



# **Review of Federal Support to Research and Development**

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**The Expert Review Panel on Research and Development**

**Submitted by:**

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## **Introduction**

The Canadian Urban Transit Association (CUTA) is the national body representing public transit systems, suppliers to the industry, government agencies, individuals and related organizations in Canada. CUTA has been recognized as “the voice of Canada’s urban transit industry” since 1904.

## **R&D and Innovation in the Transit Industry**

Innovation and Research & Development may not be the first things that come into mind when thinking of public transit. Transit users want to have systems that are reliable, on time, frequent, rapid, efficient, safe, and at a competitive cost. When governments develop their budgets, they may think of transit from an infrastructure perspective, which includes maintenance facilities, rolling stock, bus shelters, terminals, etc. But for those within the transit industry, innovation is found everywhere.

The broad and inclusive definition of innovation used by the OECD is the best description of the wide variety of R&D and innovation that takes place in the transit industry. Indeed, in this sector, innovation signifies “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.” Whether this translates into improved vehicles, communication systems, or transit oriented development, innovation plays a role in all aspects of the industry.

## **The Canadian Transit Industry’s International Influence**

Many of the North American transit industry’s centres of excellence are found in Canada. The reach of the Canadian transit industry’s innovation can be seen in practice around the globe. Canada’s transit vehicle manufacturing sector is an important player within the North American and world markets. For example, the world’s largest public transit rail manufacturer (Bombardier) locates its research and development operations in Kingston, Ontario; North America’s three largest transit bus manufacturers – accounting for 70% of the continental market – are located in the provinces of Manitoba, Ontario and Québec. Information technology has been at the forefront of greater efficiency to transit operations across the world. For instance, Thales (a developer of automated train control systems) and GIRO (a developer of scheduling optimization software) have located their research and development activities in Canada.

## **Driving Factors that Foster Innovation in Transit**

### ***Government Regulations (Federal, Provincial and Territorial)***

Innovation is required to respond and adapt to evolving environments and new policy directions from government. This is the case, for example, when a government makes commitments on reducing greenhouse gas (GHG) emissions. As the transportation sector accounts for approximately 25% of Canada’s GHG emissions, it will be called upon to play an important part in reducing our carbon footprint. Much R&D can go into new technologies to increase energy efficiency and reduce fuel consumption, but even these changes lead to other needs for greater R&D. For instance, the technology involved in reducing bus GHG emissions and increasing energy efficiency adds significant weight to buses, which in turn has a negative impact on fuel consumption, road deterioration and ultimately on transit system operating cost. In some cases, this extra weight may have an impact on the ability for a manufacturer to comply with provincial regulations. Therefore, more innovation will be necessary simply to comply with the regulations in place. In this example, manufacturers have to invest in R&D in a responsive fashion.

Another driving factor that leads to R&D is changing demographics. The aging of the population has an influence on the type of service transit systems must offer. To increase accessibility and better serve their clients, manufacturers have developed low-floor and kneeling buses, deployable ramps and other components within the bus to accommodate mobility devices and mobility-challenged customers. Again, these technologies contribute to adding weight to the vehicle and also reduce seating capacity. Fewer seats on a bus can make a real difference during rush hours when demand is at its highest, and increase the number of vehicles required to maintain comparable capacity. In order to outweigh the impacts of increasing accessibility, manufacturers invest in R&D to develop new concepts and designs to find the optima balance between accessibility and capacity while complying with relevant regulations. In the case of accessibility, as with vehicle weight, the adaptation is often made mandatory due to new regulations.

What is important to understand in these cases is that the innovation cycle is often unexpected and can be remarkably short. When a business decides to develop a new product, it establishes plans in advance and adapts its business plan accordingly. When innovation is imposed on a sector and performed in a reactive mode, it can have a dramatic impact on small and medium sized businesses and can affect an entire industry.

### *Customer Orientation*

One of the key sectors in 21<sup>st</sup> Century R&D is Communications and Information Technology. Whether it is the ever-growing smart phone applications or Global Positioning Systems (GPS), these technologies are now an integral part of our daily lives, even when we do not notice them. This is no exception for the transit industry. Real time information and Intelligent Transportation Systems (ITS) are becoming more common in public transit because of their benefits to increasing operating performance and customer demand for fast and reliable information. Clients want to know in real time when the next bus, train, or subway will arrive. The technology is available but the cost of developing and adapting it can be substantial. Sometimes the decisions can result in trade-offs between increasing the number of buses on the road or offering real time information technology to existing users.

In the same spirit, communications technology is brought on board to increase passenger safety. This is the case with cameras on buses and for next stop announcements. This last feature may appear to be a detail for the passenger but it requires considerable R&D. Customers want to hear the announcements but they do not want to be bothered by the noise. At the same time, bus operators spend many hours behind the wheel and the steady announcement of next stops can become a real annoyance. Also, the number of passengers on board and ambient noise can affect the ability to hear announcements. Therefore, the system must adapt to the noise on the vehicle and announcements also need to be pleasant to the ear. Implementing such a feature on a vehicle requires more innovation, R&D, and testing than might at first be apparent.

There is also R&D involved in ensuring the comfort of passengers. For instance, thousands of people will sit on any given seat on a bus. R&D will be required to develop resistant and comfortable material that is easy to clean. There are as many examples as there are components that comprise bus and rail vehicles, but these illustrate that what may appear to be simple elements of a transit vehicle are actually the result of long and sustained R&D efforts.

By performing customer-oriented innovation, the transit industry ensures user retention and attraction. More transit customers mean fewer cars on the road, lower GHG emissions, cleaner air, and less traffic congestion. Ultimately, these factors contribute to saving money, increased productivity and a better standard of living.

### ***Municipal Policies (Planning, Urban Development)***

Improving practices and sharing knowledge on Transit Oriented Development (TOD) or Transportation Demand Management (TDM) is not something people notice on their commute to work. Yet, there is a lot of R&D involved in the development of Bus Rapid Transit (BRT), Light Rail Transit (LRT), commuter rail and subway systems. In terms of planning and development, one would have to look beyond any particular project to fully grasp the extent to which R&D played a role in achieving the final result. It often begins with comprehensive research in universities on best practices, the knowledge is then shared within the industry, collaboration and partnerships are established, projects are drafted and refined, ideas and concepts are tested and validated, and then – if financing is available – a new dedicated transit corridor can be built. This would not be possible without core research being supported at the early stage. However, academic research cannot simply be applied in a given city without proper adaptation and further research and development. As defined by Robbins and Decenzo<sup>1</sup>, innovation is the “process of taking a creative idea and turning it into a useful product, service, or method of operation.” This is precisely what happens in the transit industry.

Government must consider this critical aspect of innovation when designing its R&D support programs. Programs should provide adequate support for knowledge transfer from colleges and universities to municipalities, transit systems, manufacturers, urban planners, and other key stakeholders in the industry. More concretely, research and areas of research that can easily be transferred and applied to the field should benefit from direct R&D support.

## **Measures Supporting Innovation in the Transit Industry**

### **Funding Research & Development**

#### ***Canada***

The Government of Canada offers a number of programs and incentives for research and development. These have primarily been targeted towards private industry, of which some have been able to benefit public transit. Awareness of these programs and the complexity of the processes involved have been highlighted as barriers to gaining access and benefitting from them, especially for smaller and new start companies.

CUTA has benefited from research and development programs, such as Transport Canada’s KOA, on a number of occasions. While a small number of projects were submitted, the filling of knowledge gaps and information gathered through them promised to bring greater efficiencies. The biggest challenge associated with these programs was the influence on the scope of the research being undertaken by government policies. The policies did not necessarily reflect requirements of the transit industry and as such, did not yield optimal results.

#### ***United States***

In the United States, the Federal Government provides a program to support and develop research needs of the transit industry. An annual budget of US\$10 million is dedicated to the Transit Cooperative Research Program (TCRP), which is a dedicated program administered by the Transportation Research Board of the National Academies. The program serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet its demands. The Canadian transit industry has regularly participated in TCRP projects, as an effort to piggyback on U.S. initiatives and in the absence of Canadian support for transit R&D, even though the results do not always reflect the Canadian operating context.

## **Standards Development**

Standards use collective wisdom to provide a path to a desired outcome with a means to measure success. Standards programs are generally developed using a consensus based process. There are multiple benefits to both government and industry in fostering robust standards programs: minimizing government intervention through regulation, industry influenced outcomes, promotion of market competition, assisting new market entries and improving safety.

### ***Canada***

The Canadian Standards Association (CSA) and Standards Council of Canada (SCC) are two standards organizations to which the public transit industry has contributed. While the partnerships developed with these standards organizations have been beneficial to the transit industry, they are far from optimal. The developments of new and updating of current standards do not keep up with the continual evolution of the transit industry due to the introduction of new technologies and products. Competing priorities, return on investment and resource allocation are some of the challenges faced on a regular basis.

### ***United States***

In the United States, the transit industry has its own successful standards program, managed through CUTA's sister organization, the American Public Transportation Association (APTA) and its Standards Development Program. Through a federally funded annual budget of US\$3 million, the program has permitted the consistent development and updating of standards for the transit industry within a timely manner. In the interest of developing harmonized North American standards and in the absence of Canadian support, the Canadian transit industry has participated in the APTA Standards Development Program, although the results do not always reflect the Canadian operating context.

## **The Transit Industry**

### **Industry Association**

CUTA represents the entire transit industry in Canada and works with its members to improve practices, develop and share knowledge, and then build and reinforce capacities in the sector that will lead to innovation. CUTA provides networking and information sharing through its two annual conferences, national and regional committees, through online technology such as webinars and its web site, and publishes industry documents such as a trade magazine, bi-weekly newsletter and numerous benchmarking and industry reference reports. CUTA also recently developed a 30-year generational vision of the future of public transit: Transit Vision 2040.

### **Research & Development Project Priorities**

Through its Technical Services Committee (TSC), CUTA assembles common research and development requirements, which are developed by a consensual process that brings together all transit industry stakeholders, such as transit systems, vehicle manufacturers, system suppliers, government agencies, consultants and engineers. One of the many mandates of the Committee is to assemble common research and development requirements. Catalogued on its Research & Development Priority List, the Committee and its sub-groups (Vehicle Maintenance and Technology, Accessible Transit, Planning & ITS, Statistics), insert and review research and development priorities on an annual basis. The list currently holds a number of unfunded projects, examples of which are provided below:

- Guided Busway Technological Review
- Adapting Transit Service and Vehicle Design to the Changing Characteristics of Passengers
- Safety, Security and Anti-Vandalism Tools
- Use of Transit ITS for Proactive Service Control
- Professional Capacity Building for Transit Service Planning and ITS Development
- Best Practices for the Electronic Provision of Transit Passenger Information
- Transit Oriented Development in Canada: Experience and Lessons Learned
- Maintenance Benchmarking
- Cold Weather Transit Service Issues
- Providing Quality Transit Service in Low-Density Areas
- Specialized Transit Eligibility Criteria – Serving Customers with Special Needs

### **Transit Vision 2040: Greening & Energy Strategies**

Transit Vision 2040 defines a future in which public transit maximizes its contribution to quality of life with benefits that support a vibrant and equitable society, a complete and compact community form, a dynamic and efficient economy, and a healthy natural environment. As part of Transit Vision 2040, CUTA is undertaking the development of Greening and Energy strategies for the transit industry.

The greening strategy is a result of a need for industry-wide research, guidance and knowledge development. Transit systems are much more likely to take up new technologies and practices in a timely fashion if they have been centrally developed and tested. This strategy will address all elements of transit operations including vehicles, fuels, structures, planning, training, maintenance, procurement and waste disposal. A particular focus will also be placed on life-cycle considerations that address impacts as well as costs.

The energy strategy is a result of the rapid development of alternatives to diesel buses. Guidance is needed on existing options, such as expansion in the use of electric trolley buses, and on the maturity of evolving technologies such as diesel-electric hybrids and hydrogen fuel cells. Appropriate migration routes are to be identified with adoption staging. It is conceivable that accelerated electrification of the industry (or critical elements such as rapid transit and commuter rail) may be required, in the interests of maintaining economic competitiveness and quality of life, should global petroleum supplies deteriorate.

### **Conclusion**

R&D and Innovation can lead to higher productivity and efficiency when applied and adequately supported. In order to achieve positive results and foster innovation, the government must have an inclusive approach when designing its R&D programs so that they respond to the needs and realities of all industries. CUTA believes that standards programs and targeted R&D, which address unique Canadian requirements and could be exported internationally, should be developed. Partnerships between industry, government and academia would lead to internationally recognized public transit R&D and solidify current R&D investments by industry in Canada and encourage new investments by other companies. CUTA is pleased to play an instrumental role in representing the public transit sector in this context.

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<sup>i</sup> Robbins S.P., and Decenzo D.A., Fundamentals of Management, 3<sup>rd</sup> Edition, Prentice Hall, Upper Saddle River, New Jersey, no date available