure of class-based representation of forces within the economy and state. Policy debates and the framework of institutional capacities were not separate sources of policy formation that came together with "powerful interests" to determine policy, but were deeply informed themselves by the wider context of social forces.

A final note is necessary before moving on to the analysis offered in this book. In my arguments I break with explanatory frameworks that emphasize the institutional prerequisites for industrial strategies and argue that in Canada "the combined institutional legacy of the Westminster model of parliamentary government and federalism... fosters a weak state tradition and discourages anticipatory policy making."<sup>45</sup> In my work, I found little evidence to suggest that the federal division of powers or the Westminster model led to a lack of institutional capacities or an inability to formulate forward-looking transformative proposals in the area of R & D and innovation. Concerning the impact of federalism, I found no instances where the federal division of powers was regarded as a significant

impediment to transformative policies and programs. The debates were conducted in terms of the appropriate role of the state in shaping production and investment in the Canadian economy, not in terms of the institutional obstacles created by the constitutional role of the federal state.

Significant capacities within the federal state and moments of transformative politics also existed that did not support the notion of a “weak state tradition.” In chapter 2, I discuss the transformation of the Canadian economy in a Fordist direction that was supported in a number of ways by federal state actions. In both parts of the book, I refer to institutional capacities that existed in the federal state – such as the research capacities created during the Second World War, the connections between the federal state and the manufacturing of jet aircraft in the 1950s, and the awareness in the federal bureaucracy at various moments of the structural limitations on R & D and innovation in the Canadian economy – all of which could have been mobilized to support a transformative strategy. I also discuss key moments when transformative projects were generated from within the federal state, at the cabinet level with the Gray proposals in the 1970s and 1980s, and at the parliamentary level with the detailed proposals put forward by the Senate Special Committee on Science Policy in the 1970s. The latter set of proposals called for, among other things, an Office of Industrial Reorganization in the Department of Industry, Trade and Commerce.

In these instances, there was no shortage of policy proposals focused on the need for a structural transformation of the organization of domestic R & D and innovation and, within the federal state, capacities existed that could have been used to support them. What was missing was a political economic context of forces that could carry them forward in the face of the commitment of class interests, as those were organized in the state and the economy in different historical periods, to dependent technological development. Although there were no guarantees that the strategies, if implemented, would have been successful, there was also no way that a transformation in the domestic technological capacities of Canadian industry could be accomplished without them. It was this dynamic that was crucial. The failures I point to are thus not failures that derived simply from an inadequate set of institutional arrangements or an inadequate set of policy measures located at the level of the state. Rather, they derived from a set of social relations that concentrated social power in the hands of a select group of capitalist economic and political elites in a way that ensured there would be little meaningful progress in establishing greater domestic technological capacities. In the next chapter, I will elaborate on this theme by discussing how this underlying principle of capitalist power has been missed in the broad literature that has attempted to explain the course of technological development under capitalism.

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<sup>1</sup> A. Glyn, A. Hughes, A. Lipietz, and A. Singh, “The Rise and Fall of the Golden Age,” in *The Golden Age of Capitalism*, ed. S. Marglin and J. Schor (London: Clarendon Press, 1990), 46–72; Leo Panitch and Sam Gindin, *The Making of Global Capitalism* (London: Verso, 2012), 91–102.

<sup>2</sup> Panitch and Gindin, 106–7.

<sup>3</sup> The level of US industrial R & D, massively supported by federal state spending, was “greater than the total for all other OECD countries combined” in 1969 and was not exceeded by these other countries until 1979. See: David Mowery and Nathan Rosenberg, *Technology and the Pursuit of Economic Growth* (Cambridge: Cambridge University Press, 1989), 125.

<sup>4</sup> David Mowery, “Plus ça change: Industrial R & D in the “Third Industrial Revolution,” *Industrial and*

*Corporate Change* 18, no. 1 (2009): 25.

<sup>5</sup> On the disruptions and crises in this period, see Glyn et al., “The Rise and Fall of the Golden Age,” 72–113; and Panitch and Gindin, *The Making of Global Capitalism*, chap. 6. Panitch and Gindin, departing from the analysis of Glyn et al., also argue that the movement away from the “Golden Age” was not characterized by a decline in the hegemony of the American state, but involved a reconstitution of American power with the development of a new neoliberal global capitalist order.

<sup>6</sup> For a discussion of these changes, see Nigel Grimwade, *International Trade: New Patterns of Trade, Production and Investment* (New York: Routledge, 1989); and Philip McMichael, *Development and Social Change* (Los Angeles: Sage, 2012), chap. 4.

<sup>7</sup> Hannes Lacher, *Beyond Globalization: Capitalism, Territoriality and the International Relations of Modernity* (New York: Routledge, 2006), 160–1.

<sup>8</sup> Greg Albo, “‘Competitive Austerity’ and the Impasse of Capitalist Employment Policy,” *Socialist Register 1994: Between Globalism and Nationalism. Socialist Register* 30 (London: Merlin Press, 1994), 146.

<sup>9</sup> For a review of the attempt by states to stimulate R & D and establish various forms of technological cooperation in the 1980s and 1990s, see OECD, *Industrial Policy in OECD Countries: Annual Review 1990* (Paris: OECD, 1990), 22–120; and OECD, *Science, Technology and Industry Outlook 1998* (Paris: OECD, 1998), 65–91. Concerning those policies at the end of the 2000s, see OECD, *Science, Technology and Industry Outlook 2012* (Paris: OECD, 2012), 156–80.

<sup>10</sup> John Rigby, Yanuar Nugroho, Kathryn Morrison, and Ian Miles, “Who Drives Innovation?,” in *Innovation Policy Challenges for the 21st Century*, ed. Deborah Cox and John Rigby (New York: Routledge, 2013), 9.

<sup>11</sup> OECD, *Science, Technology and Industry Outlook 2012*, fig. 5.1, 147.

<sup>12</sup> Honourable Paul Martin, Minister of Finance, *The Budget Speech* (22 February 1994), 8, cited in John de la Mothe, “One Small Step in an Uncertain Direction: the Science and Technology Review and Public Administration in Canada,” *Canadian Public Administration* 39, no. 3 (1996): 404.

<sup>13</sup> On this strategy, see Marcus Sharaput, “Biotechnology Policy in Canada: The Broadening Scope of Innovation,” in *How Ottawa Spends, 2002–2003*, ed. G. Bruce Doern (Don Mills: Oxford University Press, 2002).

<sup>14</sup> David Wolfe, “Innovation Policy for the Knowledge-Based Economy: From the Red Book to the White Paper,” in *How Ottawa Spends, 2002–2003*, ed. G. Bruce Doern (Don Mills: Oxford University Press, 2002), 144.

<sup>15</sup> Jacek Warda, *Canadian R & D Tax Treatment: An International Comparison* (Ottawa: Conference Board of Canada, 1994), 14–17.

<sup>16</sup> McPetridge and Warda found that in the early 1980s federal R & D tax incentives were the second highest of the twenty major industrialized countries. The only country with higher tax incentives was Singapore. See: Donald McPetridge and Jacek Warda, *Canadian R & D Incentives* (Toronto: Canadian Tax Foundation, 1983), 78. An update done by Warda at the end of the 1980s found that federal R & D tax incentives were still among the highest of all major industrialized countries. Only Australia and Korea had higher tax incentives. When provincial tax incentives were added in, the level in Canada was higher than anywhere else in the world. See: Jacek Warda, *International Competitiveness of Canadian R & D Tax Incentives: An Update* (Ottawa: Conference Board of Canada, 1990), v.

<sup>17</sup> Royal Commission on the Economic Union and Development Prospects, *Report*, vol. 2 (Ottawa: Minister of Supply and Services, 1985), 105.

<sup>18</sup> *Ibid.*, 104.

<sup>19</sup> Jorge Niosi, *Canada’s National System of Innovation* (Montreal: McGill-Queen’s University Press, 2000), 193–4.

<sup>20</sup> John de la Mothe, “Ottawa’s Imaginary Innovation Strategy: Progress or Drift?” in *How Ottawa Spends, 2003–2004* (Montreal: McGill-Queen’s University Press, 2003), 177.

<sup>21</sup> Wolfe, “Innovation Policy,” 152.

<sup>22</sup> OECD, *Main Science and Technology Indicators 2012* (Paris: OECD, 2013), table 24, 43.

<sup>23</sup> OECD, *Main Science and Technology Indicators 1998* (Paris: OECD, 1998), table 25, 26.

<sup>24</sup> OECD, *Main Science and Technology Indicators 2012*, table 11, 30.

<sup>25</sup> *Ibid.*, table 25, 44.

<sup>26</sup> OECD, *Main Science and Technology Indicators 1998*, table 25, 26.

<sup>27</sup> OECD, *Science, Technology and Industry Outlook 2012* (Paris: OECD, 2012), 256.

<sup>28</sup> Roger Voyer, “Thirty Years of Canadian Science Policy: From 1.5 to 1.5,” *Science and Public Policy* 26, no. 4 (1999): 282.

<sup>29</sup> OECD, *Main Science and Technology Indicators 2011* (Paris: OECD, 2012), table 2, 21.

<sup>30</sup> Robert Howse and Marsha Chandler, “Industrial Policy in Canada and the United States,” in *Degrees of Freedom: Canada and the United States in a Changing World*, ed. K. Banting, G. Hoberg, and R. Simeon



(Montreal: McGill-Queen's University Press, 1997), 244.

[31](#) Conference Board of Canada, *How Canada Performs* (Ottawa: Conference Board of Canada, 2007), 2.

[32](#) Peter Phillips and David Castle, "Science and Technology Spending: Still no Viable Federal Innovation Agenda," in *How Ottawa Spends, 2010–2011*, ed. G. Bruce Doern and C. Stoney (Montreal: McGill-Queen's University Press, 2010), 171.

[33](#) Jane Jenson, "'Different' but not 'Exceptional': Canada's Permeable Fordism," *Canadian Review of Sociology and Anthropology* 26, no. 1 (1989): 78–80.

[34](#) Concerning the growth of university "managerialism" in pursuit of restructuring universities to attract private-sector money, and the role of the federal state in supporting these changes, see Janice Newson, "The Corporate-Linked University: From Social Project to Market Force," *Canadian Journal of Communication* 23, no. 1 (1998): 107–20; Clare Polster, "From Public Resource to Industry's Instrument: Reshaping the Production of Knowledge in Canada's Universities," *Canadian Journal of Communication* 23, no.1 (1998): 91–106; and Clare Polster, "Canadian University Research Policy at the Turn of the Century: Continuity and Change in the Social Relations of Academic Research," *Studies in Political Economy*, No. 71/72 (Autumn 2003 /Winter 2004), 177–95.

[35](#) Richard Lipsey and Kenneth Carlaw, *A Structuralist Assessment of Technology Policies – Taking Schumpeter Seriously on Policy* (Ottawa: Industry Canada, 1998). Another study, more clearly inspired by the National Systems of Innovation literature, also pointed in a structuralist direction. See: Michael Gibbons, *Technology and the Economy: A Review of Some Critical Relationships* (Ottawa: Industry Canada, 1995).

[36](#) Markus Sharaput, "Harper Government Industrial Strategy and Industrial Policy in the Economic Crisis," in *How Ottawa Spends, 2010–2011*, ed. G. Bruce Doern and C. Stoney (Montreal: McGill-Queen's University Press, 2010), 116.

[37](#) Jeff Kinder, "The Doubling of Government Science and Canada's Innovation Strategy," in *How Ottawa Spends, 2003–2004* (Montreal: McGill-Queen's University Press, 2003), 204.

[38](#) De La Mothe, "Canada's Imaginary Innovation Strategy," 178.

[39](#) Phillips and Castle, "Science and Technology Spending," 181.

[40](#) Prominent examples of the first approach are provided by Mel Watkins, "A Staple Theory of Economic Growth," in *Perspectives on Canadian Economic Development*, ed. G. Laxer (Toronto: Oxford University Press, 1991), 80–96; and Kari Levitt, *Silent Surrender* (Montreal: McGill-Queen's University Press, 2002). For an example of the second approach, see William Carroll, *Corporate Power and Canadian Capitalism* (Vancouver: University of British Columbia Press, 1986).

[41](#) For examples of this view, see Rianne Mahon, *The Politics of Industrial Restructuring: Canadian Textiles* (Toronto: University of Toronto Press, 1984), 11–12; Melissa Clark-Jones, *A Staple State* (Toronto: University of Toronto Press, 1987); and Wallace Clement and Glen Williams, "Resources and Manufacturing in Canada's Political Economy," in *Understanding Canada: Building on the New Canadian Political Economy*, ed. W. Clement (Montreal and Kingston: McGill-Queen's University Press, 1997), 48–51.

[42](#) For a more general discussion and critique of the feasibility of progressive competitiveness strategies, see Greg Albo, "'Competitive Austerity' and the Impasse of Capitalist Employment Policy," 148–57.

[43](#) See, for example, Richard G. Harris, *Trade, Industrial Policy and International Competitiveness*, Royal Commission on the Economic Union and Development Prospects for Canada, Collected Research Studies 13 (Toronto: University of Toronto Press, 1985), 93–121; Daniel Drache and Meric Gertler, "The World Economy and the Nation-State: The New International Order," in *The New Era of Global Competition: State Policy and Market Power*, ed. D. Drache and M. Gertler (Montreal and Kingston: McGill-Queen's University Press, 1991), 21; David Wolfe, "Technology and Trade: Finding the Right Mix," in *Getting on Track: Social Democratic Strategies for Ontario*, ed. D. Drache (Montreal & Kingston: McGill-Queen's University Press, 1992), 17–29; Daniel Drache, "The Way Ahead For Ontario," in *Getting on Track*, ed. D. Drache, 230–6; Charles McMillan and Alex Baluta, "Technology and Competitiveness: A Canadian Strategy," in *Canada and the New World Economic Order*, ed. T. Wesson (Toronto: Captus Press, 1998), 339–68; and Roger Martin and James Milway, *Canada: What it is, What it Can Be* (Toronto: University of Toronto Press, 2012).

[44](#) Janet Atkinson-Grosjean, *Public Science, Private Interests* (Toronto: University of Toronto Press, 2006), 40.

[45](#) Michael Atkinson and William Coleman, *The State, Business and Industrial Change in Canada* (Toronto: University of Toronto Press, 1989), 76.