OPPORTUNITIES AND CHALLENGES FOR INNOVATION IN THE TRANSPORT SECTOR

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Introduction

Over the past year, Transport Canada has engaged in a national series of consultations with stakeholders representing the transport industry, academia and governments. Workshops and roundtables were held in Montreal, Calgary, Vancouver, Halifax, St. John's, Toronto, Montreal and Ottawa.[1] The objectives of these consultations were to increase knowledge and improve understanding of the issues facing the transportation sector, to identify the drivers and barriers to innovation, and the opportunities and challenges as they pertain to improving transportation performance. Transport Canada has identified its role as that of knowledge broker, catalyst and facilitator to foster innovation by reducing barriers to innovation where possible, and identifying opportunities for collaboration and partnership to advance innovation in transportation.

The purpose of this paper is to provide the preliminary results from the workshops. This paper presents the positions expressed by stakeholders in response to the general questions that were posed at the workshops; the issues facing the industry, where the opportunities are for innovation to address those issues, any barriers to innovation and what possible roles Transport Canada might assume to foster innovation in the sector. A number of key, cross-cutting themes that emerged from the discussions form the basis of this paper.

[*] The views expressed in this paper do not necessarily reflect those of Transport Canada.

Context

The solutions to many transportation challenges of today and tomorrow will increasingly depend on innovation. Productivity in Canada overall has been decreasing over the past decade, although the transport sector has made important productivity gains, having outperformed the rest of the economy largely through efficiency improvements. Productivity growth in transportation impacts growth in other sectors, as it lowers the cost of doing business over distances and enables greater access to markets. The future now lies in the adoption of innovative products and business practices to maintain a competitive edge.

Recent assessments of Canada's innovation performance tell us that all is not well. The Council of Canadian Academies, in its April 2009 report, *Innovation and Business Strategy: Why Canada Falls Short*, demonstrated that the persistent weakness of productivity growth in Canada is rooted in sub-par business innovation. The report's principal conclusion is that Canada's poor performance with respect to innovation is due to the prevalence of business strategies that do not emphasize innovation as a key competitiveness tool.

The Science, Technology and Innovation Council, in its May 2009 report, *Canada's Science, Technology and Innovation System: State of the Nation 2008*, found that Canada is having difficulty keeping pace with the best innovators as measured by key performance indicators such as research intensity, commercialization rates, quality of research and workforce skills. Canada remains in the middle of the pack of 30 countries in the Organisation for Economic Cooperation and Development (OECD) and sixth in the G-7 in terms of business R&D as a proportion of gross domestic product. In addition, the report found that low overall business R&D and commercialization has been a constant feature in Canada for 40 years.

In its February 2010 *Report Card on Innovation*, the Conference Board of Canada ranked Canada 14th among 17 industrialized countries. Canada's low relative ranking means that innovation is less

of a factor accounting for overall economic activity in Canada than is the case in comparable industrialized economies. The report found that, with a few exceptions, Canada lags behind in commercializing its scientific and technological discoveries into world-leading products and services.

Many countries that have proven to be successful innovators have done so in response to a crisis. Proponents of innovation warn that there is a need to shake off the complacency that has resulted from a long history of prosperity and raise the alarm bell now to create a sense of urgency before it is too late and we lose our competitive advantage. Government has a role to play to plan for the future and help to create an environment that is conducive to innovation.

Over the past few years, the Government of Canada has increased its focus on innovation as a key component to advance Canada's prosperity through such initiatives as *Advantage Canada*; *Seizing Global Advantage: A Global Commerce Strategy for Securing Canada's Growth and Prosperity*; *Competition Policy Review Panel; and Mobilizing Science and Technology to Canada's Advantage*. The 2010 Budget identified innovation as key to harnessing Canada's competitive advantage and announced new spending for research, innovation clusters, commercialization of products and technology partnerships.

Innovation is a key component of Transport Canada's forward-looking plan to identify measures to enhance transportation efficiency, environmental performance, safety, and security. Innovation has implications for trade facilitation, supply chain management, security and competitiveness and is strongly linked to environmental sustainability, climate change and greenhouse gas emissions.

Transport Canada defines innovation in its broadest sense and refers not only to new and emerging technologies, but also new or better ways of using existing technologies. Equally important to innovation are research and development, business practices, policies and regulatory approaches, skills development, and capacity building.

Cross-cutting Themes

Over the course of the consultation workshops, six, high-level, cross-cutting themes emerged from the discussions:

- policy and leadership;
- regulation;
- partnership and collaboration;
- research and development;
- skills capacity; and
- data and information requirements.

The following is a summary of the issues and positions raised by stakeholders.

1. Policy & Leadership

Industry is looking to government to create a coherent, multi-modal transportation strategy that includes innovation and that guides longer-term development. Leadership is required to see beyond jurisdictional disputes and develop a vision for the sector based on the importance of transportation to economic development. The vision should further identify the need for cost-competitive, reliable and secure service that is predicated on transportation as a means to facilitating trade and increasing prosperity. Finally, it should further position Canada as a world leader in areas where there is unique expertise, such as cold and harsh climate scenarios.

Innovation is most often incremental and involves continuous improvement to performance and productivity. The creation of innovation roadmaps to support value-added technologies and processes will assist the industry in identifying and investing in innovation. Roadmaps should be accompanied by realistic action plans that focus on the strategic priorities identified in the vision, encourage partnerships and build research capacity.

Industry requires the right policy frameworks and tools to encourage, rather than hinder or stifle, innovation. A portfolio of support

mechanisms is required that includes sustained and predictable funding for research and development, marketing and commercialization support, capital investment, and demonstration and showcasing of technologies.

Transport Canada can assist by acting as an advocate for the sector with other government departments, provincial governments and with other governments internationally. The department should represent the interests of the sector by being the single window at the federal level through which industry interacts with other departments. Furthermore, Transport Canada should take the lead in developing a higher and more compelling profile for the transportation sector and its role in the Canadian economy, especially through building a wider understanding of its importance in the daily lives of Canadians and its existing and potential contribution to international trade and competitiveness.

To further promote and encourage innovation in the sector, government should create centres of excellence in transportation that will bring industry, universities and governments together to collaborate on innovation and facilitate the sharing of global best practices. Transport Canada has a role to play in ensuring a sustained dialogue with all stakeholders on issues of strategic importance to the sector. This could be accomplished through the creation of a permanent, advisory committee comprised of industry and academic representatives, to raise awareness of issues and provide advice.

2. Regulation

Transportation is among the most heavily regulated industries. Government policies and regulations are known to influence the development and uptake of new technologies, private sector investment in research and development, and innovative business practices. International examples exist where forms of regulatory control have been used to facilitate modal shifts to achieve other public policy objectives, such as the use of congestion pricing to encourage the shift to public transit. In some situations, a conflict of

interest exists where government is both regulator and provider of services or otherwise has oversight responsibilities.

Industry has identified the need for flexible, performance-based regulations that will encourage, rather than hinder, innovative solutions to regulatory objectives. In particular, stakeholders requested a performance-based approach to safety regulations that are based on industry best practices, and a risk management approach built on a solid foundation for safety management systems (SMS). Transport Canada is being encouraged to continue the introduction of SMS as an important regulatory instrument that provides the flexibility to businesses to adopt innovation solutions.

To facilitate innovation, industry requires regulations that are responsive to changing environments and that anticipate emerging, rather than existing or current, technologies and business practices. Performance based regulations will allow the industry to adapt quickly to changes in market conditions. In areas where technology adoption is advancing rapidly, Transport Canada can facilitate industry investment in new technologies by providing the necessary regulatory certainty to build business confidence.

Industry is often subject to many levels of regulation (federal, provincial and local) each of which has differing objectives and priorities or in some cases may duplicate or "layer" regulations. Other jurisdictions may lack adequate knowledge of the sector, inadvertently creating barriers to innovation.

To facilitate both inter-provincial and international trade, internal issues should be resolved and regulations harmonized. Where possible, international standards should be adopted for use in Canada. Furthermore, government has a role to play in the setting of international regulations and standards but is not always involved in the actual process, deferring instead to industry players. Government should create a regulatory environment that supports Canada's global competitiveness in transportation by streamlining regulations pertaining to the movement of goods and people across borders (especially the US) to promote international trade. Regulations

should consider the impact on the entire supply chain, and not just one category of player.

Industry would like regulators to be aware that the costs of meeting regulatory requirements, such as obligatory service fees and taxes, may adversely affect innovation. Regulatory requirements imposed by other jurisdictions, for example for marine GHG emissions, are not only costly but sometimes the technology is not available to meet the requirements. The testing of new technologies for safety certification, such as crash testing of real equipment, involves considerable cost that could be alleviated through the use of alternative means such as computer-based simulation.

3. Partnerships and Collaboration

Innovation cannot be conducted in silos; it requires visionaries, research partners, entrepreneurs, competitors, community leaders and policy makers. To successfully promote innovation, a three-pronged approach of government, industry and academia is needed to establish common lists of goals and objectives. For example, Europe is leading in innovation in rail because industry, government and researchers came together to develop a 20- year plan, which is now being implemented.

Stakeholders have identified a general lack of awareness, much less collaboration, between industry, academia and governments. Consequently, research is not always responsive to industry needs as there are few mechanisms in place where universities and industry can interact. Conversely, industry is often unaware of the availability of new products or opportunities to adapt technologies to other modes of transport. The creation of networks or centres of excellence will serve to facilitate interaction between industry and researchers. Transport Canada can act as an advocate to encourage the creation of networks and partnerships.

Existing technologies are often sourced outside of Canada due to a lack of knowledge of Canadian expertise and availability of products. The industry requires better access to information and better sharing

of best practices both domestically and internationally. Suppliers of transportation equipment and vehicles often drive the innovation by conducting research and dictating the technologies that are being introduced. Collaboration with suppliers will provide operators with the knowledge they require to make sound investments and provide some influence over the introduction of new products.

Collaboration among all partners on specific gateways and corridors is required to create a seamless supply chain to support and expand trade. Enhancing the supply chain requires multi-stakeholder participation and cross-enterprise collaboration to improve the process and efficiency of the entire system, rather than achieving improvements to individual components or productivity. The adoption of information technologies is key to ensuring collaboration and improvement of the supply chain through programs such as the gateways and corridors that encourages cross-enterprise collaboration and providing information about new and emerging technologies.

Especially in large urban areas, the alignment of land use planning is needed to permit future corridor growth, including increased demands on transportation infrastructure, requiring collaboration among municipal, provincial and federal governments. Equally important in an urban context is the management of the interface between passenger and freight movements, and the connections between public transport, traffic congestion, urban freight, roadway and rail capacity, traffic control, traffic management and driver information systems. To facilitate freight movement within critical corridors, Transport Canada can encourage the development of traffic management strategies by providing opportunities for all levels of government involved to share information and collaborate on technology solutions.

4. Research & Development

Corporate research has all but disappeared because it is unaffordable; there is greater specialization in the industry with a concentration in corporate ownership. The linkages between industry and research that enabled innovation to happen more quickly are missing. The

challenge is how to get into the hands of industry the research potential and technology opportunities that are available. Transport Canada needs to revitalize the government's R&D capacity in transportation, which has been declining steadily since the 1980's.

Research is a fundamental component of innovation. Canada has one of the most generous tax incentive programs, the Scientific Research and Experimental Development (SR&ED) program, to encourage private sector investment in R& D, but the program has not produced the desired results for most of the sector. The program is not well promoted or used. Generally speaking, small and medium sized companies that are struggling for survival don't have the resources to invest in research and are not participating in the tax credit program.

Most R&D tax credit programs have too narrow a definition of innovation and fail to take into account investments in processes, including business processes. Private industry requires incentives, other than tax relief, to adopt new technologies.

A number of Canadian companies are subsidiaries of parent firms that conduct their research offshore. Most of the effort for the Canadian subsidiaries is focused on product development and internal processes rather than innovative technologies.

To encourage innovation, companies need to understand the delays between investment and returns and be able to explain and defend the longer-term benefits to shareholders who are concerned with the bottom line and require short-term gains.

Government invests in basic research through National Science and Engineering Research Council (NSERC) grants and other programs, however, transportation is not a priority of granting institutions; the exceptions are the automotive sector and aerospace. Transportation and logistics research is often not considered inter-disciplinary or inter-jurisdictional which, in many cases, are conditions to qualify for funding. Researchers have a difficult time accessing funding and are often not aware of the availability of funding programs. Transport

Canada has a role to play to provide a single window access point for R&D funding.

Analysis of Canada's record in R&D reveals that while Canadians are good at initiating new ideas, those ideas are seldom brought to the marketplace. There is less support, through appropriate funding and promotion, for applied research that leads to the development of products for commercial use. Academic success is measured by R&D activity but doesn't always make the connection to the application and marketing (commercialization) of an innovation. Access to venture capital in support of market innovations is seriously lacking in Canada, further discouraging investment in innovation. Funding needs to cover not only research but also the uptake and commercialization of ideas.

The government has a role to play in supporting Canadian innovation by showcasing successes, by encouraging niche opportunities where Canadians excel, by identifying and promoting emerging technologies, conducting marketplace monitoring or collecting marketplace intelligence and by being an early adopter of new products and practices. Industry and academia need to work together to promote research that leads to innovation. Transport Canada could facilitate that collaboration by establishing fora for researchers and industry to connect.

5. Skills and Human Resources

The transport sector is facing the same demographic challenges as other sectors; facing the prospects of losing a significant proportion of the existing workforce and associated expertise, through retirement. It is difficult to innovate when large numbers of workers approaching retirement lose their focus on building organizational success and tremendous knowledge is lost when employees retire.

In addition, there are increasing problems with the attraction and retention of employees to an industry that has lost its appeal as an employer of choice. The younger generation places more emphasis on work/life balance and is no longer willing to make the kind of

commitments required for some of the traditional transportation jobs. Companies are struggling with succession planning and mentoring of new employees. These issues are not unique to one mode and most are expected to be addressed by individual firms.

Some firms see the expected shortages of labour as a unique opportunity to focus on innovation that will achieve productivity improvements. The principal challenge is to overcome what are sometimes adversarial relationships and bring all sides together in a cooperative environment around shared objectives and with a collective sense of urgency. The role of labour will need to be changed so it becomes a partner in adopting innovative solutions.

Potential employees are having difficulty finding appropriate training especially where certification and competency standards are lacking. The industry sees opportunities to make better use of apprenticeship programs and simulation training but government policies and regulations can create obstacles to their use.

While Human Resources and Skills Development Canada (HRSDC) has overall responsibility for skills development and employment, Transport Canada has a role to play as advocate for the industry to ensure the human resources needs of the transport sector are appropriately addressed. Transport Canada can also play a role in marketing the transport sector to young people, starting at the public school level. The overall challenge for the industry is to find ways to attract the best and the brightest by making transportation a desirable career.

Colleges and universities have to compete to attract students and there are very few support programs for students in transportation. Dedicated scholarships and apprenticeship programs are needed, for example the Railway Association of Canada (RAC) has a railway training and employment project with the Assembly of First nations (AFN), funded by HRSDC for career opportunities in Canada's rail industry.

To encourage the growth of research in an increasingly knowledge-based sector, the department can look to the successful Railway Research Advisory board (RRAB) as an example of collaboration between industry, academia and government to identify and support priority research. Among the many initiatives are opportunities for graduate students to get exposure to leading edge researchers and facilities, to raise awareness of the sector and promote skills development.

7. Data and Information Requirements

A general lack of industry knowledge and supporting data creates an impediment to innovation. Reliable traffic data, especially freight data, is required to support planning, generate development options, inform public policy and find innovation solutions to ease congestion in urban centres. Access to better data enables the modeling of systems/networks for infrastructure management, optimization and investment analysis.

There is a need for improved forecasting and sharing and integrating intelligence on a long-term basis. Essential information, such as where excess capacity exists, is required to enable shippers to balance their use of infrastructure. Improved data collection systems and methods to share data across supply chains will enhance reliability and efficiency and increase international market share. There is a need to support and encourage the use of electronic data interchange (EDI) technologies that are currently used by larger carriers and shippers to gain competitive advantage, but smaller companies still use manual documentation.

Data will provide a basis for informed discussion; the challenge is to motivate collaboration and bring it together systematically in one place. Though confidentiality issues related to data gathering have been successfully addressed without government involvement, government still has a role to demonstrate the value of public-private data partnerships. There is a particular urgency to generate and aggregate urban passenger and freight movement data for analysis to

support planning, the development of options, and informed public policy discussion.

Although there are some examples of models that represent progress, such as the Transportation for Tomorrow Surveys (TTS) covering passenger traffic, a huge critical gap is the absence of urban freight data and analysis. Initiatives are required to improve sharing of industry data, which is expensive to gather and is often not accessible. An example of a successful partnership is the McMaster Institute for Transportation and Logistics (MITL), in which the private sector plays an important role and which includes researchers from other universities.

Sharing data and providing access to data is important to improve service delivery and enhance competitiveness. Innovative use of technologies, such as the use of GPS to track rail cars, would increase visibility, and demonstrate reliability and efficiency by providing accurate and up-to-date information.

Conclusion

Throughout the workshop discussions, the role that innovation plays in driving competitiveness emerged as an overarching theme. Innovation is seen as the key to making the Canadian transportation sector more efficient and, therefore, competitive. Given the significant role that transportation plays in the national economy, a more competitive transportation system will also help Canada improve its relative standing internationally. Competitive advantage flows to companies that are innovative in their approaches to performance and productivity and that deploy the latest technologies to improve efficiency.

Stakeholders felt that the industry was lagging behind in global competitiveness due to the lack of a seamless supply chain. The focus, they believe, needs to be on creating an efficient, reliable, and secure system by tackling such issues as labour shortages, inconsistent or non-existent technology standards, and inconsistent regulations. Opportunities exist to better integrate the supply chain

by improving the flow of information, streamlining logistics processes, adopting green initiatives and sharing best practices and technology adoption. Governments and industry need to work together to improve the efficiency and reliability of the supply chain to improve Canada's competitive position.

To encourage innovation, the sector requires a suite of incentives and support mechanisms to address economic barriers. Firms that are struggling financially are finding it difficult to invest in innovation. Canadian tax structures and user fees, as well as a general lack of federal financial support, are cited as obstacles that are hampering competitiveness for the entire sector. Canada's business tax environment is more favourable than in the past but the ease of doing business can be improved. Some of the obstacles include tariffs on manufactured goods and cumbersome foreign trade zone rules.

The transport sector requires a level playing field globally; the off loading of fees and carriage requirements affects competitiveness. On-going advances are needed to keep distribution costs low and ensure timely delivery of products and inputs. Major capital investments in systems, processes and equipment must be continually made to sustain competitiveness. The return-on-investment (ROI) of these transportation-related investments, often extending over lengthy payback periods, must be demonstrable and attractive.

Government's role is to ensure that all the appropriate frameworks are in place to allow innovation to happen.

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Endnotes

[1] Between October, 2009 and December, 2010, Transport Canada held ten consultation meetings with stakeholders on innovation in transportation. A roundtable was held in Montreal in October, 2009, including innovation experts, transport industry executives, research councils/centres and policy makers. Workshops were held in western Canada in March, 2010, involving representatives of industry, academia and other governments. The theme for the Calgary meeting was intermodal transportation and air transportation and in Vancouver, participants discussed the Asia Pacific Gateway and marine transportation. Similar workshops were held in Atlantic Canada in June, 2010. In St. John's, participants focussed on marine transportation, and in Halifax, the discussion was intermodal. In September and December, 2010, workshops were held in Toronto and Montreal, where participants discussed the challenges of operating in large, urban environments. Workshops with specific modal focus were held in Ottawa, between April and September, 2010, with representatives of national industry associations representing the air, marine and rail sectors.