Learning from the Québec Experience

TRANSITIONING TO A CIRCULAR ECONOMY

2014-2020

TRANSITIONING TO A CIRCULAR ECONOMY

LEARNING FROM THE QUÉBEC EXPERIENCE

This report aims to explore the implementation of a circular economy in the province of Québec between 2014 and 2020.

Disclaimer: Given the extent of initiatives having taken place in Québec since 2014, this report does not claim to provide the reader with an exhaustive review. It aims at featuring some of the key elements that contributed to initiating a transition to a circular economy in the province, in particular linked to the experience of the EDDEC Institute.

ABOUT

Interviews were conducted with a variety of stakeholders to inform this report. The interviewees represent a diversity of people – and organizations – who have helped to shape, influence, and propel the transition to a circular economy in Québec. Any errors or omissions are the responsibility of the report authors. Interviewees included Genevieve Dionne, Director, Ecodesign and circular economy, *Éco Entreprises Québec;* Nicolas Girard, CEO, FAQDD; Claude Maheux-Picard, Executive Director, CTTÉI, and Sonia Gagné, President and CEO, RECYC-QUÉBEC.

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About *QuébecCirculaire.org*

Québec Circulaire is an internet hub created in 2018 who's mission is to pool the variety of circular economy initiatives that are emerging in Québec as well as advance the knowledge of a community of practice via shared tools and experiences.

About Smart Prosperity Institute

Smart Prosperity Institute is a national research network and policy think tank based at the University of Ottawa. We deliver world-class research and work with public and private partners – all to advance practical policies and market solutions for a stronger, cleaner economy. **institute.smartprosperity.ca**

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FOREWORD

En tant que ministre responsable des Relations canadiennes et de la Francophonie canadienne, je suis très heureuse que le gouvernement accorde un soutien financier à Québec Circulaire à travers le Programme d'appui aux relations canadiennes. Ce projet permettra de faire rayonner à travers le Canada l'expertise québécoise en matière d'économie circulaire, qui offre un modèle économique innovant.

L'application des principes de l'économie circulaire a le potentiel de changer profondément la relation entre la croissance économique et l'épuisement des ressources naturelles qui caractérise nos systèmes économiques modernes. En repensant nos modes de production et en optimisant l'utilisation des ressources qui circulent déjà dans nos sociétés, nous pouvons contribuer à protéger nos écosystèmes, et ce, sans nuire au développement économique. Le Québec s'est déjà positionné comme un leader en recherche dans le domaine, et notre gouvernement est fier d'appuyer les acteurs du milieu afin de favoriser une transition vers une économie plus circulaire au Québec et ailleurs.

Le soutien financier accordé à Québec Circulaire permettra d'identifier les meilleures pratiques et initiatives québécoises en économie circulaire, et de transférer ce savoir-faire québécois à un public canadien. Ainsi, il sera possible de développer un langage et des objectifs communs, et d'accélérer le déploiement de l'économie circulaire à l'échelle canadienne, en s'appuyant sur l'expérience du Québec.

Je salue l'initiative de Québec Circulaire et de ses partenaires et je suivrai leurs avancées sous la bannière de ce beau projet avec enthousiasme.

Sonia LeBel
Ministre responsable des Relations canadiennes et de la Francophonie canadienne

As Minister responsible for Canadian Relations and for the Canadian Francophonie, I am pleased that the Government of Québec is providing financial support to *Québec Circulaire,* through the Canadian Relations Support Program. This project will promote Québec's innovative circular economy expertise across Canada.

The application of circular economy principles has the potential to profoundly modify the relationship between economic growth and the natural resource depletion that characterizes our modern economic systems.

By rethinking our production modes and optimizing the use of resources already circulating in our society, we can protect our ecosystems without hindering economic development. Québec has already positioned itself as a leader in research in this field, and our government is proud to support efforts in transitioning towards a more circular economy in Québec and elsewhere.

The financial support granted will allow *Québec Circulaire* to target the best of Québec's practices and initiatives in this field and to transfer this know-how to a Canadian audience. Hence, based on the Québec experience, it will be possible to develop a common language as well as common objectives in order to accelerate the deployment of the circular economy on a Canadian scale.

I welcome the initiative of *Québec Circulaire* and its partners. I will enthusiastically follow their progress under the banner of this great project.

Sonia LeBel
Minister Responsible for Canadian Relations and the Canadian Francophonie

FOREWORD

The circular economy is an innovation agenda, with the potential to usher in a new era of prosperity. Allowing us to move away from the "take, make, waste" one-way model of production and consumption, a circular system relies on building economic and natural capital, rather than depleting finite resources to create value.

Having lifted billions out of poverty and made material comfort a legitimate aspiration for all, the industrial engine is seeing obstacles on its horizon. The combination of resource scarcity and severe negative impacts makes it unreasonable to think we can carry on extracting, consuming and throwing away. Better recycling or efficiency measures can only delay the inevitable – not prevent it.

The call for a more resilient, circular and low-carbon economic model has garnered support from a growing number of businesses and governments worldwide over the past few years, and appears today more relevant than ever. In order to achieve a genuine transition and to reach scale, collaboration among actors is crucial, as the change we are seeking is of systemic nature.

By taking a proactive stance early on, stakeholders in Québec – across the private and public sectors, across academia and civil society – have put together the building blocks this ambitious transformation requires. Making the economic rationale visible, highlighting barriers and levers, convening and coordinating efforts: the *Économie circulaire ecosystem* of the province has taken a pioneer role at the national level.

The crucial work carried out by the EDDEC Institute, including research and national and international outreach, has allowed to put Québec on the global circularity map, and this effort is being carried forward by the team at CERIEC as well as by other university and college research units.

There is an undeniable favourable dynamic at play internationally, with many governments and companies embracing the circular economy, yet numerous challenges remain – especially for countries in which extractive activities represent a fair share of the wealth creation mechanisms. More work is required, but the benefits are tangible: setting a clear direction to enable private sector circular innovation to reach scale will allow Canada, its provinces and territories to combine economic regeneration, better societal outcomes and climate ambitions.

Jocelyn Blériot
Executive Lead, Institutions & Governments
Ellen MacArthur Foundation (U.K.)

EXECUTIVE SUMMARY

A spirit of inventiveness, innovation, and curiosity has propelled Québec in establishing itself as a circular economy leader. This experience is invaluable for all that are similarly seeking to transition from an unsustainable, wasteful linear economic system to one that reduces waste, captures value, fosters prosperity, and nurtures well-being within the planetary boundaries.

Québec is distinguishing itself as one of the most advanced regions in circularity in North America. This report highlights the key lessons of the Québec experience between 2014 and 2020.

For the first time, this landmark report brings key learnings from the Québec experience to the rest of Canada with the hope that this deep look can catalyze other places in their own transition to a circular economy. It is for everyone who is interested in playing a role in building a new economy and a resilient society. The richness of perspectives included, and the depth of research undertaken in consolidating the findings that follow, offer new and interesting learnings for individuals across many organizations and jurisdictions. Academics, researchers, corporate leaders, community leaders, policymakers at all levels of government, practitioners, communicators, and others will find real-world guidance that can inform their respective role in shifting to a circular economy.

Spanning the years from 2014 to 2020, five sections and two case studies describe the research, partnerships, education, and storytelling – as well as the building of relationships and communities – that are essential to co-creating a circular economy. The insights and recommendations found throughout the report are meant to be thoughtfully considered, and then adapted to regional contexts, recognizing both the distinct needs – but also the interconnectedness – of different places.

Section one explores how to build an interdisciplinary community of researchers. It follows the inception of a new Institute, the EDDEC, that played a pioneering role in the deployment of a circular economy in Québec. The Institute supported a systemic approach to circularity, creating a structure where researchers and practitioners could co-create knowledge. By establishing a common definition and framework – and fostering research that crossed and connected disciplines – the Institute helped define the opportunities created by shifting away from linear business models and policies. It took this unifying definition and disseminated the co-created knowledge among private and public actors, as well as municipalities. The section shows how the new university-based organization came to develop research, training, tools, and information that would be widely distributed, including through creative means like a collective book and massive open online courses available to a diversity of individuals. Mapping existing expertise, designing, and crafting a first interdisciplinary program of research are detailed, as well as maintaining long-term relationships with the research community and building bridges with practitioners. Creating an academic structure that crossed boundaries and bridged disciplines is explored as a key step in introducing new concepts and developing the collective knowledge that is essential for transitioning to a circular economy.

Concerted efforts to foster circularity in Québec have revealed extensive opportunities for implementation at various levels, including across value chains and regions, or by strategies. However, it takes time for stakeholders to take ownership of the concept and to integrate it into their organizations and practices. **Section two examines cultivating partnerships and cross-pollinating ideas,** so that change takes root and can grow across a system. In order to establish a common understanding of the circular economy and advance the transition, it was essential to support the formation of a community of practitioners in a bottom-up approach for knowledge co-construction. The creation of a multi-stakeholder roundtable is chronicled, including key learnings from convening and facilitating this partnership with the private sector, NGOs, government agencies, key ministries, and leading applied research organizations. Bringing together 20 key decision makers and influencers from prominent organizations across sectors was instrumental to the effectiveness of this roundtable. This section discusses how to spark interest and select the right partners to ensure diverse representation from across the entire system, including provincial and local governments, private sector, industry associations, finance, education, research, and civil society. Establishing the format and the mission of the group was critical to success, as was setting a safe space and co-creating an agenda. The approach taken to achieve these partnerships and shared missions is outlined at length, and the section concludes with insights on influencing provincial strategies.

Concepts and academic theories are often not sufficient for business leaders to invest in innovative projects and rethink their business approaches. **Section three looks at how to map and understand the benefits of a circular economy.** It highlights the importance of: identifying the sectors with high growth potential from adopting circular strategies; understanding the signals sent by government regulation, tax systems, and sources of financing; and mapping value chains and various industrial sectors to understand the limitations, strengths, weaknesses, and opportunities existing in the province. Three examples are explored:

- The City of Montréal's experience with circularity is examined as a microcosm of the larger economic system, and for its learnings about policy priorities, actions, and data tracking. Research identified key sectors and related priority strategies, including the food system loop, intensifying shared mobility, industrial symbiosis, enabling circular economy networks, and fostering the sharing economy as well as reuse, and maintenance and repair strategies. Pilot projects in three boroughs showed that about 50% of circular approaches were micro-local, and also that historic blue-collar areas undergoing social transformations showed the highest number and diversity of circular initiatives.
- A second example delves into the mapping of the Québec minerals and metals sector value chain and exploring the potential for circularity for three strategic metals extracted in the province (iron, copper and lithium). This three-year project found that circularity was already in progress in these value chains and that access to detailed information is both problematic and paramount. Forty-one circular strategies were identified, leading to recommendations ranging from carbon capture to battery recycling to additive manufacturing to urban mining to carpooling. The mapping of this value chain further allowed for the identification of three barriers: technical challenges, stakeholder inertia, and profitability.
- A consortium formed to identify and map material flows and actors in the textile value chain in the province is the third example. The preliminary research better defined consumer behaviors with regards to textiles, while also providing a portrait of textile management in Québec. This found that of all textiles that are used in the province, 30% are exported, 48% are sent to landfill, 8% are lost in the environment, 8% are used in other products, and only 6 % are recycled. Recommendations to create and implement ecodesign strategies, collaborative economy approaches, industrial material recovery, and a textile-specific recycling and re-use network of actors are underscored in this section.

The research into benefits linked to the implementation of a circular economy also included identifying GHG emissions reduction potential in the industrial sector. Four main potential emission reduction solutions emerged: better production and use of heat; use and re-use of cement, steel and aluminum from the construction sector; clustering initiatives in the sub-sector of manufacturing; and better defined approaches for methane, manure, and waste management. Section three also provides glimpses into research regarding climate change and the circular economy for the aluminum, cement, and steel sectors, as well as mapping food waste and evaluating new strategies

along the food value chain. High-growth potential sectors and policy priorities are identified, highlighting economic opportunities and impacts, and identifying sectors with significant circularity potential in Québec: agri-food, energy, construction, and metal products. This section closes with insights about informing policymaking for the collaborative economy, and a proposed framework for measuring progress.

Shaping public narratives, seeding ideas amongst key audiences, and sharing information and stories in a compelling way is critical to propelling many people and organizations towards realizing the circular economy. By developing smart communications strategies, clearly defining influencers and audiences, and drawing on a diversity of tactics, communicators have been able to advance circularity as a concept in Québec. **Section four explores how to communicate the concept of circularity, engage influencers, and rally supporters.** From a nascent stage of public understanding of the circular economy, Québec has built a wider understanding of, and support for, the model. The section looks at the importance of understanding target audiences, developing unique messages for each, creating visuals that bring the circular economy framework to life, and finding the right channels by which to connect to critical audiences. Strategy-focused and sector-specific communications are explored, including for industrial and commercial audiences, as well as for engaging younger generations. Concerted outreach efforts have helped to harness the enthusiasm of early adopters, establish connections between researchers and civil society, and create momentum in the province by demonstrating the proof of concept required for business players. This bottom-up approach to promoting the circular economy with key audiences has led to an essential awakening of governmental organizations, spurring them to support the transition. From communications strategy to specific tools to key messages that have worked, section four gives communicators and non-communicators alike guidance for telling the circular story to their own audiences.

The circular economy entails a shift in economic paradigm, a shift in business models - and a shift in approaches to education. **Section five looks at how to educate people about the circular economy.** It explores how the circular economy concept is making its way into academic circles and formal curricula, as well as other educational and training approaches outside of the walls of post-secondary institutions. Through specific real-world examples, this section emphasizes the importance of building circularity into existing educational frameworks, while also developing innovative new programs that meet the growing and evolving need for an education in circular economy principles and implementation. Circularity has been built into existing university programs by developing training tools, creating campus activities custom-made for students, hosting public roundtable discussions, and funding the next generation of circular economy researchers and entrepreneurs. This section looks at experimentation with integrating the circular economy into students' projects, and launching large-scale educational opportunities like summer schools and online courses. Key successes and lessons learned enable academics and educators to learn from the Québec experience as they expand circular economy education in the rest of Canada. Section five reinforces that research, communication, and education have to work hand-in-hand to advance the circular economy both theoretically and practically – and, given the realities of environmental crises, they have to do so without delay.

Two case studies take readers on a journey of what the transition to a circular economy has looked like in real-world applications:

1. **The case study of *Synergie Québec* illustrates the value of the interconnection of industrial symbioses –** the strategic clusters of organizations that exchange resources, such as water, energy, by-products, and innovative practices in a synergistic network that brings economic, environmental, and social benefits. This case study profiles the conditions and tactics that created success in building a province-wide community of practice focused on industrial symbiosis, explored through the example of *Synergie Québec*. This organization unified the industrial symbiosis projects that had previously been operating individually, allowed for various symbioses to connect across the province, constituted the birth of a community of practice on industrial ecology and circular economy, and allowed for the documentation of over 6,500 material flows.

2. **The case study of Insertech follows the rise of a social enterprise blending social and environmental missions to becoming a circular economy leader.** Originally founded to promote youth integration in the job market, this social enterprise integrated an environmental focus into its mandate as early as 2009. From life cycle assessments of their products to the impact of new regulations like extended producer responsibility, this case study shows how external factors and Insertech's strategic responses to them allowed the social enterprise to become a leader in the repair and reuse of electronics – closing the loop, reducing waste, and fostering new opportunities for youth while making IT equipment and services more affordable to their community. Research into four scenarios of end-of-life management of computers, as well as comparisons of recycling versus reconditioning from both an environmental and social lens, are brought to life. Insertech's success story as a pioneer shows how a social enterprise can build circularity into its business model, create positive environmental impact alongside its social mandate, and change the way that people and companies use and extend the life of products.

This report demonstrates that Québec actors have not only shown creativity and innovation in transitioning to a circular economy, but also the long-term hard work that is essential to realizing meaningful change. They have worked strategically at different levels of society, and have embraced relationship building, developing a body of knowledge, integrating in existing frameworks, socializing new ideas, and building bridges where before there were gaps. The people propelling this transition have helped identify the economic and environmental impacts of a circular economy, as well as the barriers and levers that could serve in the transition to a new economic model that contributes to the prosperity and environmental stewardship of the province.

The Québec experience is both inspiring and instructive - but it is far from done. The context will continue to evolve and change, just as ecosystems evolve and change in order to foster continued life. And, just like an ecosystem, the evolving circular economy will require many individuals and groups to act as parts in a greater whole. Researchers, academics, communicators, executives, educators, community leaders, citizens as well as policymakers will need to work together to push ahead the transition to a circular economy, in Québec as elsewhere in Canada. It will take all actors, all sectors, and all levers for change to be activated. It will take bold shifts in business, policy, academia, and citizen behaviors, so that collectively there will be a holistic, society-wide approach for systems change. It will take resilience, and it will take building connections instead of staying isolated in siloes. It will take a great number of people listening to and learning from the circularity journey that Québec has taken and continues to pursue, and then doing what people do best: approaching problems with creativity, resourcefulness, ingenuity – and homegrown solutions.

MAIN **MILESTONES**

2014

- Creation of the EDDEC Institute on *Campus Montréal*
- Creation of CE-dedicated programs at *Polytechnique Montréal*

2015

- Creation of the multi-stakeholder roundtable *(Pôle)* moderated by the EDDEC Institute
- Creation of *Synergie Québec*
- Creation of the Paris-Brussels-Montréal international academic research cooperation network
- First edition of TD scholarships for students on *Campus Montréal*

2016

- Creation of the Collaborative and Performance Economy Lab *(Lab)* by the EDDEC Institute
- Walter Stahel, one of the founders of the concept of a circular economy, is the first visiting fellow at the EDDEC Institute
- First edition of the annual EDDEC Institute CE Summer School
- Launch of the collective book "Circular Economy: An inevitable transition"
- Definition of circular economy by the multi-stakeholder roundtable *(Pôle)*
- First edition of RECYC-QUÉBEC's Call for proposals for the CE transition (APTEC)
- Start of the research project on strategic metals and circular economy in Québec, funded by the Québec Ministry of Energy and Natural Resources (MERN)

2017

- Creation of the *Groupe interministériel sur l'économie circulaire* (GIEC)
- CE consultation organized by the *Ministère de l'Économie et de l'Innovation* (MEI) and RECYC-QUÉBEC
- Launch of the Collaborative and Performance Economy *Lab* scholarships
- "Circular + Social Economy & The City" summer seminar *(Université de Montréal)*

2018

- First edition of the *Assises québécoises de l'économie circulaire* organized by RECYC-QUÉBEC and the EDDEC Institute
- Launch of *QuébecCirculaire.org* hub
- Creation of graphical representation of CE by the EDDEC Institute and RECYC-QUÉBEC
- Roundtable between politicians and researchers during the provincial electoral campaign organized by the EDDEC Institute
- Launch of the "Circular Economy in Québec – Economic opportunities and impacts" report
- Unveiling the mapping of the actors and initiatives in CE on the City of Montréal territory
- Presentation of the white paper and *Lab* recommendations to the governmental working group on collaborative economy (GTEC)
- Creation of a new circular economy course at *Université de Sherbrooke*

2019

- Launch of the first francophone Massive Open Online Course (MOOC) on Circular Economy in North America, developed by the EDDEC Institute
- *Rendez-vous de l'économie circulaire* organized by *Université de Sherbrooke*
- The CTTÉI obtains the CREIT, a NSERC Industrial Research Chair on industrial and territorial ecology
- Second Edition of RECYC-QUÉBEC's Call for proposals for the CE transition (APTEC)
- First Edition of the *Ville, territoire, économie circulaire* summer school *(Université de Montréal)*
- Unveiling of the *Économie circulaire : Portrait et pistes de réduction des émissions des GES industrielles au Québec – Volet 1* report
- Launch of the "Circular Economy Research Landscape in Canada" report by the EDDEC Institute
- The five-year mandate of the EDDEC Institute ends

2020

- Inception of the CERIEC at ÉTS
- Consultation process by the *Bureau de coordination du développement durable* (MELCC) on the Québec Government Strategy on sustainable development 2022-2027, in collaboration with RECYC-QUÉBEC
- Unveiling of the final report on the textile industry by the MUTREC consortium

Acronyms are listed on page 12.

ACRONYMS

3RV Reduce, Reuse, Recycle, Valorize

ACFAS French Canadian Association for the Advancement of Science *(Association Canadienne-Française pour l'Avancement des Sciences)*

ADEME Environment and Energy Management Agency *(Agence De l'Environnement et de la Maîtrise de l'Energie)*

APDICI Call for proposals for residuals materials in the industrial, commercial and institutional sector *(Appel de Propositions visant les Débouchés pour les matières résiduelles des Industries, Commerces et Institutions)*

APTEC Call for proposals for the CE transition for financing industrial symbiosis projects in Québec *(Appel de Propositions pour la Transition vers l'Économie Circulaire)*

ARBJ Baie-James Regional Administration *(Administration Régionale la Baie-James)*

BO Bridging Organization

CCA Council of Canadian Academies

CCME Canadian Council of Ministers of the Environment

CE Circular Economy

CEGEP College of General and Professional Teaching *(Collège d'Enseignement Général Et Professionnel)*

CEIQ Collective of work integration social enterprise *(Collectif des entreprises d'insertion du Québec)*

CELC Circular Economy Leadership Canada (formerly Circular Economy Leadership Coalition)

CERIEC Centre for Intersectoral Studies and Research on Circular Economy *(Centre d'études et de recherches intersectorielles en économie circulaire)*

CIRAIG International Reference Centre for Life Cycle of Products, Services and Systems *(Centre international de référence sur le cycle de vie des produits, procédés et services)*

CIRANO Interuniversity Centre for Research in Organization Analysis *(Centre interuniversitaire de recherche en analyse des organisations)*

CIRIDD International Resource and Innovation Centre for Sustainable Development *(Centre international de ressources et d'innovation pour le développement durable)*

CIRODD Interdisciplinary Research Centre for the Operationalization of Sustainable Development *(Centre interdisciplinaire de recherche en opérationnalisation du développement durable)*

COMETHE Design of methodological and evaluation tools for industrial ecology *(Conception d'Outils METHodologiques et d'Evaluation pour l'écologie industrielle)*

CoP Community of practice

CPEQ Québec Business Council on the Environment *(Conseil patronal de l'environnement du Québec)*

CPQ Québec Employers Council *(Conseil du patronat du Québec)*

CREDDO Regional Council on the Environment and the Development of the Outaouais *(Conseil régional de l'environnement et du développement durable de l'Outaouais)*

CREIT Research Chair on Industrial and Territorial Ecology *(Chaire de recherche sur l'écologie industrielle et territoriale)*

CRISES Centre for Research on Social Innovations *(Centre de Recherche sur les Innovations Sociales)*

CTMP Centre for Mineral Technology and Plastics Processing *(Centre de technologie minérale et de plasturgie)*

CTTÉI Centre for the Transfer of Technologies in Industrial Ecology *(Centre de transfert technologique en écologie industrielle)*

D.E.S.S. Diploma of Higher Specialized Studies *(Diplôme d'études supérieures spécialisées)*

DIF Disruptive Innovation Festival, organized by the Ellen MacArthur Foundation

ÉAU Urban food ecosystems *(Écosystèmes alimentaires urbains)*

EDDEC Institute on Environment, Sustainable Development and the Circular Economy (*Institut de l'Environnement, du Développement Durable et de l'Économie Circulaire*)

EEIO Environmentally Extended Input–Output

ÉEQ *Éco Entreprises Québec*

ELIPSE Performance evaluation of industrial and territorial ecology approaches *(EvaLuatIon des PerformanceS des démarches d'Ecologie industrielle et territoriale)*

ÉNAP National Public Administration School *(École nationale d'administration publique*

EOL End-of-life

EQA Québec Environment Quality Act *(Loi sur la qualité de l'environnement [LQE])*

EPR Extended Producer Responsibility *(Responsabilité Élargie du Producteur [REP])*

EPRA Electronic Products Recycling Association *(Association pour le recyclage des produits électroniques [ARPE])*

FAQDD Québec Action Fund for Sustainable Development *(Fonds d'Action Québecois pour le Développement Durable)*

FCCQ Québec Federation of Chambers of Commerce *(Fédération des Chambres de Commerce du Québec)*

FCM Federation of Canadian Municipalities *(Fédération canadienne des municipalités)*

FRQNT Québec Research Fund – Nature and Technology *(Fonds de Recherche du Québec – Nature et Technologies)*

GAPC Circular Plastics Taskforce *(Groupe action plastiques circulaires)*

GDP Gross Domestic Product

GETIDOS Getting Things Done Sustainably, an organization based in Europe

GHG Greenhouse gases (GES: Gaz à effet de serre)

GIEC Collaborative Economy Working Group (Groupe interministériel en économie circulaire)

GMT *Polytechnique Montréal*'s Research Group on Globalisation and Management of Technology *(Groupe de recherche en gestion et Mondialisation de la Technologie de Polytechnique Montréal)*

GTEC Québec Collaborative Economy Working Group *(Groupe de Travail sur l'Économie Collaborative)*

IAE Information, Awareness and Education

ICI Industrial, Commercial and Institutional sector

ICT Information and Communication Technology

IFSTTAR French Institute of science and technology for transport, development and networks *(Institut français des sciences et technologies des transports, de l'aménagement et des réseaux)*

INEC National Institute for the Circular Economy *(Institut national de l'économie circulaire)*

Lab Collaborative and Performance Economy Laboratory of the EDDEC Institute *(Laboratoire d'économie collaborative et de fonctionnalité de l'Institut EDDEC)*

KPI Key Performance Indicator

LCA Life Cycle Analysis

MAB Man and Biosphere

MDDELCC Ministry of Sustainable Development, Environment, and Fight Against Climate Change *(Ministère du Développement durable, de l'Environnement et de la Lutte contre les Changements Climatiques)*

MEI Québec Ministry of Economy and Innovation *(Ministère de l'Économie et de l'Innovation)*

MELCC Québec Ministry of the Environment and the Fight against Climate Change *(Ministère de l'Environnement et de la Lutte contre les Changements Climatiques)*

MERN Québec Ministry of Energy and Natural Resources *(Ministère de l'Énergie et des Ressources Naturelles)*

MFA Material Flow Analysis

MOOC Massive Online Open Course

MRC Regional County Municipalities *(Municipalité régionale de comté [MRC])*

NISP National Industrial Symbiosis Program

PACTP Action Plan for Growth and Clean Technology 2018-2023 *(Plan d'Action pour la Croissance et les Technologies Propres 2018-2023)*

PUM University of Montréal Press *(Presses de l'Université de Montréal)*

QFL Québec Federation of Labour *(Fédération des travailleurs et travailleuses du Québec [FTQ])*

RNCERQ National Association of Regional Environmental Councils *(Regroupement national des conseils régionaux de l'environnement)*

RCC Retail Council of Canada

RPP Research Participation Program

SADC *Société d'aide au développement de la collectivité*

SDA Argus Development Society *(Société de développement Angus)*

SME Small and Medium Enterprise *(Petites et moyennes entreprises [PME])*

SPEDE Québec Cap-and-Trade System for Greenhouse Gas Emission Allowances *(Système de Plafonnement et d'Échange de Droits d'émission de gaz à Effet de serre du Québec)*

SPI Smart Prosperity Institute

STM Montréal Transport Company *(Société du transport de Montréal)*

SWANA Solid Waste Association of North America

TEQ *Technologies environnementales du Québec*

TIESS Innovative territories in social and solidarity economy *(Territoires Innovants en Économie Sociale et Solidaire)*

UFV Ugly Fruits and Vegetables

WCEF World Circular Economy Forum

WISE Work Integration Social Enterprise

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SECTION 1

BUILDING AN INTERDISCIPLINARY COMMUNITY OF RESEARCHERS

1

Disclaimer: Given the extent of initiatives having taken place in Québec since 2015, this report does not claim to provide the reader with an exhaustive review. It aims at featuring some of the key elements that contributed to initiating a transition to a circular economy in the province, in particular linked to the experience of the EDDEC Institute.

INTRODUCTION

The EDDEC Institute was established in 2014 on *Campus Montréal (Université de Montréal, HEC Montréal, Polytechnique Montréal)* with the mission to promote transdisciplinary research in environment, sustainable development, and circular economy. It developed a significant focus on the latter.

This university-based organization has had a pioneering role in the deployment of a circular economy in Québec, as it helped establish a common definition and fostered interdisciplinary research that contributed to define better the boundaries as well as the opportunities created by transitioning away from linear business models and policies.

The EDDEC Institute started with the building of a community of researchers based on the principles of co-learning and co-construction in order to define a common vision[2]. This chapter explores the context that led to the inception of the EDDEC Institute, best practices that were used to establish the Institute, the vital engagement with researchers, and how this community of researchers exists in – and contributes to – the current circular economy landscape in Québec.

Note: Some of the information presented in this Section of the report is sourced and adapted from "Mapping Researcher-Practitioner Practices for a Circular Economy", Manon Boiteux, Emmanuel Raufflet, pp 102-114, S&O Center and ARCS, Collaborations in Sustainability Report, 2020.

MAIN **MILESTONES**

2009
- Creation of a working group on a project for an Institute on Sustainable Development and Environmental Protection by *Université de Montréal*

2014
- Creation of the EDDEC Institute on *Campus Montréal*

2014-2015
- Definition of a CE-focused research program, with workshops gathering over 120 researchers

2015
- First edition of TD scholarships for students on *Campus Montréal*
- Creation of the multi-stakeholder roundtable *(Pôle)* by the EDDEC Institute

2016
- Walter Stahel, one of the founders of the concept of a circular economy, is the first visiting fellow at the EDDEC Institute
- Launch of a collective book: "Circular Economy: An inevitable transition"[1]
- First edition of the annual EDDEC Institute CE Summer School

2018
- Launch of a Massive Open Online Course (MOOC) on Circular Economy

2019
- The five-year mandate of the EDDEC Institute ends

2020
- Inception of the CERIEC at ÉTS

Acronyms are listed on page 12.

Key learnings on establishing an academic CE-dedicated structure that crosses boundaries

Developing an academic structure is a lengthy process.
From *Université de Montréal*'s initial idea in 2009 to the implementation of a structure in partnership with all three institutions on Campus in 2014, it took five years to set up.

A structuring visioning exercise, such as the development of a theory of change, should be initiated at the inception.
Clearly defining the pathways to the desired ultimate impact can be instrumental in ensuring better stakeholder engagement and support, as well as the definition of key performance indicators (KPI).

Long-term engagement of founding partners is paramount.
It takes time, money, and human resources to foster the necessary mind shift that is at the core of the transition to a circular economy. Continuous support in that undertaking is key to keeping the focus on strategic development and initiatives.

An academic-based organization is perceived as an objective and neutral stakeholder.
This facilitates relationships with government bodies and decision makers, as it provides credibility and legitimacy, in particular on a new concept like the circular economy.

Active outreach is necessary to introducing new concepts in academic communities.
The creation of a motivated inter- and multi-disciplinary community of researchers is supported by regular communications and collaborative activities that tap into their expertise and present them with many opportunities for financed research projects.

It is crucial to construct a research object at the interface of several disciplines and propose added value initiatives to researchers.
This fosters interest among established researchers, in particular in the absence of dedicated funding.

To quickly establish collaborations between the academic world and practitioners, the leader need not necessarily be a researcher.
Together with their academic education and professional expertise, both the Executive Director as well as the COO of the EDDEC Institute supported the initiative. With their strong knowledge and connections with private as well as public actors, they leveraged an interdisciplinary vision for circularity to gain traction in the province.

Open innovation and bottom-up approaches enable a richer and quicker development of collective knowledge.
The approaches taken by the EDDEC team were fundamental elements that contributed to the success of the initiative.

CHAPTER 1

THE INCEPTION OF THE EDDEC INSTITUTE

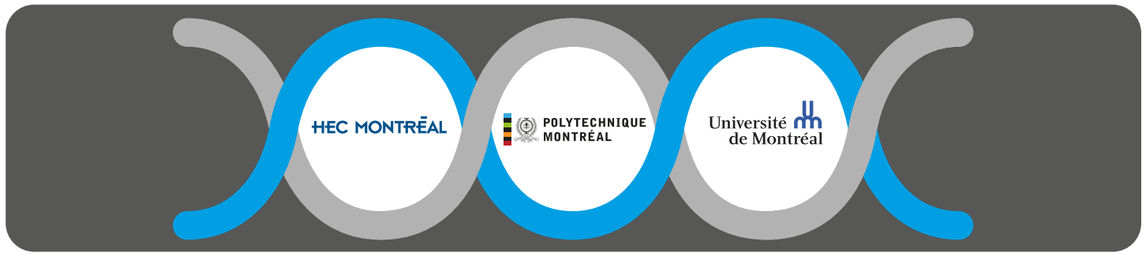
1.1 The creative process

The idea of an Institute that would focus on environmental and sustainable development sprung from *Université de Montréal* (UdeM) back in 2009. A dedicated workgroup was created, and tasked with producing a report on the opportunities that such a new organization would bring to the campus. The recommendations were presented in 2010, after attending and conducting a number of consultations, roundtables, and seminars. Those gatherings clearly established the need and strong opportunity for the creation of an Institute that would help converge sustainable development and environment-oriented initiatives between the three universities on *Campus Montréal*.

The mission of the yet-to-be born Institute was more defined after a dedicated planning session took place in the spring of 2013, gathering 23 professors and seven students in workshops and seminars. The two-day meeting helped identify professors and researchers who could contribute and should be engaged with, as well as identified potential structures and initial projects for short-term opportunities. The Institute was to be formed like a think tank structure that would focus on interdisciplinarity. It would produce research training, tools, and information that would be widely distributed, while contributing to the international reputation of *Campus Montréal*.

The initial focus on environment and sustainable development shifted when Daniel Normandin, soon to become Executive Director, met with decision-makers at *Polytechnique Montréal* and then was given the opportunity to present the circular economy framework to the members of the inter-institutional steering committee. Having explored the early Ellen MacArthur Foundation's publications on CE, he convinced them that, given that this was a theme strongly developing in Europe and in other parts of the world but that nothing yet had been deeply established in North America, it should be added to the mission of the new Institute.

It was in March 2014, five years after the initial idea, that the Institute was created through an inter-institutional agreement. It was supported by an initial 1 million CAD donation from the TD Bank, soon to be matched by the partner universities to reach a total budget of 2 million CAD. Mélanie McDonald, Director of Operations (formerly recruited as Coordinator), and Prof. Sébastien Sauvé *(Université de Montréal)* was nominated as Academic Director. Together, they established the structure of the Institute, to be named *Institut du développement durable, de l'environnement et de l'économie circulaire* (EDDEC).



1.2 The first steps of the Institute

In the second half of 2014, the team established the governance of the EDDEC Institute as well as set its strategic plan. Both team members started on a part-time basis and later transitioned to a full-time basis, also recruiting a Communications Manager when financing was secured from the Universities. Activities were developed both in parallel and in sequence at this early stage of development.

The first three steps of the Institute were:

1 **Establish governing structures**
A Board of Directors as well as a Management Committee were created, with representatives from each of the three partner universities. While other committees were envisioned, and some were formed, only the Training Committee operated for the five-years mandate of the Institute.

2 **Foster cooperation with partner universities**
Establishing a community of good practices on *Campus Montréal* was based on the weaving of relationships with each university's Sustainable Development departments. Meetings were held with key stakeholders in educational programs in order to brainstorm avenues of collaboration and the development of the Institute initiatives and programs[3].

3 **Build an interdisciplinary community of researchers**
Multidisciplinary workshops and training were developed to build an interdisciplinary community of researchers and a research program. A database that listed researchers on *Campus Montréal* with a strong link to EDDEC themes was developed, and meetings were arranged with managers of existing interdisciplinary projects, all with a goal of leading to the development of research projects[4].

Another two steps focused on enabling the transition to a circular economy:

1 **Establish a community of practice**[5]
To foster support on CE from influencers in the province and abroad, a listing of key actors was established and consultations with practitioners in Québec took place. Partnerships were established, and a strong emphasis was put on representation at events internationally, to gather new knowledge and present the advances in Québec.

2 **Engage innovators and rallying followers**
It was essential to communicate efficiently not only on the creation of a new Institute, but also on the circular economy itself, as it was a rather novel concept at the time in the province[6].

The plan devised by the partner universities was originally for the EDDEC to contribute to the creation of a Chair focused on the CE, a second one focused on ecodesign and the CE, and a third one on residual matter management. Only the third project came to life in 2016, with the creation of the Research Chair on Advanced Waste Recovery at *Polytechnique Montréal* that was inaugurated in the summer of 2017[7].

Institut eddec
Institut de l'environnement, du développement durable et de l'économie circulaire

THE EDDEC INSTITUTE MISSION WAS ESTABLISHED WITH FOUR MAIN OBJECTIVES:

1. Unite internal and external stakeholders around structuring or innovative initiatives in environment, sustainable development and circular economy
2. Weave new relationships that highlight the expertise, training, projects and resources in place
3. Promote and acknowledge the expertise in environment, sustainable development and circular economy of its members, in particular by contributing to societal issues and debates, and increase the Institute's visibility
4. Ensure the financial sustainability of the Institute

The original EDDEC Institute management team

Mélanie McDonald
MSc.
Director of Operations and Co-Founder

- Project leader, *Chemins de transition, Université de Montréal*[8]
- Sustainable Development Advisor, *Polytechnique Montréal*
- CSR Senior Consultant, *Des Enjeux et des Hommes* (Paris, France)
- MSc, Environment, *Université de Sherbrooke*
- BAA, Psychosociology, *Université du Québec à Montréal* (UQAM)

Daniel Normandin,
MSc., MBA
Executive Director and Co-Founder

- Director, CERIEC, ÉTS[8]
- VP and Co-Founder, Quantis International
- Executive Director and Co-Founder, CIRAIG, Interuniversity Research Centre for the Life Cycle of Products, Processes and Services
- MBA, Marketing, Finance, *HEC Montréal*
- MSc, Environmental Biotechnology, *Université Laval*
- BSc, Biology, *Université de Montréal*

Sébastien Sauvé,
PhD
Academic Director and Co-Founder

- Vice-Dean, Faculty of Arts and Science, Full Professor, Department of Chemistry, *Université de Montréal*[8]
- Ph.D. in soil chemistry and environmental quality 1999, Agronomy, Chemistry, Water and Environment, Cornell University (USA)

CHAPTER 2

ENGAGING WITH RESEARCHERS ON *CAMPUS MONTRÉAL*

Between 2014 and 2020, the EDDEC Institute:

- Mobilized over **2,000** researchers, professors, students and employees on *Campus Montréal*
- Initiated or supported the development of some **80** research projects
- Developed **14** inter-university collaborations on *Campus Montréal*
- Created and developed over **40** long term partnerships and professional relationships, of which **5** were international collaborations

In 2014, the EDDEC Institute launched three broad areas of research, namely Environment, Sustainable Development, and the circular economy. While the two former ones were long established and widely researched, the third was novel and largely unknown from most researchers. The challenge was to promote the CE among researchers while building on existing work. The first practice consisted in the mapping of researchers' expertise on *Campus Montréal*.

2.1 Mapping expertise

A mapping exercise that gauged where there was existing expertise was the first strategic step undertaken. It was implemented thanks to the availability of a large pool of motivated researchers interested in sustainable development on *Campus Montréal*.

The EDDEC team:

- Surveyed databases of professors and researchers of all three partner universities to select those whose program, expertise, or ongoing project had a link to sustainable development and environmental protection
- Contacted professors on a per-theme basis to evaluate interest in participating in knowledge development

The initial database listed over 450 researchers. Membership was designed as a simple process, whereby an identification sheet and a statement of interest were addressed to the Institute by interested researchers. There were no categories of membership nor membership fees applied. Over 70 researchers were particularly active and involved in CE-related initiatives.

2.2 Designing a first interdisciplinary research object

The second step of the strategy was to gather the identified and motivated researchers in a series of workshops focusing on the circular economy, in 2014 and 2015.

From the outset, it appeared that in the absence of initial research funding, the EDDEC had to deeply invest in order to meaningfully engage researchers. These investments targeted the various fields of expertise of the participants so that they could contribute to the development of a critical perspective of the proposed circularity model. Workshops were designed as multidisciplinary learning opportunities whereby researchers could take ownership of this new umbrella concept together.

The design of a first visual representation of the circular economy as well as a common lexicon were the learning objects that researchers focused on in some of the workshops. They also established working assumptions as a foundation for moving forward[9].

The collaborative work of researchers led to the design of a first visual representation of the circular economy that the EDDEC Institute could in turn use to promote to practitioners, including members of the *Pôle Québécois de concertation sur l'économie circulaire (Pôle).*

> "While everyone came up with their own piece of the puzzle, which is an important perspective on a particular field of research, building the puzzle into a societal change required a central team that connected all these pieces of expertise".
>
> **Mélanie McDonald,** Director of Operations, EDDEC Institute

2.3 Crafting a research program

A first research program was also established during those workshops to study and experiment with the circular economy from different angles. It involved the work of over 120 researchers from a great variety of backgrounds, fields of expertise, and institutions. The program represented one of the first interdisciplinary academic explorations on the circular economy globally, and it benefited from consultations with non-academic organizations[10].

The program was comprised of seven priorities, each involving several research projects. This formed the basis of the work of the EDDEC Institute and its partners from 2015 onwards. A great number of programs, initiatives, and activities have been put in place in relation to that research program. They are presented in the various sections of this report.

A workshop held later in 2017 was designed as an opportunity for researchers and graduate students to take stock of the latest developments in CE and to collaborate with the then visiting fellow at the EDDEC Institute, Dominique Bourg. Its objective was also, in the format of a "World Café", to gather collective intelligence on what future activities should focus on.

2.4 Maintaining long-term engagement with the community

The interest and motivation of researchers was maintained through a number of activities. Researchers interests had been recorded early on and a strategy was devised to provide them with added value as well as the opportunity for collective learning around, and on, the circular economy.

The main initiatives were:

- Active monitoring of global and local circular economy research and initiatives, that was disseminated through a monthly newsletter
- An international Visiting Fellows' program[11]
- The creation of a collective book project[12]
- The co-development of a MOOC[13]
- The production of peer-reviewed publications[14]

2.5 Establishing bridges with practitioners

In 2015, the EDDEC Institute convened and facilitated a multi-stakeholder roundtable called the *Pôle Québécois de concertation sur l'économie circulaire (Pôle).* It is composed of some 20 key decision makers and influencers from prominent organizations across sectors in the province. That structure, supported by specific committees as well as the safe space it created, enabled an efficient bottom-up approach for knowledge co-creation between researchers and practitioners. It led to the construction of a common language upon which the initiatives leading to a transition to a circular economy could be based[15].

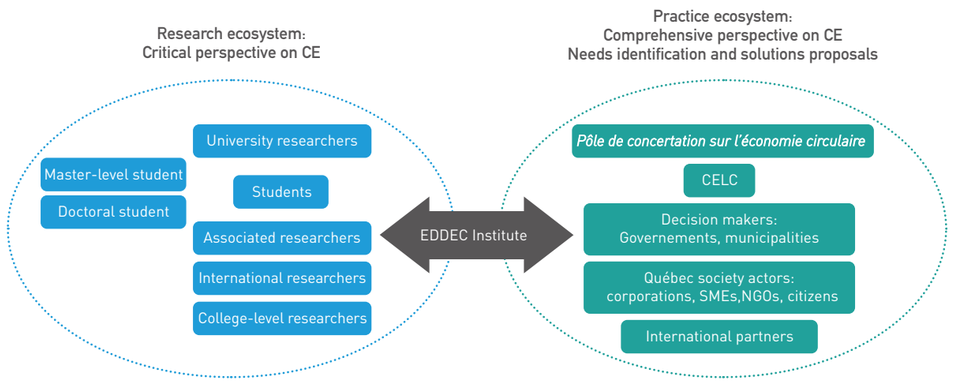
Academic Directors at the EDDEC Institute

2014-2016
Professor Sébastien Sauvé, *Université de Montréal*
Vice-Dean, Faculty of Arts and Science
Full Professor, Department of Chemistry
Expertise: Contaminants – chemical and ecotoxicological risk assessment

2017-2018
Professor Franck Scherrer, *Université de Montréal*
Associate Dean, Research, discovery, creation and innovation
Full Professor, Urban Planning and Landscape Architecture School
Expertise: The sustainable city – a multidisciplinary approach to urban collective action

2018-2019
Professor Emmanuel Raufflet, *HEC Montréal*
Professor, Department of Management
Expertise: Social innovation, sustainable development, and circular economy

EDDEC Institute stakeholders mapping



Adapted from "Mapping Researcher-Practitioner Practices for a Circular Economy", Manon Boiteux, Emmanuel Raufflet, pp 102-114, S&O Center and ARCS, Collaborations in Sustainability Report, 2020

CHAPTER 3

THE ADVENTURE CONTINUES AT ÉTS

The EDDEC Institute's five-year financing and mandate came to a close in 2019. Another university-based organization has taken on the challenge to pursue the transition to a circular economy in Québec: the Centre for Intersectoral Studies and Research on Circular Economy (CERIEC). It was created in September 2020 within the *École de Technologie Supérieure* (ÉTS) in Montréal.

CERIEC's mission is to help shape and deploy a circular economy through a cutting-edge interdisciplinary scientific research program and initiatives involving training, dialogue, added-value, and knowledge transfer, to maximize benefits for economic stakeholders, governments and society as a whole.

CERIEC's ambition is to become the leading reference in terms of knowledge, skills, and value creation around CE in Canada. Located at ÉTS, it provides a substantial testing space for researchers and engineering students, especially with respect to innovations intended to facilitate the transition towards a sustainable, circular future.

CERIEC
Centre d'études et de recherches intersectorielles en économie circulaire

Host university: *École de Technologie Supérieure* (ÉTS) – *Université du Québec*

Financing: A major contribution of $2.1 million over five years by Desjardins Group is completed by substantial funding from ÉTS

Scientific Committee: 15 members from ÉTS

Team: 6 employees

Four components:

Research and innovation: Contribute to the advancement of knowledge and capacity building for interdisciplinary research and innovation in terms of solutions, business models, and technology leading to a CE through living labs

Education and training: Increase the highly qualified workforce to support the deployment of the CE through training and the development of skills among engineers, managers, and professionals

Outreach and communication: Maintain an ongoing dialogue with stakeholders in the community to direct research and training activities in order to meet their needs and to guide public policy

Added-value and transfer: Support the efforts of companies, governments, and society to accelerate their transition to a CE through effective transfer of knowledge, solutions, technologies, and skills

CONCLUSION

The effort to transition Québec towards circularity has been mainly initiated by a university-based organization in the province.However, different types of organizations can undertake the implementation of a circular economy at the level of a province or a territory. These can include private, public, and collaborative initiatives.

The EDDEC Institute was conceived of and established by an experienced and passionate team, that was dedicated to leading a provincial effort. Although limited access to funding and institutional resources has hindered the capacity of the organization to achieve its full potential, the challenge has been successfully met.

The Institute, in supporting a systemic approach to transitioning to a circular economy, created boundaries and structure as a safe space where researchers and practitioners could co-create knowledge. On *Campus Montréal* as well as in other universities, interdisciplinary and circular-economy-centred education courses and programs were initiated. Raising Québec-wide awareness of the circular economy has been accomplished through varied communication efforts, including conferences, the creation of a Massive Open Online Course (MOOC), and the publication of a collective book.

Although it was not in the EDDEC Institute's mission to support organizations in the implementation of a CE, the narrative of some companies – of which a number had already implemented sustainable development strategies – has evolved to specifically refer to the circular economy.

The EDDEC Institute's efforts resulted in increased understanding of the circular economy framework, as well as a wider dissemination of the model to diverse audiences. In that regards, the EDDEC Institute was a strong influencer. It contributed to build policy momentum, allowing Québec to create a roadmap for transitioning to a circular economy, while also supporting government-wide, policy-oriented research that identified industries with the highest potential for circularity.

The CERIEC, together with other academic actors, among which the CIRAIG at *Polytechnique Montréal*, the *Pôle 3EC* at *HEC Montréal* and the CTTÉI at CEGEP[16] Sorel-Tracy, will pursue the research, outreach and educational efforts to foster the transition to a circular economy in the province of Québec.

The strategy and the initiatives that were implemented by the EDDEC Institute are detailed in the subsequent sections of this report, so that stakeholders, from policymakers to academics to corporate leaders to communicators, can learn from the Québec experience and apply these learnings to other jurisdictions.

Endnotes

1 *L'économie circulaire : une transition incontournable* – PUM
2 Note: Some of the information presented in this Section of the report is sourced and adapted from "Mapping Researcher-Practitioner Practices for a Circular Economy", Manon Boiteux, Emmanuel Raufflet, pp 102-114, S&O Center and ARCS, Collaborations in Sustainability Report, 2020
3 Refer to Section V of this report for educational cooperation and development
4 Refer to Section III of this report for research projects
5 Refer to Section II of this report
6 Refer to Section IV of this report
7 The RCAWR aims to develop, integrate and transfer knowledge to help optimize communities' waste-management and -recovery strategies to meet their current and future needs in the perspectives of a circular economy and a life-cycle approach.
8 Current position as of May 2021
9 Refer to Section II, Foreword of this report
10 Refer to Section III, Chapter 1 of this report
11 Refer to Section IV, Chapter 3, subsection 3.2 of this report
12 Refer to Section IV, Chapter 3, subsection 3.1 of this report
13 Refer to Section IV, Chapter 4, subsection 4.3 of this report
14 The level of implication of the EDDEC Institute in initiating those papers is difficult to assess clearly.
15 Refer to Section II, Chapter 1 of this report
16 CEGEP is a French acronym that stands for *Collège d'enseignement général et professionnel*, known as a general and vocational college. They are public institutions and represent the first level of higher education, dubbed post-secondary education, in Québec.

SECTION 2

ESTABLISHING KNOWLEDGE NETWORKS

2

Disclaimer: Given the extent of initiatives having taken place in Québec since 2014, this report does not claim to provide the reader with an exhaustive review. It aims at featuring some of the key elements that contributed to initiating a transition to a circular economy in the province, in particular linked to the experience of the EDDEC Institute. In the same period, a number of actions were initiated by various stakeholders in the province, among which RECYC-QUÉBEC; the *Ministère de l'agriculture, des Pêcheries et de l'Alimentation* (MAPAQ); *Transition énergétique Québec* (Energy Transition); the *Institut de la statistique du Québec*; the *Institut de développement de produits* (IDP), and *Villes et régions innovantes-Réseau de l'économie circulaire* (VRIC), to name a few.

The authors would like to thank Sonia Gagné, Director of RECYC-QUÉBEC for providing valuable feedback on the Section, as well as *Éco Entreprises Québec* (ÉEQ) for having provided insights into the creation of the multi-stakeholder roundtable *(Pôle)*. Any errors or omissions remain the sole responsibility of the authors.

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INTRODUCTION

There has been growth of circular economy (CE) interest in recent years among industry players, researchers, and the public. This has led to many definitions of the circular economy[1]. A research community had been established in 2014 by the recently created EDDEC Institute[2], a collaboration between *Université de Montréal, Polytechnique Montréal* and *HEC Montréal*.

It seemed to the organization that to build engagement strategies on solid ground with partners across sectors, the first challenge was to build a common understanding. An interdisciplinary team of researchers convened by the EDDEC Institute had taken a conceptual framework of the circular economy and adapted it to Québec realities, and they had established working assumptions as a foundation for moving forward[3] :

- The **linear economy is unsustainable** and it is urgent that we go beyond a waste-based economic model
- **Referring to the circular economy as an umbrella concept has the potential to connect** both knowledge and expertise relevant to the transition to a circular economy
- **Critical evaluation and assessment are key** and must be achieved through interdisciplinary and multi-stakeholder conversations
- The **circular economy is one important path toward sustainable socioeconomic transition**, and it requires co-construction by the interplay between research and practice, as well as through intersectoral cooperation
- **Smart policies and regulations are essential** to build the coherence required to efficiently deploy a circular economy

With that in mind, and as part of its academic mission, the EDDEC Institute set out to foster knowledge transfer and to help new networks emerge, in order to develop or expand initiatives supporting the transition to a circular economy.

The fundamental concept underlying the approach was collaborative work.

MAIN **MILESTONES**

2014

- Creation of the EDDEC Institute on *Campus Montréal*

2015

- Creation of the multi-stakeholder roundtable *(Pôle)* moderated by the EDDEC Institute
- Circular economy session at Americana Environmental forum and International trade show for environmental technologies
- Creation of *Synergie Québec*
- Creation of the Paris-Brussels-Montréal international academic research cooperation network

2016

- Creation of the Collaborative and Performance Economy Lab *(Lab)* by the EDDEC Institute
- Definition of circular economy by the multi-stakeholder roundtable *(Pôle)*
- Walter Stahel, one of the founders of the concept of a circular economy, is the first visiting fellow at the EDDEC Institute
- First edition of the annual EDDEC Institute CE Summer School
- First edition of RECYC-QUÉBEC's Call for proposals for the CE transition (APTEC)

2017

- Evolution of the multi-stakeholder roundtable *(Pôle)* and creation of committees
- Creation of the *Groupe interministériel sur l'économie circulaire* (GIEC)
- CE consultation organized by the *Ministère de l'Économie et de l'Innovation* (MEI) and RECYC-QUÉBEC

2018

- Creation of the final graphical representation of CE by the EDDEC Institute and RECYC-QUÉBEC
- Creation of Circular Economy Leadership Canada (CELC)
- EDDEC Institute roundtable between politicians and researchers during the provincial electoral campaign
- First edition of the *Assises québécoises de l'économie circulaire* organized by RECYC-QUÉBEC and the EDDEC Institute
- Launch of *QuébecCirculaire.org* hub
- *Genium 360: Rencontres de génie 2018: L'économie circulaire et innovation,* first engineering congress in CE in Québec
- Launch of the report "Circular Economy in Québec – Economic opportunities and impacts"

2019

- Circular economy session at Americana
- *Rendez-vous de l'économie circulaire (Université de Sherbrooke)*
- The CTTÉI obtains the CREIT, a NSERC Industrial Research Chair on industrial and territorial ecology
- First Edition of the *Ville, territoire, économie circulaire* summer school *(Université de Montréal)*

2020

- Circular economy session at the *Salon des Tech 2020*
- Creation of the group of experts on CE by the Council of Canadian Academies (CCA)
- Launch of the 2019-2024 action plan for the *Politique québécoise de gestion des matières résiduelles*, with funds in excess of $100 million
- Consultation process by the *Bureau de coordination du développement durable* (MELCC) on the Québec Government Strategy on sustainable development 2022-2027, in collaboration with RECYC-QUÉBEC

Acronyms are listed on page 12.

CHAPTER 1

THE BIRTH OF A COMMUNITY OF PRACTICE

To establish a common understanding of the Circular economy and advance the transition, it seemed essential to support the formation of a community of practitioners. Indeed, EDDEC's Daniel Normandin, Executive Director and Mélanie McDonald, Director of Operations, believed that one of the best ways to ensure the highest possible buy-in from stakeholders at various levels across a territory was to enable a bottom-up approach for knowledge co-construction. To them, establishing a community of practice (CoP) seemed to be the most effective strategy to ensure a real adaptation of academic research in a way that answered the requirements of practitioners. In Daniel's and Melanie's experience, to achieve this, it was necessary for researchers and practitioners to "speak the same language". This also implied that society as a whole needed to be represented among the members of the CoP. A necessary first step for that CoP was to conduct a concrete needs assessment.

In partnership with the private sector, NGOs, government agencies, key ministries and leading applied research organizations, the EDDEC Institute has convened and facilitated a multi-stakeholder roundtable called the *Pôle Québécois de concertation sur l'économie circulaire (Pôle)* since 2015. It is composed of 20 key decision makers and influencers from prominent organizations across sectors that work together creating a unique bottom-up approach.

The successful set-up of that CoP started with activities that contributed to raising interest. Then the EDDEC Institute ensured that:

1. Participants were truly representative of society and their respective sectors
2. Participants' interest in the initiative was genuine
3. The motivation of participants would be maintained in the long run on a voluntary basis
4. Participants felt they could safely contribute
5. Objectives were co-defined, clearly understood and accepted

1.1 Spark interest and select the right partners

In June 2014, the EDDEC Institute management team participated in the first *Assises de l'économie circulaire* held in Paris (France). Partnerships were outlined with a number of French institutions, and the importance of reaching out to private and public organizations in Québec was highlighted. Awareness needed to be built among key stakeholders.

In order to do so, multiple actors from municipalities, governments, organizations, and civil society were identified and convened. This group was comprised of the key influencers of the society in Québec.

In January 2015, in alignment with the revision of the provincial government's strategy on sustainable development, these pre-identified stakeholders were gathered together and consulted by the EDDEC Institute for the first time. The government had set out to consult with key actors of the society, and this represented a great opportunity to introduce the concept of a circular economy. Several stakeholders who were presenting at the hearings were invited to co-develop common key messages to be presented by one of them, though adapted to their specific context. This represented a first concerted action, in order to raise awareness about the circular economy in Québec.

As a result, the adopted *Stratégie gouvernementale de développement durable 2015-2020* incorporates the circularity principles and steers government bodies toward a green economy by identifying objectives for the fight against climate change.

Building upon this first approach, one-on-one formal and informal meetings were organized to ascertain the EDDEC Institute's understanding of the landscape in Québec, as well as to validate the rationale for the creation of a multi-stakeholder table where CE discussions could be pursued.

In August 2015, selected practitioners – the key representatives of their respective sectors – met for the first time and created the *Pôle Québécois de concertation sur l'économie circulaire (Pôle).*

The members of the *Pôle* were selected in order to ensure representation of the various provincial stakeholders at the decision-making level.

Provincial government and related organizations:
- *Ministère de l'Énergie et des Ressources Naturelles* (MERN)
- *Ministère de l'Économie et de l'Innovation* (MEI)
- RECYC-QUÉBEC

Local government:
- *Union des Municipalités du Québec* (UMQ)
- *Regroupement national des conseils régionaux de l'environnement* (RNCRQ)

Private organisations and associations:
- *Fédération des Chambres de Commerce du Québec*
- Québec Business Council on the Environment *(Conseil Patronal de l'environnement du Québec – CPEQ)*

Industry associations:
- *Éco Entreprises Québec* (ÉEQ)
- *Écotech*
- Aluminium Association of Canada

Non-profit:
- *Équiterre*

Finances:
- *Fonds d'action québécois pour le développement durable* (FAQDD)
- *Fondaction*

Education & Research:
- *Centre de transfert technologique en écologie industrielle* (CTTÉI)

Civil society:
- *Chantier de l'économie sociale*

Over time, as people change positions or government bodies change with elections, individual members may have changed but organizations have remained constant since its inception. Additional key stakeholders have joined the *Pôle* over time, and since 2019 the members also include:

- Economic Development Canada for Québec regions
- *Fédération des travailleurs et travailleuses du Québec* (FTQ)
- *Réseau Environnement*
- *Bureau de Coordination du Développement Durable* (BCDD), as part of the *Ministère de l'Environnement et de la Lutte contre les Changements Climatiques* (MELCC)
- *Transition énergétique Québec*

1.2 Establish the format and the mission of the working "body"

In the summer of 2015, during the first meeting of the *Pôle*, 15 strategic stakeholders shared knowledge about the rationale behind the implementation of CE, in particular in the province of Québec. They aimed to discover and discuss the proposed model developed the previous year with researchers on *Campus Montréal* as well as its strategies and implementation principles. They also discussed the proposed mission and the structure of the *Pôle* as well as the participation guidelines for its members.

The success of this meeting relied on the ability of both the director and the Director of Operations of the EDDEC Institute to mobilize their expertise in order to help create a common vision, leveraging their knowledge of each type of actor's realities and language.

Several founding principles were discussed from the onset and evolved over time:

Organizational structure and modus operandi

The governance mechanisms of the *Pôle* were co-constructed with its members. This new body was to remain non-formal as to avoid conflicts of interest between members' own organizational affiliation and their participation in the *Pôle*. MOUs and the creation of a non-for-profit organisation were initially considered, but disregarded at this early stage of development. It was decided that it needed to be further researched however, and after seeking expert advice, it was decided that separate work would take place in two distinct yet parallel streams over the course of the first operating year. The members would pursue the analysis aiming to define the most appropriate organizational structure as well as related financing options, while proactively engaging work to foster the transition to CE in Québec.

Since high-level decision makers typically have busy agendas, all voted in favour of a light structure and operating mode, coordinated by the EDDEC Institute team.

The *Pôle* was to meet 3-4 times a year, and meetings were to take place alternatively at the offices of the member organizations. Bigger organizations designated backup representatives to ensure continued participation.

Financing

Given the varied nature and size of member organizations, questions of financing were delicate from the onset. For example, it was established that a membership-based structure was not appropriate. Various possibilities have been discussed over time. The fact that the governance of the *Pôle* is organic - which means that it has no legal existence nor hierarchical structure – and that members are so diverse makes it complex to procure financing and attribute funds.

The members of the later-created Committees are very active in their respective sectors and a number of new initiatives have regularly been proposed over time. Action is always dependent on financing, and it is a recurrent challenge for the *Pôle* to initiate new actions while ensuring the continued financing of existing projects. Members must take it upon their own resources to implement activities, and must decide to dedicate resources, whether human or financial, which can present challenges for turning plans into action.

Mission

In 2015, the following mission was adopted:
Mobilize and rally Québec practitioners and foster enabling conditions for the transition towards a circular economy.

The objectives of the *Pôle* were defined as:

1. Initiate flagship projects, document existing initiatives and create outreach reports that underline the benefits of the implementation of CE strategies, as well as put in light opportunities and threats by type of practitioner;
2. Develop and implement mobilisation strategies and tools within an organizational structure that allows for a large participation;
3. Pool existing expertise, knowledge and resources, in the province of Québec, in the rest of Canada and internationally, and identify stakeholders' needs;
4. Present recommendations to different government levels in order to create favourable conditions for the implementation of a CE, in particular through the development of regulatory tools as well as programs that foster experimentation.

Underlying all this work lay a key challenge: building a working definition of circular economy upon which all could agree, and that would help in establishing a strong common foundation and understanding.

Setting the participation rules: safe space

The activities of the *Pôle* were coordinated by the EDDEC Institute, which provided for a non-partisan neutral moderation of all the work. Without fear of information theft, members could participate without restraint and bring their whole expertise to the table[4].

1.3 Co-create an agenda

Within a few months of the inception of the *Pôle*, members had established the preliminary proposal which covered the first year of operations.

The 2016-2018 strategic planning was approved, which objectives were to establish the governance model while creating the necessary conditions for the *Pôle's* work to start. This consisted in specific research that tied into outreach efforts, as well as promotion. The agenda was refined over time, and the main elements are as follows:

Define a common language

For several months, there were many rich and animated discussions about establishing a common definition of the circular economy. It is the process in itself that guaranteed that the final definition was truly comprehensive. This in turn ensured the establishment of a strong common base upon which various initiatives could be undertaken. A key role of the EDDEC Institute team was to help gather scientific knowledge and practitioners' expertise together along with guiding members' work towards framing it into a common understanding for the *Pôle*.

This definition was then embedded into communication and outreach tools. The definition of a common language and shared understanding of concepts has proven to be the cornerstone of the success of the *Pôle* and its actions.

> "The interplay of ideas, interests and institutions in a safe space allowed for the true co-design of a common understanding of the circular economy. It has been the invaluable foundation of our work moving forward, and the assurance of its success."
>
> **Sonia Gagné**, President and CEO, RECYC-QUÉBEC

In the spring of 2016, the *Pôle* members finalized their definition of CE for the Province of Québec:

"A circular economy is a production, exchange and consumption system which optimizes the use of resources at all stages in the life cycle of a good or a service, in a circular logic, while reducing the environmental footprint and contributing to the well-being of individuals and communities."

Engage in transformative peer-to-peer communication

From the start, each member of the *Pôle* was responsible for reaching out to its organizational Board Members, as well as its professional network, through one-on-one as well as group meetings, in order to introduce the concepts of circular economy. A strategic meeting plan with pre-identified key stakeholders and potential strategic partners in the province was also established. This outreach was mainly conducted in the course of 2016.

Use message amplifiers: the media and events

A preliminary communication strategy was devised, relying on a combination of media interviews and participation in key conferences and events to strategically position the *Pôle* and its actions. As a result, numerous interviews and news stories were produced in media outlets, with some key interventions taking place over the last five years[5].

Implement an initial assessment of CE in the province of Québec

To devise an efficient strategy that would contribute to the province's transition to a CE, it was necessary for the *Pôle* to assess the situation and identify gaps and opportunities. As a result, key tools were developed:

1. Mapping of key stakeholders (2016)
2. Examples of Québec's best practices (2018)
3. Preliminary list of opportunities and threats to a transition (2018)

Since 2019, the *Pôle* is also instrumental in the reflection towards the implementation of a network of regional CE acceleration labs. These labs would be opportunity-based agile organizations that would focus on insuring quick gains by strategic sectors[6].

Spearhead the transition in Canada

In the spring of 2018, the creation of Circular Economy Leadership Canada (CELC) prompted members to elaborate on the opportunities this represented. The EDDEC Institute had been invited to participate in that new initiative and was to act as a focal point for the province of Québec. *Pôle* members identified pathways to promote the establishment of a shared vision in order to accelerate the implementation of a circular economy throughout Canada. Among the options discussed were the translation of *QuébecCirculaire.org* or the creation of a Canadian platform on the same hub[7].

AGENDA FOR BUILDING A COMMUNITY OF PRACTICE

1. Define a common language
2. Engage in transformative peer-to-peer communication
3. Use message amplifiers: the media and events
4. Implement an initial assessment of CE in the province of Québec
5. Spearhead the transition in Canada
6. Showcase Québec internationally

Showcase Québec internationally

Conversations in the community of practice led to the identification of the need to generate and disseminate actionable knowledge to a broader audience of decision-makers and managers.

In 2015, the management team of the EDDEC Institute had already approached the French organizations founders[8] of *economiecirculaire.org*. This website is an established francophone hub showcasing initiatives for the implementation of a circular economy in Europe, and in particular in France and Switzerland. It seemed a natural fit that Québec would join that community. Participating in this initiative would enhance possibilities for international exchanges of best practices and partnerships. As a result, in the fall of 2018 *QuébecCirculaire.org* was launched.

In 2019, RECYC-QUÉBEC and the EDDEC Institute coordinated their efforts to represent Québec's unique bottom-up approach at international gatherings like the World Circular Economy Forum (WCEF) in Helsinki, in collaboration with the *Pôle* members. They also collaborated in the organisation of the WCEF that was to be held in Toronto in 2020, and that became a virtual event in the context of the COVID-19 pandemic.

1.4 Be agile & adapt: The *Pôle* 2.0

In 2017, members articulated the mission of the *Pôle* and defined their vision for 2025:

"By establishing a circular society that integrates economic, social and environmental benefits that can be both measured and verified, Québec will be a pioneer and a visionary in North America[9]."

That same year, the governance of the *Pôle* was fine-tuned. After a year of collaborating together and co-creating, members were more comfortable with - and eager to - taking on responsibilities and allocating human resources as well as financing to initiatives.

In particular, in 2025, the circular economy will:

- Represent a rallying force for various stakeholders and will galvanize the economy and employment
- Catalyze innovation and differentiation for organizations, in particular social innovation
- Contribute to various governmental strategies, and possibly be integrated into a holistic and inspiring legislative framework
- Be integrated into economical development plans at various implementation levels (resources, products, organizations, territories and government)
- Be measurable and possibly integrated into the various reporting systems and requirements in Québec

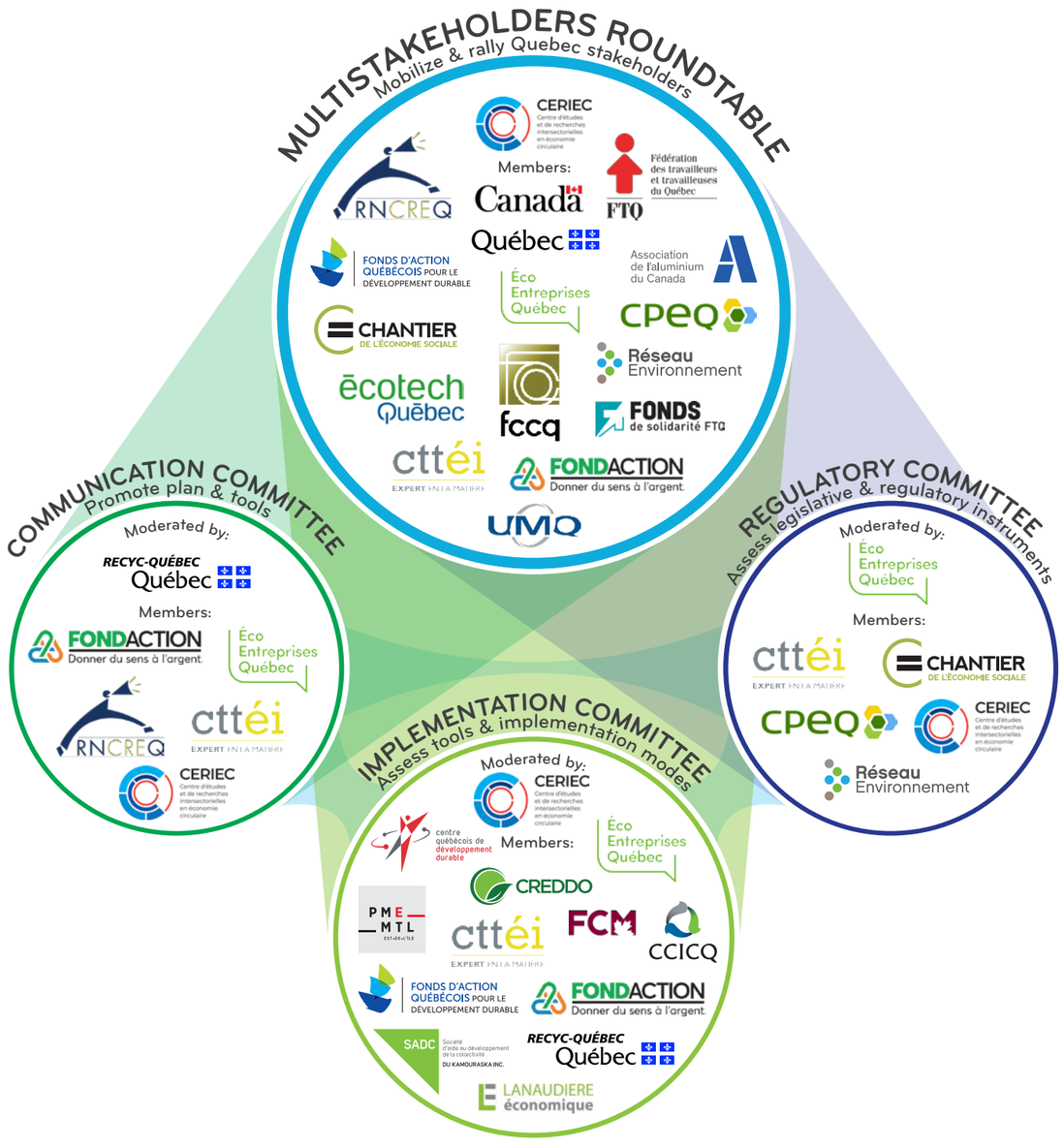
Committees were created in order to more efficiently advance three strategic aspects of the transition: Communication; Implementation, and Regulation. A fourth committee, focusing on Economic Impacts, was created on an ad-hoc basis. Committees were implemented over 2017 and 2018.

This new governance model enabled a more active and defined implication of the stakeholders and allowed for advancing the work in parallel. All committees report on progress at *Pôle* meetings. They act like satellite vessels reporting to the mothership, and meet as needed, sometimes up to 6 times per year. To further their work, they have rallied other stakeholders like the Federation of Canadian Municipalities, *Lanaudière économique, PME Montréal, SADC du Kamouraska, MRC de la Vallée-du-Richelieu* and CREDDO.

Each committee is led by a member of the *Pôle* and includes other members and as well as selected experts, invited upon agreement of all members, at the *Pôle* or the committee level.

The work emerging from each committee (reports, white papers, tools, etc.) is presented by its respective leader during *Pôle* meetings and validated by the *Pôle* members.

The creation of a committee that would focus on the financing of the initiatives was proposed during 2020. It would be open to other key actors in the financing world, and would help reflect upon the policies and framework that could be put into place in Québec.



Éco Entreprises Québec, 2020. In collaboration with the CERIEC. Reproduction authorized. Modification prohibited.

1.4.1 Communication Committee

Founded: Fall 2017
Leading organization: RECYC-QUÉBEC
The organization took the lead as it was well aligned with its mission.

Challenge:
Upon the *Pôle*'s inception, it was clear that one of the key challenges was to create a common understanding. That meant avoiding pitfalls such as:

- Solely defining circular economy by some of its strategies, like recycling, or industrial ecology, both having been prominently promoted for a number of years
- Restricting CE to some of its tools, like Life Cycle Analysis or responsible procurement

It also implied to:

- Differentiate CE from other emerging approaches (e.g. blue or green economy)
- Make a strong link to the implementation of sustainable development
- Position CE as a model comprised of various strategies that are prioritized according to their relevance and impacts at different stages of the life cycle of a service or a product

Mission:
Speaking the same language
Before the implementation of committees, communication work had focused mainly on establishing a common definition of CE. It now needed to be transposed into a visual representation that had the potential of being understood by various stakeholders, from various sectors, industries, institutions or organizations. The graphic was intended to translate the work done by researchers of *Campus Montréal* into a language that could be understood by practitioners. It meant bridging the gap between theory and practice.

The contribution of the Communication Committee has been crucial in this work led by RECYC-QUÉBEC. It has been an evolving tool. Three versions have been released overtime, the latest in 2020, reflecting the robust co-design with practitioners in addition to the evolution of knowledge about the concept of CE itself. The challenge was to give the chart enough detail so as to encompass, in a life-cycle approach, all the strategies and tools related to CE, while remaining accessible to various audiences. To do so, the strategies have been divided into four families that are hierarchized along the life cycle, and which allow for well-known concepts like the 4-RV approach[10] to be included. The twelve strategies put forward underline the circular loops at different stages.

> "The visual representation of the circular economy that was co-designed by the EDDEC Institute and RECYC-QUÉBEC, and validated by the *Pôle* members, results in an analytical model not unlike that of the Ellen McArthur Foundation, yet it is sufficiently self-explanatory to be used in educational contexts or for outreach efforts."
>
> **Franck Scherrer**, Associate Dean, Research, discovery, creation and innovation Vice-Rectorate at *Université de Montréal* and full professor at the Urban Planning and Landscape Architecture School. Former academic director of the EDDEC Institute.

Commmunicating and educating

- Documentation: RECYC-QUÉBEC, in collaboration with the Committee, designed and translated into English simple-yet-crucial tools such as a two-page document that has been widely distributed in Québec and adopted in the province and in the rest of Canada.
- Adaptation of the visual representation: It has also been adapted to represent the realities of various industries, like the food sector.
- Showcasing CE: In its first years, the Committee was also instrumental in the co-design of the first *Assises québécoises de l'économie circulaire,* organized by RECYC-QUÉBEC, in collaboration with MEI and the EDDEC Institute, that took place in December 2018, reaching more than 400 managers and leaders from diverse sectors of society[11].

- Promoting and educating to CE: The mission of the Committee evolved to include the designing and implementation of a full communication plan. Its overall objective is to inform, promote and encourage adoption of a common vision of CE in Québec, while nurturing networking opportunities between CE actors. In 2020, the communication plan was released to the *Pôle*. It spans until 2022 and focuses on three target audiences: companies, municipalities and government bodies. Their communication needs have been assessed via focus groups held in 2019 and 2020. The comments gathered during those working sessions underline the need for tangible examples showcased at different steps of implementation. Focus groups findings also highlight economical, environmental and social benefits. Communication tactics have been adapted for target audience and sub-targets audiences.
- The Committee also furthers its work by fostering the international recognition of Québec's approach and initiatives, in particular through the *QuébecCirculaire.org* hub.

In parallel, other communications activities have been undertaken by the EDDEC Institute[12].

1.4.2 Implementation Committee

Founded: Fall 2017
Leading organization: FAQDD, followed by the EDDEC Institute

Challenge:
The primary objective of the Implementation Committee was, among members, to establish a quick assessment of the convergences between their existing projects and initiatives. This highlighted the needs to be addressed in terms of tools for implementation of CE. Among the findings, it was clear that:

1. Economic impacts of circular economy needed to be showcased
2. Stakeholders training was paramount, in particular at municipal levels as well as within SMEs
3. Training as well as approaches and tools needed to be tied into existing frameworks where possible

In the course in 2018, the objectives of this Committee were further defined. It includes the creation of a toolbox as well as sourcing and mapping initiatives to illustrate the circular economy in Québec, in particular on *QuébecCirculaire.org*. It also includes the creation of a repertory of programs and resources and the creation of a CE implementation guide.

Mission:
Building a circular economy, one tool at a time
A plethora of tools existed already to define or implement CE. Members agreed upon the definition of "tool", and over 225 tools were sourced to create a toolbox, from the resources available at that time worldwide. Tools were evaluated according to several keys, and aggregated by type of strategies or of implementation, by phases (such as assessment or implementation), and by target public (such as companies, municipalities, citizens, and research bodies).

Among those, 100 tools have been prioritized by the Committee, and further categorized according to the level of change they implied or enabled within an organization. They also included turnkey tools, such as those helping to conceive a business model that is compatible with a circular economy.

Students were recruited by the EDDEC Institute to conduct this research and propose adaptations to Québec realities. Members of the Committee tested a number of tools in order to validate what adaptations would be relevant.

Showcasing CE
The work of the Implementation Committee was also designed to support other committees.

In 2018 for example, it aligned its planning to launch 75 priority tools on the *QuébecCirculaire.org* hub ahead of the first *Assises québécoises de l'économie circulaire*.

In 2020 a contest was also launched province-wide on the hub in order to identify initiatives to be showcased, increasing the existing database. Over 40 organisations participated, most of them SMEs and non-for-profit initiatives.

Anchoring the work
One objective of this Committee is to anchor the work at the provincial level.

In 2019 for instance it evaluated potential collaboration with the new EcoLeader network of agents[13], whose mission it is to foster the implementation of clean technologies and eco-responsible business practices in Québec. Proposals have been made for training agents on CE. The adaptation of the *QuébecCirculaire.org* hub, to host the EcoLeader initiative, was also considered. Although those early proposals have not been accepted, the agents refer organizations to the hub when they receive CE-related requests.

Ad-hoc consultations with recognised experts are also conducted when the Committee work focuses on some specific fields, like responsible procurement.

1.4.3 Regulatory Committee

Founded: Fall 2018
Leading organization: ÉEQ

Challenge:
The work started with the acknowledgement that current regulatory frameworks in Québec and in Canada are not generally well adapted to enable a transition towards a circular economy.

While some elements might help foster it, like the extended producer responsibility (EPR), others are blocking and prevent the re-circulation of material and residues. Québec also lacks incentive measures to foster the purchase of products with recycled content.

A study had emerged from the *Université de Sherbrooke* in 2017 on the benchmarking of International law and regulation[14]. In 2018, although the *Ministère de l'économie et de l'innovation* (MEI) had first stalled its call for projects for a comparative analysis between Québec and international initiatives as well as an analysis of the enforceability of best practices in the context of the province[15], students from the Master in Environment from the *Université de Sherbrooke* were mandated to undertake research[16]. This informed the Committee's work.

Mission:
The mission of the Committee was therefore two-fold:

1. First, to identify the regulatory threats and weaknesses as well as assess the leveraging actions that could be implemented.
2. Second, to formulate recommendations to *Pôle* members so they could promote actions towards the government and contribute to the positive evolution of frameworks in their respective sectors.

This effort was started in a context whereby the province's government was devising its future strategies, and therefore it was hoped that the work of the Committee could somewhat influence positively the process, via recommendations made to the GIEC[17].

In view of other priorities, the activities of the Committee had been temporarily halted, however at the occasion of a *Pôle* meeting at the end of 2020, it was decided that it is to be revived in 2021.

1.4.4 Economic Impact Committee

Founded: Fall 2018, as an ad-hoc group
Leading organization: CPEQ

Challenge:
The research "circular economy in Québec – Economic opportunities and impacts", elaborated in collaboration with GMT, presented by CPQ, CPEQ and ÉEQ in 2018, identified a number of key sectors where a transition to a circular economy would be very beneficial. However, the research was based upon a literature review, and more research was required in order to better define the opportunities and challenges.

Mission:
The Committee's mission was three-fold:

1. Following-up on "Circular Economy in Québec – Economic opportunities and impacts" study
2. Survey Québec companies to assess their needs in terms of CE
3. Survey Québec companies to evaluate which benefits they expect to/have obtained from the implementation of CE strategies. Invitations were extended to companies to discuss further the best approach to make circularity principles percolate into the management of organizations in Québec

As part of its mission, the Committee formulated recommendations to the *Pôle* to further its action. They suggested that the multi-stakeholder roundtable should ask for government's leadership and assistance on:

- Mapping the actors by sectoral value chain at the scale of the province, as well as identifying the regulatory framework applicable to each
- Mapping and characterizing the resources in each sectoral value chain
- Making this information easily accessible to the public, so that it fosters proactive closing of the circular loops

> "The results of the study on the economic impacts of the implementation of a circular economy were an eye-opener. It highlighted several other opportunities and markets for materials that otherwise were treated as waste and were sent to the landfill. It made us think outside of the box and look at different implementations in different sectors."

Genevieve Dionne, Director, Ecodesign and circular economy, *Éco Entreprises Québec*

1.5 Influence provincial strategies

In 2017, under the leadership of the *Ministère de l'économie et de l'innovation* (MEI, formely MESI) and RECYC-QUÉBEC, a group of representatives from 13 Government of Québec's ministries and state companies was set up. Called GIEC[18], the role of this group is to coordinate the efforts of the different departments of the Québec Government for a more efficient implementation of the circular economy.

The idea behind the setting-up of such a group comes from the Action 7 of the Government of Québec Sustainable development action plan[19]. It had also been discussed at *Pôle* meetings.

RECYC-QUÉBEC, as a state company, is fully coordinating the GIEC since 2019, and is instrumental in relaying the intelligence gathered by the members of the *Pôle* as well as in informing the decision process.

In 2016, work started toward the definition of a potential roadmap for a transition to a circular economy for Québec. The *Pôle*, via the EDDEC Institute, was a key contributor from the onset.

In December 2017, a private consultation on this project was held and benefited from the input of the 50 stakeholders invited.

As a result, in the summer of 2018, the five-year action plan on clean growth and clean technologies for a green economy released by the MEI adopted the definition of CE elaborated by the *Pôle*. The 2018-2023 *Plan d'action pour la croissance et les technologies propres – vers une économie plus verte et prospère* identified opportunities and threats for an efficient transition, as well as measures that should be implemented in the short-term. It also highlighted specific measures on the circular economy. In particular, it planned the support of 35 structuring projects by 2023.

Although the work of the GIEC might have suffered some delays due to the change of governmental priorities following the provincial elections, and more recently due to the reallocation of priorities in the view of the COVID-19 pandemic, it is fully operating, with an objective of a meeting 2 to 3 times per year.

1.6 Looking forward – The *Pôle* 3.0

Convening and facilitating the *Pôle* had represented a significant amount of work for the EDDEC Institute, which had tended not to be seen as strategic from the university-based leadership on *Campus Montréal*.

At the same time, the investment in this community of practice allowed to build trust between external stakeholders and faculty. It contributed to making circular economy research more relevant for society as well as identifying more precisely that research is relevant for business stakeholders as well as ENGOs and governments.

Since 2015, the landscape has evolved in Québec towards the implementation of circular economy in part thanks to the work of the multi-stakeholder roundtable. Outreach to key audiences was increased. Initiatives have risen in all sectors and at all levels of government.

> "The fact that the approach was led by a university-based organization, whose mission and expertise was to bridge the gap with practitioners, was paramount to ensure a holistic approach to circular economy. And to help develop a definition and a visual representation that federates across sectors and actors."

Julien Beaulieu, Chair holder – NSERC Industrial Research Chair on industrial and territorial ecology, CTTÉI

This community of practice has led to several outcomes over five years:

- The *Pôle* has been a safe space for diverse leading stakeholders from various sectors to have co-constructed, revised and adapted the definition of the circular economy (CE).
- The multi-stakeholder table has increased members' understanding of the concepts and provided opportunities for implementation of practices among their respective organizations and sectors.
- The work has led to the adoption of the *Pôle*'s definition of CE by the Government of Québec, and the adaptation of its visual representation to specific industrial sectors and supply chains.

As a result, the concept of the circular economy has gained traction with sectoral actors, industries and regions[20] .

Frameworks and challenges have also evolved over this 5-year period. Agility is key to success moving forward.

The EDDEC Institute's 5-year financing and mandate ended in 2019. In 2020, another university-based organization has taken on the challenge to pursue the transformation of Québec society via the implementation of a circular economy. Under the newly created CERIEC, the version 3.0 of the *Pôle* will be designed and a new strategic plan will be developed.

KEYS TO IMPLEMENTING
A BOTTOM-UP APPROACH VIA A MULTI-STAKEHOLDER TABLE

Select the right players and the right structure

The membership selection process as well as the co-design of an agile governance structure are essential.

Set up a safe space

Exchanges moderated by a neutral body brings legitimacy and credibility to the approach. This is key to transparency and meaningful progress.

Collaborate, collaborate, collaborate

Co-identification of threats and opportunities and co-designing of solutions are paramount for success.

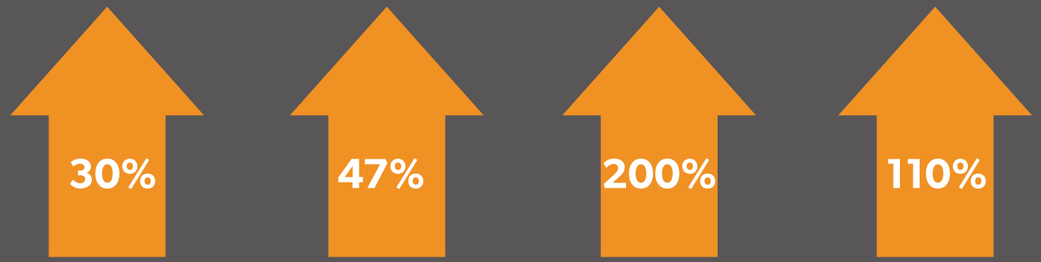
Develop a common language

Understanding and action can only take place when everyone is on the same page.

Motivate stakeholders

Project management abilities, strong networking expertise, seasoned communication skills and in-depth knowledge of both research and practitioners' realities, timelines and needs are all essential.

The evolution of CE showcased by *QuébecCirculaire.org*
(data as of 2020)



142 initiatives featured, with an increase of almost 30% in 2020, following the call for initiatives

47% of the initiatives featured are SMEs, 45% are non-profit organizations

36,300 users, an increase of 200% compared to the previous year

100,000 pages views, an increase of 110% compared to 2019

CHAPTER 2
CROSS-POLLINATION AND PARTNERSHIPS

Since 2015, a number of initiatives and activities have been elaborated by and between the members of the *Pôle*, be it research, training or awareness-raising activities like webinars. Some collaborations have been pursued deeper than others, such as the following:

2.1 The EcoLeader Network

The EcoLeader fund was created by Québec's government *Plan d'action pour la croissance et les technologies propres* in 2019[21]. It is coordinated by the *Fonds d'action québécois pour le développement durable* (FAQDD), in collaboration with the *Centre québécois de développement durable* (CQDD) and Écotech Québec.

Its mandate is, by March 2023, to support 50,000 companies in Québec (20% of all companies of the province) towards the implementation of clean technologies and ecoresponsible business practices. In order to do so, the program is based on three elements:

- A network of regional representatives to ensure local presence in all regions of Québec
- A fund of $18.5 million targeted towards SMEs, cooperatives and non-for-profit businesses to hire experts, carry out studies and assessments that lead towards the adoption of an eco-responsible practice or the purchase of the clean technology
- Three repertories for funding sources, experts and tools

In this program, the circular economy falls under the broader category of ecoresponsible practices. The repertoire of tools includes several sub-categories, according to the CE strategy selected: calculators, case studies, guides, communication tools and so on.

The Fund is co-coordinated by 3 members of the *Pôle*, who can foster knowledge and information transfers in order to strengthen the initiative. Daniel Normandin, current Director of the CERIEC, is also a member of the Advisory Board.

2.2 A symbiotic approach (CTTÉI)

Affiliated with the CEGEP[22] Sorel-Tracy, the CTTÉI is a college-based technology transfer centre that aims to increase the performance of companies and communities through research and development in industrial ecology. The centre concentrates its efforts on three main aspects: the optimization of residual materials; the development of clean technologies; and the implementation of industrial symbiosis. The CTTÉI has supported industrial symbiosis since 2008 and it generates a significant amount of information on this CE strategy. Since 2015, over 2,700 organizations, some 850 synergies and 22 industrial symbiosis projects in Québec are networked within a community of practice called *Synergie Québec*.

With a living lab approach, *Synergie Québec* contributes to establishing synergies that extend beyond a given territory. The CTTÉI's clientele is quite diverse and ranges from companies to municipalities and industrial parks, and from SMEs to major GHG emitters. Over 6,500 material flows have been documented. The CTTÉI also documents successful case studies and develops decision-support tools. They calculated that since 2015, some 17,800 tons of residual matter were not sent to the landfill; savings reached 4.3 million CAD$; and GHG emissions decreased by 9,200 t CO_2-eq.

Relationships between the EDDEC Institute and the CTTÉI have gone much beyond the connection in the context of the *Pôle*. Other collaborations consisted mostly in training and research.

Since 2016, and annually, the CTTÉI team has provided industrial ecology and symbiosis training during the EDDEC Institute summer school on circular economy.

In 2017, the EDDEC team trained staff and stakeholders from a local economic development agency – *Lanaudière économique*, as well as staff and stakeholders for a symbiosis in the *MRC Vallée-du-Richelieu*.

A year later, proposals have also been put together in cooperation with the CTTÉI for other trainings within the network of symbiosis, for providing them for a specific toolbox, or for other opportunities like with the Québec section of the Solid Waste Association of North America (SQ-SWANA) and *Réseau Environnement*.

On the research front, the CTTEI and researchers initially gathered together by the EDDEC Institute in 2017 have been working on a project to reduce industrial GHGs through the application of strategies related to the circular economy. The report *Portrait et pistes de réduction des émissions de GES industrielles au Québec* was released in the fall of 2019. It is the result of a collaborative project aimed at profiling the direct industrial GHG emissions in Québec as well as identifying the main industrial sub-sectors. It also aimed at presenting opportunities to reduce the GHG emissions[23].

The CTTÉI obtained an NSERC Industrial Research Chair on industrial and territorial ecology: the (CREIT)[24] in 2019. Through applied research, the chair fuels the different projects that the CTTÉI oversees. Its multidisciplinary research team focuses on three main themes: industrial metabolism, the emergence of industrial synergies and territorial metabolism.

The CTTÉI also collaborated with the *Université de Sherbrooke* to put together the conference *Rendez-vous de l'économie circulaire* which, in May 2019, featured presentations by a number of the *Pôle* members as well as the EDDEC Institute, as well as a focus on the local symbiosis called *Synergie Estrie*. It also featured parallel brainstorming sessions and roundtables on selected CE strategies and concluded with a pitching contest for innovative young initiatives to win coaching done by CTTÉI.

2.3 The example of *Outaouais*

In 2016, the Regional Council for Environment and Sustainable Development of the Outaouais *(Conseil régional de l'environnement et du développement durable de l'Outaouais (CREDDO)* initiated a program for a circular economy called *Synergie Outaouais*. It partnered with the EDDEC Institute and, thanks to the financing of the *Ministère de l'économie et de l'innovation* (MEI), they co-designed a training program geared towards local companies, adapted to their specific sectors and realities.

In the summer of 2016, the EDDEC Institute team moderated the first workshop. This was a pilot program designed to test some tools in order to adapt them to Québec realities and it was designed to be reproducible in other regions of the province. Five one-day sessions were initially planned, geared towards groups of no more than 12 participants in order to foster meaningful connections and interaction.

Over time, other trainings have been designed to accompany the members of *Synergie Outaouais*, bringing in partners like the Federation of Canadian Municipalities for example.

Synergie Outaouais is also a member of *Synergie Québec*, moderated by the CTTÉI. In 2017, they partnered to establish a mapping of the material flows between organizations in the *Outaouais* region. This revealed a great potential for the circular economy, in particular for the building, renovation and demolition sectors. Since then, a regional consulting roundtable is organized for that specific sector twice a year.

CHAPTER 3
FOCUSING ON SPECIFIC STRATEGIES OR SECTORS: LABS

The "Lab" approach is increasingly adopted by practitioners. The circular economy, being a rather new and versatile concept, constitutes a great playing field for the implementation of Labs for strategies or sectors, or even for approaches such as value chains or municipal implementation.

3.1 The Collaborative Economy and Performance Economy Lab

While the concepts of a circular economy were debated on *Campus Montréal* via various workshops organized by the EDDEC Institute since 2014, it appeared that there was expertise and interest among researchers to work on two strategies: the collaborative economy and the service or performance economy. The creation of the *Lab* constituted a bottom-up approach: researchers first brought up their interest in those two strategies, and the EDDEC Institute team co-designed with them a research proposal during workshops. The strategies being rather new and unknown, the *Lab* had difficulty finding appropriate financing to start the co-designed program – it therefore never really took off.

However, in 2017 and 2018, funding from a private foundation enabled four research projects led by 3rd cycle students from *Campus Montréal, Polytechnique Montréal* and *HEC Montréal* through a tailor-made scholarship program. Circular economy strategies applied to northern Québec communities as well as adverse effects of the collaborative economy are two of the subjects that have been studied[25].

One key sector that was analysed was the food sector as it was a field of expertise for a number of members of the *Lab*. In 2017, research was presented at the 5th international conference of the Centre for Research on Social Innovations (CRISES).

In 2018, under the leadership of the EDDEC Institute, researchers also collaborated to a white paper presented to the government of Québec appointed workgroup on collaborative economy (GTEC) and participated in consultations. A number of the recommendations presented by the members of the *Lab* have been referred to in the GTEC report[26].

3.2 Sector-specific approaches

In the spring of 2019, an initial proposal was established by the EDDEC Institute for the creation of several labs, organized as an ecosystem. Each lab was to address either a specific value chain (transportation, textiles, plastics and construction industry), a strategy (performance economy), or a territory. Most of the proposed work was halted as the 5-year initial financing of the EDDEC Institute was coming to an end, and further financing had yet to be found. However, some initiatives made progress.

Social economy and circular economy

The synergies between the social economy and the circular economy were also to be explored in one of the labs. Indeed, this sector traditionally uses several strategies of a CE, among the ones that intensify product use, like the sharing economy, or that extend the life of products and components (maintenance and repair, donating and reselling, refurbishing, performance economy), or even the strategies that aim to give resources a new life. A project started as a collaboration between the *Territoires innovants en économie sociale et solidaire* (TIESS) and the EDDEC Institute. Called *Économie sociale et économie circulaire: potentiels de synergies et modèles d'affaires porteurs*, it aims at documenting how social economy models and organizations can leverage the transition to a circular economy. In particular, over 2020 and 2021 its objective is to map successful initiatives that have implemented CE strategies; follow the elaboration and development of some initiatives in selected areas or sectors; and transfer knowledge to all regions throughout the project.

Alongside this project, public consultations were led by the *Chantier de l'économie sociale* to identify the opportunities and threats for social economy organizations

to deploy a CE in Québec. The elements uncovered via the consultations led by this organization – which supports the work of Québec-based social purpose organizations (SPOs) – were then reported in a white paper addressed to the government for implementation in potential regulatory frameworks in development.

In 2019, parallel working sessions were also held with the *Cooperative de développement régional de Québec*. Its mission is to support and promote the creation as well as the development of cooperatives in all Québec regions. Undertaken via its "sustainable development and natural resources" section, the objective of the work was to demonstrate and strengthen the links between the cooperative sector and the circular economy.

Northern communities

During the EDDEC Institute's 2018 CE Summer School, connections were initiated with the Cree and Jamesian population of Eeyou Istche Baie-James region. The Cree government, the *Société de développement de la Baie James* (SDBJ) and the *Administration régionale la Baie-James* (ARBJ) had formed a Nordic pole of innovation to identify resourceful solutions based on circular economy principles to the housing, food and mobility issues on their territory. This non-for-profit organization was selected as one of the poles integrated in the network of 18 regional poles set up by the government of Québec in 2019 as part of its 2017-2022 *Plan d'action gouvernemental en entrepreunariat* (PAGE).

The EDDEC Institute was approached to mobilize a multidisciplinary team of researchers to identify solutions for northern housing. A research project was put together. The project was informed with data sourced from *Campus Montréal* students' projects that occurred over the course of the year. The Institute's expertise of knowledge transfer was also put to use, and the project was amplified on the *QuébecCirculaire.org* hub.

Plastic waste management

In the spring of 2019, several stakeholders were gathered together by the EDDEC Institute, among which RECYC-QUÉBEC, ÉÉQ, the *Ministère de l'Environnement et de la Lutte contre les changements climatiques* (MELCC), the *Centre de technologie minérale et de plasturgie* (CTMP) and a borough of the City of Montréal. The aim was to discuss the opportunity of creating a lab that would focus on the management of plastic packaging. In a context of raising international awareness about sea pollution, the development of alliances and charters against plastic waste, and the Canadian Council of Ministers of the Environment action plan on zero plastic waste, it seemed relevant to develop a circular economy approach to this issue to anchor it at a local level. Indeed, the province of Québec is one of the two Canadian provinces most active in plastic processing.

The objectives of the lab were, over four years, to start with an analysis and the identification of priorities at different stages of the life cycle, then to develop and test tools, methodologies and technologies, and finally to transfer knowledge to targeted stakeholders in the value chain, via business support and training programs. The overall mission was to foster the adoption of circular economy strategies and approaches in the plastic industry in order to reduce one-time-use new plastic consumption, rethink the design of plastic packaging and optimize the use of already circulating plastics. The collaboration with other Canadian entities was crucial. The work had been temporarily paused to follow the more technology-oriented work of the *Groupe Action Plastiques Circulaires* (GAPC) managed by the CTTÉI, and progress has been halted due to the COVID-19 pandemic. Phase one has been completed in December 2020, and phase 2 should start early in 2021. Collaborations are currently studied between the two initiatives, and CERIEC is an active partner of the second phase of the project.

Textiles and circularity

In the spring of 2018, an open-innovation collective named MUTREC was formed after being granted funding following an application to the call for projects launched by RECYC-QUÉBEC[27]. The objective of this collective was to gather together experts who are able to understand the material flows in Québec, in order to define means to valorize textile and fiber waste in the province.

The newly formed consortium is composed of the Vestechpro Apparel Research and Innovation Center, the *École de design* of *Université de Montréal*, le *Centre interdisciplinaire de recherche en opérationnalisation du développement durable* (CIRODD) and the Retail Council of Canada (RCC). The EDDEC Institute was represented via the CIRODD. The consortium has identified and mapped material flows and actors in the textile value chain in Québec[28]. The textile industry in the province of Québec is a linear economy.

The EDDEC Institute led some consultations with stakeholders to validate the needs and opportunities to take this work further in the format of a lab, but the lack of financing prevented its creation at this stage.

Coming up in 2021

One of CERIEC's first endeavours was the launch of the Ecosystem of Circular Economy Acceleration Laboratories (ELEC) in April 2021, a unique testing ground to promote the research, development and transfer of new practices and innovative technologies. The network will be composed of eight or nine interconnected laboratories deployed over a span of five years. These laboratories might be dedicated to construction, agri-food, mines, or plastics, or they may focus on specific strategies such as the product-service system or the social/solidarity-based economy. The ensuing projects will aim to develop and test solutions so that they can ultimately become mainstream.

> "Innovation and the environment are important focus areas at ÉTS, and the circular economy allows us to combine them in order to develop cutting-edge expertise in emerging fields. ELEC is a promising project designed to propose innovative solutions for the circular economy and sustainable development."
>
> **François Gagnon,** CEO, ÉTS

CHAPTER 4
COLLABORATING WITH OTHER PROVINCES IN CANADA

Through its membership of the National Zero Waste Council (NZWC) in Canada, RECYC-QUÉBEC collaborates to various projects geared towards the reduction of waste, such as, for example, the Love Food Hate Waste campaign for food waste management. They also work on the reduction of plastic packaging and on the theme of circular cities.

The EDDEC Institute management team always had, at heart, sought to stimulate the transition towards a circular economy not only in the province of Québec, but in the rest of Canada too. It was first given the opportunity to do so in an applied manner thanks to the creation of Circular Economy Leadership Canada (CELC).

4.1 Circular Economy Leadership Canada (CELC)

The CELC is a not-for-profit alliance of corporate and NGO leaders, think tanks and sustainability experts that was launched in the fall of 2018.

The CELC brings together large companies like Unilever Canada, IKEA Canada, Loblaw Companies Ltd., Walmart Canada, NEI Investments as well as various organizations – the International Institute for Sustainable Development (IISD), the National Zero Waste Council, The Natural Step Canada – and university-based initiatives – the Smart Prosperity Institute and the EDDEC Institute.

Its mission is to provide thought leadership, technical expertise and a collaborative platform for the development of pioneering solutions that eliminate waste at all stages of the life cycle of products and accelerate the transition to a circular economy.

Being regarded as a leader in the transition to a CE in Québec, the EDDEC Institute was approached in 2018 and became one of its founding members. Although both organizations seek to catalyze the transition towards a circular economy, they operate differently. Where the experience in Québec is rather organic and favours a bottom-up approach with the setting of the *Pôle,* the approach put forward by the CELC in Canada is more centralized. Both organizations converge in the principles put forward: fostering collaboration among industries, experts, communities and all levels of government in the development and implementation of new circular economy solutions that protect and regenerate our natural environment while enhancing prosperity.

The EDDEC Institute was a contact point for the province of Québec, whereby information is exchanged bilaterally in order to create and further common knowledge across Canada. The CERIEC has now taken over this role.

4.2 The Council of Canadian Academies

The Council of Canadian Academies (CCA) is a not-for-profit organization that convenes the best experts in their respective fields to assess the evidence on complex scientific topics of public interest to inform decision-making in Canada. Independent assessments are conducted by multidisciplinary and multisectoral panels of experts from across Canada and abroad who volunteer their time and lend their expertise and knowledge to the CCA. The assessments are peer-reviewed. The overarching goal of CCA assessments is to evaluate the best available evidence on particularly complex issues where the science may be challenging to understand, contradictory, or difficult to assemble. Upon completion, assessments provide key decision-makers, as well as researchers and stakeholders, with high-quality information and evidence to develop informed and innovative public policy.

In the spring of 2020, Environment and Climate Change Canada submitted the request for an assessment to the CCA, with this question: *What are the potential opportunities and challenges for a circular economy in Canada?*[29]

The CCA has therefore assembled a multidisciplinary panel to examine the potential economic, environmental, and social impacts of advancing a circular economy in Canada. The Expert Panel is chaired by Tima Bansal, FRSC, Professor of Sustainability and Strategy at the Ivey Business School at Western University, who leads a multi-stakeholder group drawn from academia, government and business both Canadian and international, with extensive expertise in economics, engineering, industrial design, sociology, environmental studies, and public policy.

The objective is to provide a better understanding of what a circular economy looks like and what it holds for Canada, in order to help decision-makers advance evidence-based policy and practice. Daniel Normandin, Director of CERIEC, is a panel member, as is a researcher from *Polytechnique Montréal,* Prof. Pierre Lafleur.

4.3 Other collaborations

Since 2018, research projects and other collaborations have been conducted between the EDDEC Institute and the Smart Prosperity Institute, the National Zero Waste Council and the Natural Step Canada. Among the projects are an interdisciplinary literature review in 2019, roundtables, collaborations for the World Circular Economy Forum in 2020 (WCEF) and the report "Transitioning to Circular Economy – Learning from the Québec experience".

The e3c Hub: Environment, Energy and Circular Economy

The e3c Hub is a spin-off of the former EDDEC Institute at *HEC Montréal*. It aims at developing research, training and knowledge transfer initiatives, as well as organizing outreach events.

In 2018 it collaborated to the Mines and Circular Economy project elaborated by the EDDEC Institute for the Ministry of Energy and Natural Resources (MERN), in particular via the economic studies on circularity strategies for three metals (copper, iron, lithium)[30].

CHAPTER 5
ESTABLISHING INTERNATIONAL PARTNERSHIPS

Over the years, a number of key actors in Québec have established partnerships with European and international entities. To name a few, RECYC-QUÉBEC has a partnership with ADEME in France and works with Circle Economy in Amsterdam to launch the "Circularity Gap Report for Québec" in 2021. The CTTÉI collaborates with Association Orée (France), and ÉEQ has established partnerships with a number of organizations from the U.S.A.

A number of Québec representatives, including RECYC-QUÉBEC, the CTTÉI and the MELCC are members of the Canada Mirror Committee of the ISO Standard on the CE (ISO/TC323). They collaborate with representatives of some 80 countries. Other Québec members include *Polytechnique Montréal,* Hydro-Québec, the *Bureau de normalisation du Québec* (BNQ) and McGill University.

The EDDEC Institute has established cooperative links with institutes in France and with European universities to facilitate knowledge transfers between countries, and it has signed an agreement with the founders of the *economiecirculaire.org* hub to establish the *QuébecCirculaire.org*.

5.1 Partnerships with academia

In 2015, the workshop "Paris-Brussels-Montréal: cooperation strategies for a circular economy" was presented during the Disruptive Innovation Forum (DiF) (Ellen MacArthur Foundation, U.K.). This was one of the first initiatives of an international academic research cooperation network between the *École d'urbanisme et d'architecture de paysage* (UdeM, Canada), the *Chaire en économie circulaire et métabolisme urbain (Université Libre de Bruxelles,* Belgium), and the LABEX Urban Futures of University Paris-Est in France.

At the end of 2016, Franck Scherrer, the director of the *École d'urbanisme et d'architecture de paysage* of the *Université de Montréal*, became Academic director of the EDDEC Institute created a summer school dedicated to the implementation of CE at the municipal level. A first edition was created in 2018, and it was a great success. An international version took place in 2019 simultaneously in three countries, but the 2020 and 2021 editions were cancelled because of the COVID-19 pandemic.

Meanwhile, in 2019, the *Chaire Économie Circulaire et Métabolisme Urbain* was established in Paris. It collaborates with the Paris-Brussels-Montréal network.

Visiting Fellows program

Since 2015, the EDDEC Institute also instigated a Visiting Fellows program in order to foster international exchanges.

Meetings arranged between researchers and each visiting fellow fostered multilateral cooperation. The public conferences organized ensured the best possible outreach on the subject of circular economy and more widely on sustainable development to various audiences. Relations have also been established with a number of actors from Québec.

Overall, the Visiting Fellow program was key in promoting circular economy to various publics and elaborating innovative collaborations. The program ended in 2018.

5.2 Collaborating with Europe

Partnerships with European actors, in particular French and Belgian, were initiated as early as 2014 via the EDDEC Institute. Collaborations have been established with the French agency for ecological transition (ADEME), as well as with the *Centre international de ressources et d'innovation pour le développement durable* (CIRIDD), and the *Institut National de l'Économie Circulaire* (INEC).

Early 2020, the creation of a pilot project on the performance economy for SMEs emerged from discussions between the EDDEC Institute and five symbiosis (*Capitale-Nationale, SADC du Kamouraska,* Lanaudière, Montréal and Vaudreuil-Soulanges). The objective is to benefit from expertise developed in France on providing business support to companies to transition their business models towards the performance economy. Knowledge transfers, business support and documenting the approach and the results are the three phases of the project. It has evolved to include a 6th symbiosis and is now managed by the CTTÉI.

CONCLUSION

The first five years of concerted efforts to foster the transition to a circular economy in Québec have shown that there are extensive opportunities for implementation at various levels: value chains, territories, or by strategies. However, it takes time for stakeholders to take ownership of the concept of circular economy and to integrate it into their organizations and practices. Initiatives are also dependent on financing and regulations, and public funding as well as regulatory frameworks have yet to adapt to include the principles of a circular economy.

However voluntary approaches such as the one spearheaded by the multi-stakeholder roundtable moderated by the EDDEC Institute have paved the way to change.

The recent funding of the CERIEC will allow for additional projects to be generated and will foster adaptations of circular economy strategies and tools to different sectors, territories and types of organizations. Furthermore, the circular economy seems to have gained traction in the view of the recent pandemic, as governments and cities are investigating ways forward to implement a more resilient economy. News like the recent creation of an investment fund of 33 million by *Fondaction*, in collaboration with the City of Montréal, to support the economic recovery of the metropolis, combined with the recently announced five millions fund by the *Fonds de recherche du Québec – Société et culture* (FRQSC) to support the future Québec Circular Economy Research Network seem to attest to this.

> "In Québec, the initial spark came from the academic world, which first sought to circumscribe the circular economy as an object of research. Collaboration with other stakeholders in society through field projects and training then made it possible to begin the transition".
>
> **Daniel Normandin**, Director, CERIEC

Upcoming CE events and milestones to watch for in 2021

- WCEF 2021 (Toronto) and Circular Solutions Series
- *Assises québécoises de l'économie circulaire* 2021
- *HEC Montréal* – ÉTS CE Summer school
- Report from the group of experts on CE by the Council of Canadian Academies (CCA)
- "Circularity Gap Report for Québec"
- New sustainable development Québec governmental strategy
- Actions from the *Plan d'action 2019-2024 de la Politique québécoise de gestion des matières résiduelles*
- Actions from the recently released Québec Plan for the Development of the critical and strategic minerals 2020-2025
- Actions from the Plan for a green economy 2030
- Canada Plastics Pact (launched January 2021)
- Launch of the Québec Circular Economy Research Network
- Modernization of the deposit and selective collection systems in Québec
- Modernization of the Extended Producer Responsibility (EPR)

Endnotes

1 Kirchherr, J., Reike, D., Hekkert, M., 2017. Conceptualizing the circular economy: An analysis of 114 definitions. Resources Conservation and Recycling 127, 221-232.
2 *Institut du développement durable, de l'environnement et de l'économie circulaire* (I-EDDEC)
3 "Mapping Researcher-Practitioner Practices for a Circular Economy", Manon Boiteux, Emmanuel Raufflet, pp 102-114, S&O Center and ARCS, Collaborations in Sustainability Report
4 "Mapping Researcher-Practitioner Practices for a Circular Economy", Manon Boiteux, Emmanuel Raufflet, pp 102-114, S&O Center and ARCS, Collaborations in Sustainability Report
5 See Section IV of this report
6 See Chapter 3
7 See Chapter 3
8 *Institut National de l'Économie Circulaire* (INEC) and *Centre International de Ressources et d'Innovation pour le développement durable* (CIRIDD)
9 *Le Québec fera œuvre de pionnier et de visionnaire en Amérique du Nord par son projet de société en économie circulaire, intégrant des bénéfices économiques, sociaux et environnementaux quantifiables et vérifiables*
10 3RV: Reduce, Reuse, Recycle, Valorize
11 This event is programmed to take place on a regular basis, but due to the pandemic, the 2020 edition has been postponed to 2021.
12 See Section IV of this report
13 See Chapter 2
14 *Étalonnage des initiatives et des incitatifs en économie circulaire provenant des administrations publiques, 21 décembre 2017,* by Aurore Courtieux-Boinot, Adeline Masson, Marie-Claude Perron, Esther Tremblay. *Remis au Ministère de l'Économie, de la Science et de l'Innovation dans le cadre du cours ENV 803 — Projet intégrateur, Université de Sherbrooke*
15 *Appel à projets du Ministère de l'Économie, de la Science et de l'Innovation (MESI) – Direction du développement durable et de la veille stratégique : Analyse comparative de la situation du Québec par rapport aux initiatives internationales en économie circulaire et de l'applicabilité des meilleures pratiques.*
16 *Analyse comparative de la situation du Québec par rapport aux initiatives internationales en économie circulaire et de l'applicabilité de meilleures pratiques,* Fall 2018 by Joanna Gastellu, Jasmin Hurtubise and Lamine Kone.
17 See paragraph 1.5
18 *Groupe interministériel sur l'économie circulaire*
19 *Mettre en place une structure de concertation interministérielle en vue de favoriser l'émergence de l'économie circulaire au Québec*
20 Adapted from "Mapping Researcher-Practitioner Practices for a Circular Economy", Manon Boiteux, Emmanuel Raufflet, pp 102-114, S&O Center and ARCS, Collaborations in Sustainability Report
21 https://www.Québec.ca/gouv/ministere/economie/publications/plan-daction-pour-la-croissance-et-les-technologies-propres-2018-2023/
22 CEGEP is a French acronym that stands for *Collège d'enseignement général et professionnel*, known as a general and vocational college. They are public institutions and represent the first level of higher education, dubbed post-secondary education, in Québec
23 See Section III, Chapter 2, subsection 2.5 of this report for more details
24 See Section III, Chapter 2, subsection 2.4 of this report for more details
25 See Section III, Chapter 3, subsection 3.2 of this report for more details
26 See Section III, Chapter 3, subsection 3.2 of this report for more details
27 *Programme d'aide visant les débouchés de matières résiduelles des ICI* (APDICI)
28 More information on this initiative and the results of this research can be found in Section III, Chapter 2, subsection 2.3 of this report
29 https://cca-reports.ca/reports/the-circular-economy-in-canada/
30 Refer to Section III, Chapter 2, subsection 2.2 of this report for more details

SECTION 3

RESEARCHING THE BENEFITS LINKED TO A CIRCULAR ECONOMY

3

Disclaimer: Given the extent of initiatives having taken place in Québec since 2015, this report does not claim to provide the reader with an exhaustive review. It aims at featuring some of the key elements that contributed to initiating a transition to a circular economy in the province, in particular linked to the experience of the EDDEC Institute.

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INTRODUCTION

Concepts and academic theories are often not sufficient for fostering action among practitioners. The setting up of a community of practice and the co-design of a definition of the circular economy in 2016 by the multi-stakeholder roundtable *(Pôle[6])* was an important springboard for practitioners to start the transition towards a CE in Québec.

The circular economy promotes a more efficient use of extracted resources through the life cycle of products, and it therefore provides the opportunity to create new products and services: it can bring about the transformation of business models. However, business leaders want proof of return of investment before investing resources in innovative projects and rethinking their business approaches.

To advance the implementation of a circular economy, it is critical to identify sectors that are experiencing the negative impacts of the linear economic system, and are needing to deploy new strategies. This research and fact finding created a sound foundation as well as an understanding of opportunities and gaps, strengths, and weaknesses in traditional linear sectors in the province.

Academic research has identified sectors with high growth potential from adopting circular strategies and forecast the financial as well as environmental and social gains that could be brought about by a transition. Because organizations may also need clear signals from government regulation, tax systems and sources of financing, comparative research to characterize policy and funding priorities was also key.

This section explores the mapping of value chains and various industrial sectors, and present a number a studies and key findings of reports on the circular economy, regarding climate change or CE strategies such as the collaborative economy.

MAIN **MILESTONES**

2014

- Creation of the EDDEC Institute on *Campus Montréal.* A first research program on CE is established.

2015

- Consultations on the modernization to amend Québec Environment Quality Act and its environmental approval regime
- Creation of the Paris-Brussels-Montréal international academic research cooperation network and presentation at Ellen McArthur Foundation's Disruptive Innovation Festival (DIF)

2016

- Creation of the Collaborative and Performance Economy Lab *(Lab)* by the EDDEC Institute
- Start of the research project on strategic metals and circular economy in Québec, funded by the Québec Ministry of Energy and Natural Resources (MERN)[1]

2017

- Unveiling of the progress report for the circularity of metals commissioned by MERN
- Mission in France to advance research and partnerships[2]
- Research from the *Lab* is presented at the 5th international conference of the Centre for Research on Social Innovations (CRISES)
- Announcement of the recipients of the *Lab* scholarships
- Convening of the Paris-Brussels-Montréal cooperation network in France
- Unveiling of the preliminary research results for the circularity of metals at the annual *Québec Mines* congress

2018

- Launch of the "Circular Economy in Québec – Economic opportunities and impacts" report
- Launch of the preliminary report on the textile industry from the MUTREC consortium
- Unveiling of final reports for the circularity of strategic metals
- Announcement of Recipients of the *Lab* scholarships
- Unveiling the mapping of the actors and initiatives in CE on the City of Montréal region[3]
- Presentation of the white paper and *Lab* recommendations to the governmental working group on collaborative economy, the GTEC[4]

2019

- Unveiling of the *Économie circulaire : Portrait et pistes de réduction des émissions des GES industrielles au Québec – Volet 1* report
- Launch of the "Circular Economy Research Landscape in Canada" report by the EDDEC Institute[5]

2020

- Unveiling of the final report on the textile industry by the MUTREC consortium
- Launch of the study report *Obstacles aux stratégies d'économie circulaire et aux synergies pour la réduction des GES dans les industries du ciment et de l'aluminium*

Acronyms are listed on page 12.

CHAPTER 1

DEVELOPING AN ACADEMIC RESEARCH PROGRAM

In 2014, a first research program was established by the EDDEC Institute[7], to study and experiment with the circular economy from different angles. It involved the work of over 120 researchers from a great variety of backgrounds and expertise. The program represented one of the first interdisciplinary academic explorations on the circular economy globally. It convened researchers from *Université de Montréal, HEC Montréal* and *Polytechnique Montréal,* as well as other universities in Québec, namely through a partnership with the CIRODD, which represents 18 educational institutions and universities in the province of Québec.

The resulting research program also benefited from consultations with non-academic organizations, many of which later participated in pilot projects. The overall objective was to position Québec and Canada as leaders in the circular economy and enable innovative partnerships with international counterparts.

The research program was developed around the initial visual representation the EDDEC Institute had developed for the circular economy. It is comprised of seven priorities, each involving several research projects. This formed the basis of the work of the EDDEC Institute and its partners from 2015 on.

A study conducted by the EDDEC Institute in 2019, surveyed the landscape of CE Research in Canada. It provided a summary analysis of the state of CE, and closely related and synergetic issues in research in the country. It identified noticeable gaps and early opportunities for macro-level policy related to research moving forward. The report also proposed options to strengthen Canada's research capacity related to CE[8].

The seven priorities of the EDDEC Institute's research program

1. Identification of factors contributing to stakeholders' engagement and to the development of a collaborative culture that strives to protect collective resources

2. Identification of factors contributing to stakeholders' engagement and to the development of a collaborative culture that strives to protect collective resources

3. Assessment of the status of resources and the related issues in Quebec/ Canada

4. Review of the 10 proposed strategies of circular economy, featuring their potential and limitations

5. Experimentation and analysis of a transition to a circular economy through the implementation of pilot projects and field studies

6. Identification of factors contributing to stakeholders' engagement and to the development of a collaborative culture that strives to protect collective resources

7. Analysis of the potential contribution of existing expertise, methodologies, and tools, and development of new tools and indicators

CHAPTER 2

EXAMINING DATA

ISSUES, OPPORTUNITIES, AND PROJECTS MAPPING

At this early stage of the transition towards a circular economy, research mainly focused on the identification of issues and opportunities as well as existing initiatives, in order to establish a clearer image of the landscape prevailing at the time.

The research projects presented below contributed to:

- the analysis of the potential evolution of industrial sectors
- the description of the issues and opportunities in a given value chain
- the illustration of the variety of initiatives at the municipal level
- the potential for circular economy or in the fight against climate change

2.1 Mapping projects: The City of Montréal

Cities are microcosms that concentrate, in a geographically-restricted urban ecosystem, large levels of consumption, generating important material flows as well as a lot of waste. For these reasons, big cities and metropolises are bound to be particularly interested in the deployment of a circular economy. They represent a great example of CE initiatives[9].

Because the City of Montréal benefits from a great concentration of researchers working on the circular economy at an international level, it seemed natural that it would engage with the topic.

In the spring of 2016, the economics department as well as the sustainable development office of the City mandated both the EDDEC Institute and the *Lab Ville Prospective* of the *Université de Montréal* to evaluate the state of the deployment of CE in the City. This evaluation was meant to consider its "Sustainable Montréal 2016-2020" plan and its 2011-2017 Economic Development Strategy.

The project mapped the CE projects and actors on the island of Montréal and identified policy priorities and actions for the City. The interdisciplinary research project also aimed to inform key actors about the concepts and strategies that help build a CE.

The project allowed Professors Christophe Abrassart and Franck Scherrer[10], founders of the *Lab Ville Prospective*, to adapt a research methodology that was being developed at the time, and to test it in three pilot boroughs. This was completed with a literature review on existing mapping practices, led by Professor Emmanuel Raufflet[11], Department of Management at *HEC Montréal*. The work also benefited from knowledge-sharing with the *Paris-Brussels-Montréal* international academic research cooperation network.

MAPPING CE INITIATIVES IN THE CITY OF MONTRÉAL:

- **18** boroughs and two cities (Dorval and Pointe-Claire)
- **19** geographical datasheets
- **8** fact sheets on innovative initiatives

The research had three components:

1. First, to provide information on CE to a wide set of stakeholders, including: municipal staff from environmental, economic or urban development departments of the City's boroughs; community development organizations; organizations supporting the development of SMEs; neighbourhood consultation tables; and eco-districts representatives.
2. Second, to gather knowledge of the realities of each borough.
3. Third, to develop an iterative listing of initiatives that implement CE strategies, approaches, and tools.

More than a simple inventory

Activities that were considered by researchers as "traditionally" using CE strategies, such as car repairs, thrift shops, food banks, existing recycling programs, and so on, were voluntarily overlooked. The objective was to illustrate innovative ways to implement CE, and new production or consumption behaviors that present potential for development.

When outreach and data mining go hand in hand

Innovative tools have been developed that served two purposes: facilitating uncomplicated information on CE for targeted audiences, and data mining.

- A tailor-made handbook was distributed, providing definitions, illustrations, and key questions. It also served as a preparation guide for ensuing group interviews. Participants had to reflect upon CE strategies and identify related businesses on their respective borough.
- The group interviews started with a presentation on CE and were then organized around working groups whose objectives were to identify some of the most promising initiatives on each organization's borough, and then to imagine new circular loops that could be developed.
- A data collection template was circulated among the participants who in turn were encouraged to share it with key actors in order to gather specific data on the local initiatives. The research team then proceeded to cross-reference the collected data with the listing established by OuiShare in 2016[12] in order to enrich the list.

Key Findings

- Just about 50% of the initiatives were micro-local, of which over 40% were led by social economy organizations, non-profits, or cooperatives.
- A number of the micro-local initiatives implemented various CE strategies, which could indicate that a new ecosystem of CE actors was emerging.
- Historic blue-collar areas undergoing social transformations (such as renovations, gentrification, and creative ecosystems) showed the highest number and diversity of CE initiatives. They also benefited from production sites that could be adapted to collaborative initiatives, such as *FabLabs*, makerspaces, and co-working spaces.

The aggregated data provided the first portrait of the deployment of CE strategies and tools in the City of Montréal. The resulting report highlighted discrepancies between boroughs and shone a light on exemplary projects.

A number of trends arose from this research, with regards to the scale of initiatives, the most used CE strategies, the portrait of the innovators behind the transition, as well as the geographic and historic impacts on the development of initiatives in some boroughs.

A transition led by micro-initiatives and social economy organisations

Initiatives and projects were classified according to this scale:

- Start-ups
- Micro-local, reaching less than 5,000 people
- Local-Structuring, impacting over 5,000 people
- Metropolitan scale

Priority sectors and strategies

The research contributed to define key sectors and related priority strategies:

- Focus on the food loop (production, recycling, energy recovery, and reuse of nutrients)
- Foster the sharing economy, reuse, and maintenance and repair strategies
- Intensify shared mobility, including cars, bikes, scooters, and utility transport
- Tap into the potential of a symbiosis within a local ecosystem of actors, between organizations, inhabitants, consumers, and repairers
- Enable circular urban networks, in water, energy, transportation, communication, and waste management
- Develop *third places,* including cafés, clubs, *FabLabs,* and public libraries

Recommendations

The report also highlighted the role of the City of Montréal in fostering the transition via the implementation of a CE policy. It was suggested that this policy should include responsible consumption and procurement strategies. It should also promote sharing and performance economy strategies, as well as apply strategies to the waste generated by the city's own activities. One additional recommendation was to consider applying CE strategies not only to the city's activities, but also to the use of its real estate and urban property.

2.2 Mapping a value chain: The mining and metal sector

The Québec Ministry of Energy and Natural Resources (MERN) was interested in exploring the potential for circularity for some strategic metals extracted in the province.

The EDDEC Institute was granted 900 000$ over a 3-year period to fund a research project on metals and circular economy in Québec, funded through the Mining Sustainable Development Partnership Research Program[13],[14]. At the time, this represented one of the most significant contributions from research on the circular economy in Canada. The project was headed by Professor Manuele Margni, from the International Reference Centre for Life Cycle of Products, Services and Systems (CIRAIG).

The project focused on three metals that are predominant in the province of Québec: iron, copper and lithium

- **Iron:** 26 million tons of iron concentrate were produced in 2015[15]. The whole value chain is represented in the province, which allows for the implementation of a greater number of CE strategies.
- **Copper:** 438,000 tons were fully transformed and processed in 2014[16]. The only Canadian copper smelter is located in Québec (Rouyn-Noranda). The research focused on primary metallurgy and metal processing.
- **Lithium:** 181 tons were transformed in 2014, and 50% of this resource ended up in landfills at the end of its life cycle. Four extractive projects were being implemented at the time. This sector was to undergo great development in subsequent years and represented a great opportunity for a proactive CE approach in a context whereby the province was encouraging an extended electrified transportation framework.

A selection grid was developed to decide upon which metal to focus. Criteria included:

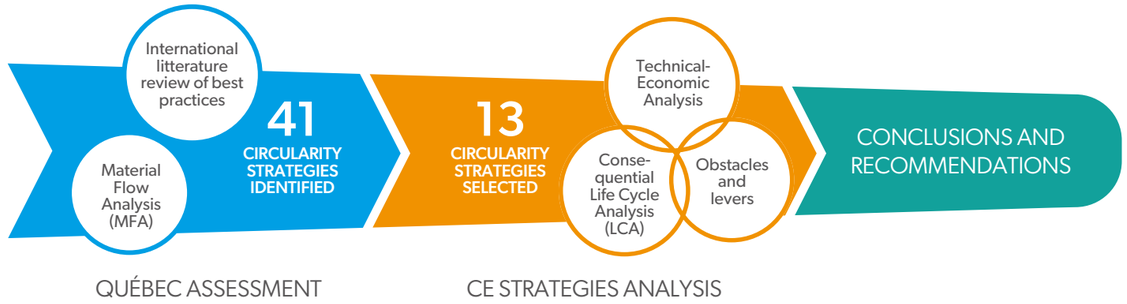
- the volume of production in the province
- the potential for recycling
- the number of associated jobs
- the average duration of use
- the percentage of resource recycled
- the risk analysis (such as procurement and environmental impacts)

Considering a transition to a CE for those three metals was a necessity, since in a business-as-usual scenario, by 2030 the demand was forecasted to grow 30 times for lithium, and increase three-fold for copper and iron.

The study focused on three aspects for each metal:

1. Availability locally and worldwide
2. Main actors and products in Québec
3. Products and processes that represented the best potential for the implementation of CE strategies

Stages of Research



The research was conducted in several steps:

- Documentation of material loss (in the environment, mine wastes, exportation)
- Identification of existing circularity loops
- Identification of CE strategies that would foster increased material flow and circularity, at the different stages of the life cycle of the products

Researchers gathered by the EDDEC Institute undertook an array of rigorous activities:

- Conducted an international literature review to identify CE strategies usually applied to metals. 41 were identified.
- Established a selection process with an inter-ministerial committee based on selected criteria (feasibility; relevance; scope; environmental, economical and social benefits; implementation potential; and resource conservation). 13 strategies were selected.
- Conducted interviews with key local actors to validate opportunities and threats to the implementation of the selected strategies. 23 semi-directed interviews were held with key actors in the value chain.
- Implemented consequential life cycle analysis (LCA), material flow analysis (MFA), and technical and economic analyses.

In 2017, the progress report was unveiled and the preliminary research results were presented at the annual *Québec Mines* congress.

For copper and iron, the following product categories were selected for the study:

- Vehicles (automobiles, trucks, and busses, as well as maritime, aviation and rail transportation)
- Household appliances (small and large)
- Buildings (including infrastructure)
- Mechanical and industrial equipment

Electrical wiring and cables, as well as mobile phones and portable computers, were also considered for copper. For lithium, lithium-ion battery was the product category selected for the study, including batteries present in mobile phones, portable computers, and vehicles.

Among the 41 circular strategies identified, 18 were specific to the life-cycle stages of the resource:

- eight at resource extraction stage
- two at primary metallurgy stage
- three at metallic transformation and manufacturing stages
- two at use stage
- three at end of life stage

The remaining strategies were specific to the product categories selected per metal.

A summary table can be found on the website of the MERN.

Priorities and strategies

In the spring of 2018, the final report was published and made a number of recommendations, including specific interventions:

- Carbon capture from iron slag, if it was to be included in the SPEDE[17], Québec carbon market
- Recycling lithium-ion batteries, in particular for vehicles;
- Additive manufacturing, for example applied to the aviation industry and replacement parts
- Ecodesign of vehicles
- Urban mining, which has great potential, but requires intensive data collection and more research
- Car sharing and car pooling, as the two strategies can bring positive environmental impacts and allow for intensification of the use of resources per person

The study also noted that the use of used batteries to store solar energy in the context of the province may bring negative environmental impacts, if it were to lead to lower hydroelectric production of energy.

Three main barriers to the implementation of the selected CE strategies were identified:

1. **Technical challenges,** due to the newness of the technologies or methods
2. **Stakeholders inertia,** due to resistance to change, lack of knowledge on CE, and lack of skilled labour force
3. **Profitability,** as investments required might be too high, or competition from new products make CE strategies economically unsustainable

Policy-making, education and outreach are therefore key levers, as well as CE-dedicated government funding of R&D and public subsidies.

Key Findings

The research underlined the fact that:

- **Circularity was already in progress in the value chain for the three selected metals,** and in particular for copper, for which Québec industry seemed to be a leading recycling example at an international level.
- **Access to detailed information is paramount** in order to ascertain trends, opportunities, or gaps, and elaborate accurate life cycle and material flow analysis upon which strategies and policy-making can be based. In the context of this study, the confidentiality or quality of some of the data had to be counterbalanced by secondary information sources (literature, public databases, extrapolation, or expert evaluations). The project therefore helped in identifying avenues to improve the collection for more dependable data, to identify new sources, and to illustrate innovative methodologies.
- **The results for copper, iron and lithium-ion cannot be extrapolated to other metals.** More research was needed as circularity strategies have to be adapted to local conditions for extraction, transformation, production, use, and waste management.

A specific communication strategy was designed to promote the report, and ensured that the results were broadcasted to a large audience and made easily available online.

This research has informed the new "Québec Plan for the Development of Critical and Strategic Minerals: future resources for a greener Québec", unveiled in October 2020.

2.3 Mapping a linear industry: Textile

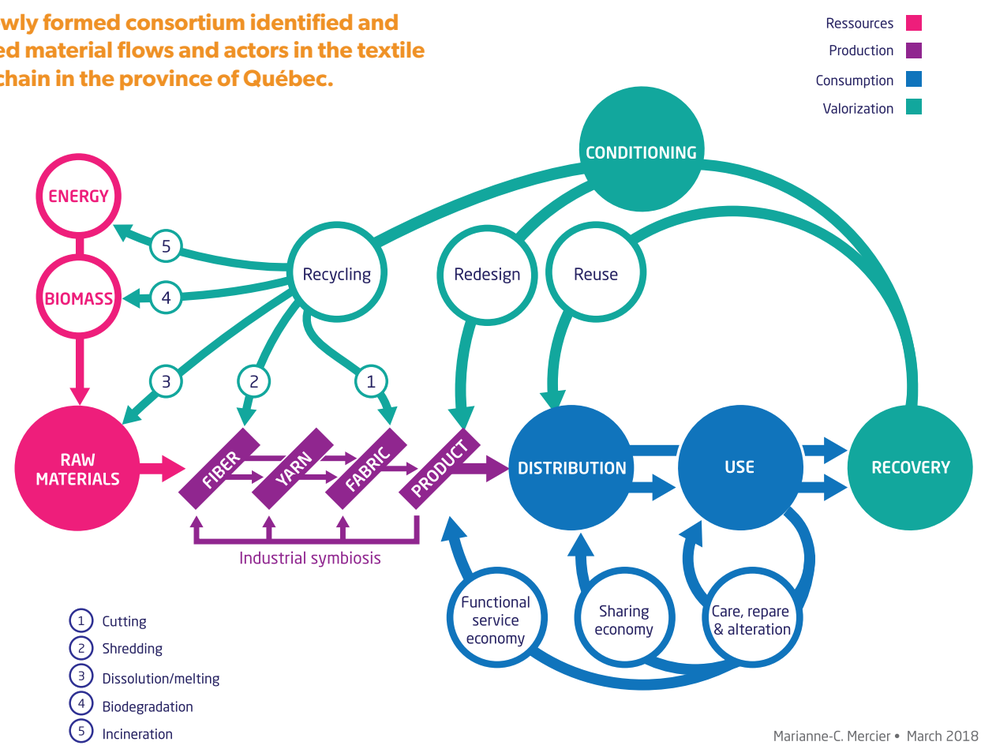
Circularity in the textile sector was another circular economy opportunity to be explored. Since 2016, a number of stakeholders have gathered to identify the opportunities in this sector in Québec.

In the spring of 2018, an open-innovation collective named MUTREC[18] was formed after being granted funding, following an application to the call for projects launched by RECYC-QUÉBEC[19]. The objective of this collective was to convene experts who are able to understand textile material flows in Québec, in order to define means to valorize textile and fiber waste in the province.

A first assessment conducted by the CTTÉI in 2017 and released in June 2018 indicated that fiber recycling in closed loops was anecdotal at best.

> "The absence of ecodesign at the development stage of textile products hinders the potential for circularity. For example, fiber mixes may make it impossible to recycle them separately, professional uniforms may be covered with brand elements that are difficult to remove, fabric waste from cut panels may be unusable."
>
> **Marianne-Coquelicot Mercier,** Circular Economy Adviser for the textile industry

The newly formed consortium identified and mapped material flows and actors in the textile value chain in the province of Québec.



Marianne-C. Mercier • March 2018

Key Findings

The research highlighted a number of facts and issues for the province, among which:

- Québec does not produce any textile fiber
- Québec consumes some 343,000 tons of new textile goods per year
- The province is heavily dependent on imports, with some 376,500 tons originating mainly from China and Bangladesh
- Of all textiles that are used in the province, 30% are exported, 48% are eliminated, 8% are lost in the environment (wear and tear, deterioration), 8% are used in other products (mainly furniture), and only 6 % are recycled
- Most of textile waste is generated in urban centres, mainly in Montréal (60%) and Québec City (25%), and recycling remains an issue in less urban areas
- A whole ecosystem largely composed of non-profits, associations, and sorting centres depends upon the sale of second-hand textiles to fund jobs or community services
- At the time of the study, there was no facility or process in place to transform post-consumption textile into non-woven textile
- Québec's regulatory framework forbids the recycling of post consumption fibers in upholstery and drapery textiles

That preliminary research better defined consumer behaviours with regards to textile, while also providing a portrait of textile management in Québec. The research was supported by a material flow analysis (MFA) based on data available in 2015, together with a literature review and interviews with key actors in the value chain.

Imports are high, recycling is low

Of all textiles that are used in the province…

Recommendations

The report includes a number of recommendations, including the creation and implementation of:

- Ecodesign strategies
- Collaborative economy approaches
- Industrial material recovery
- A textile-specific recycling and re-use network of actors

A report was produced by the MUTREC collective in 2020, presenting a more in-depth analysis based on the current context.

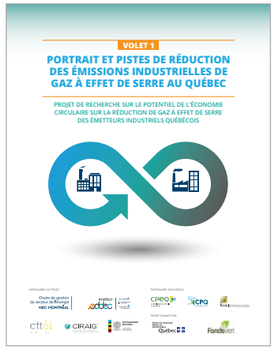
The research highlights that the textile sector in Québec is 48% linear.

The report made clear that there is still a long way to go in building a circular economy for textiles in Québec.

2.4 Identifying GHG emissions reduction potential in the industry

As a result of a collaborative research project profiling the direct industrial GHG emissions in Québec as well as identifying the main industrial sub-sectors, a report was released in the fall of 2019. It also identified opportunities to reduce the GHG emissions[20].

The report *Portrait et pistes de réduction des émissions de GES industrielles au Québec* constitutes the first part of research on industrial GHG emissions in Québec[21].



The industrial sector emits 44% of GHG emissions in the province.

The diversity of industrial sub-sectors makes this research both necessary and difficult as a great diversity of solutions has to be considered to lower emissions. A great number of GHG reduction technologies exist, and are reviewed. However, the objective of the report was not to discuss energy management.

Four main potential emission reduction solutions have emerged:

1. **Better production and use of heat**
   Many technologies exist already that should be adopted. Where there exists unused residual heat, circular loops should be implemented to recuperate it via complementary industrial applications.
2. **Use and re-use of cement, steel and aluminum from the construction sector**
   On top of the implementation of GHG emission reduction technologies, industrial symbiosis should be explored and those sectors be subject to further analysis.
3. **Clustering initiatives in the sub-sector of manufacturing**
   Resource sharing, among other strategies, should be implemented in this sub-sector characterized by a great number of smaller actors.
4. **Methane, manure and waste management.**
   Better defined approaches should be elaborated to reduce and manage these emissions, in particular in the agricultural sector where CH_4 and nitrous oxide emissions are high.

The potential for both direct and indirect emissions reductions achieved by the implementation of circular strategies was evaluated in the second part of the proposed research. This was published in the spring of 2021 and focuses on three industrial sectors (cement, aluminum and steel).

Key Findings

- Industrial GHG emissions are not energy-related (not CO_2 nor CH_4). Substituting energy sources to cleaner ones will not be sufficient, and industrial processes and energy management will be necessary
- Emissions originate from a great variety of actors and sub-sectors, some with emissions reaching over 500,000 tons GHG per year in the fields of oil refining, aluminium smelters, metallurgy, and cement industries. Further research must be conducted in these industries in order to find solutions to reach the province's 2030 and 2050 GHG emissions targets
- The sub-sector composed of other manufacturing industries, the third most important contributors to GHG emissions for the province, is composed of thousands of SMEs, which makes the challenge of decarbonization all the more difficult. However, since many are located close to urban centres and their energy production is mostly related to heating, industrial symbiosis and indirect heat recuperation can be considered
- A high level of GHG emissions is related to biomass and to the pulp and paper industry, which are however considered neutral since they are plant-based, and because the resource will regenerate and absorb carbon

2.5 Other projects: Climate change and food waste

Many other research projects have been undertaken by the EDDEC Institute, and many more were proposed still, but have received no funding yet. The two projects summarized below, led by students from *Campus Montréal,* cover topics of particular importance for the implementation of a circular economy: climate change and the food sector.

Climate change and the circular economy for the aluminum, cement and steel sectors

Published in the fall of 2020, the *Obstacles aux stratégies d'économie circulaire et aux synergies pour la réduction des GES dans les industries du ciment et de l'aluminium* report[22] completes the previous research conducted by the Chair in Energy Sector Management of *HEC Montréal* (see 2.4).

The objective of this report was to determine what are the barriers to the circular economy and to industrial symbiosis for Québec's aluminum, cement and steel industries. After conducting a literature review on the barriers to circular economy strategies, energy efficiency and industrial symbiosis, a new classification of barriers was created:

- Government/laws
- Products/resources
- Market/competitive environment
- Consumers/social norms
- Costs/financial
- Technology/skills
- Organisational (structural)
- Organisational (individual)

Interviews were then organized with different stakeholders: consultants, industry employees or managers, and government representatives. It appears that the major barriers are, in order, government and laws, followed by market and competitive environment, and then by costs and financials tied with structural organizational barriers.

A number of recommendations have emerged after a detailed analysis of these interviews:

- Foster better communication between the industry and government representatives
- Implement a better exchange network between actors of the sector (e.g. industry forums)
- Develop specific management practices that help lower individual barriers and resistance to change
- Ensure adequate financing from the government and from the industries

It is also recommended that the government develop and implement an integrated circular economy approach and deploy awareness-raising actions geared towards both citizens and industrial actors.

Mapping food waste

Food waste represents a big challenge in our societies and a great potential for the circular economy. In 2017, a student project at *Polytechnique Montréal* allowed for the first mapping of the food waste in Québec, via a Material Flow Analysis. The objectives of the study were to quantity food waste and its value, identify the most wasteful stages and where the biggest food recovery potentials are, as well as identify the actors in the value chain.

The preliminary results of the study showed for example that food waste reaches 30% all along the value chain. One of the main obstacles encountered during this research was the difficulty to obtain data, and up-to-date data, which therefore doesn't allow for a real representation of the issues. As the study[23] wasn't the object of a thesis as such, the depth of the analysis should be considered with caution. This research constituted one of the steps towards the creation of Toucan, a project that had been selected by EntrePrism at *HEC Montréal* for mentorship and support, and which aimed at valorizing food surpluses and food waste in Montréal.

Evaluating new strategies along the food value chain

Researchers from the *Lab* (see 3.2) also focused on another aspect of the food sector, in particular the sale of 'ugly' fruits and vegetables (UFV) in grocery stores.

A preliminary study[24] unveiled in the fall of 2018 aimed to:

1. **Understand** the motivations of various stakeholders to start processing or selling UFV
2. **Identify** issues for the UFV supply chain, in particular for producers
3. **Highlight** the adverse social impacts potentially associated with the mass marketing of UFV
4. **Assess** to what extent collaborative economy strategies and more generally CE strategies were put in place in the food sector

Results show that there is a strong information asymmetry between consumers and distributors. They also reveal that:

- The confusion created for consumers, who link the visual quality to a product price, combined with the high negotiation power of large distributors, might lead to lower prices for equivalent products, therefore impacting producers negatively
- The increased sales of UFV could lead to a lower supply for food banks

> Food waste reduction practices are already in place within the supply chain, and are close to industrial synergy strategies as they imply a collaborative approach between varied stakeholders.

The authors recommended strengthening and systemizing the existing collaborative ecosystem relationships within the supply chain, for example via online platforms that would identify surpluses.

2.6 Tooling the transition towards a circular economy: The CREIT

Affiliated with the CEGEP[25] Sorel-Tracy, the CTTÉI is a college-based technology transfer centre that aims to increase the performance of companies and communities through research and development in industrial ecology[26]. The centre concentrates its efforts on three main aspects: the optimization of residual materials; the development of clean technologies; and the implementation of industrial symbiosis. It also moderates the community of practice *Synergie Québec*[27].

In 2019, the CTTÉI obtained an NSERC Industrial Research Chair on industrial and territorial ecology: the (CREIT), whose work is strongly linked to *Synergie Québec*. Through applied research, the Chair fuels the different projects that the CTTÉI oversees.

With this funding of $500,000 over 5 years, the CREIT multidisciplinary research team[28] (made up of professor-researchers and experts in engineering, computer science, economics and social sciences) focuses on three main themes: industrial metabolism, the emergence of industrial synergies, and territorial metabolism.

Its overall objective is to support Québec businesses transition towards the circular economy, by providing innovative but concrete solutions to the current issues of waste management experienced by municipalities, organizations, and businesses. It aims, among other things, to develop relevant tools to better measure the impact of industrial symbiosis and help industrial and territorial stakeholders in their resource management decisions.

> The overall objective for businesses is the reduction in their environmental impact while improving their competitiveness.

Both private and public partners contribute to the research. In particular, private partners are interested in testing the tools developed by CREIT in their own businesses. Once tested, feedback is collected in order to fine-tune the tools for further implementation. For example, the team is currently working on Material Flow Cost Accounting (MFCA). In collaboration with a sustainable development agent of the *Société de développement économique de Dummondville* and Professor Marc Journeault at *Université Laval*, the CREIT is elaborating a guide and a calculator that should allow an organization to account for the direct and indirect costs linked to the management of residual materials.

Other projects include:

- The creation of an industrial symbiosis within the CEGEP Sorel-Tracy
- The implementation of a circularity indicators system for CTTÉI projects
- The development of a database on the valorization of residual material, called *Valoripédia*

The results of the work will be disseminated in industrial, institutional, and scientific communities, both nationally and internationally.

CHAPTER 3

IDENTIFYING HIGH-GROWTH POTENTIAL SECTORS AND POLICY PRIORITIES

A total of 120 Ministries and organisations fall under the Québec government "Strategy on sustainable development", which includes references to a circular economy. The Strategy is currently being revised, with a consultation process in October 2020, and a public report expected in early 2021.

A public workshop was convened in the summer of 2020 to discuss strategic directions for including the deployment of a circular economy in the 2022-2027 Strategy[29]. This was organized and moderated by CIRANO and the MELCC[30]. It brought together stakeholders from different levels of decision making from academia, government, the private sector and the community. The workshop included a scoping lecture, which prepared participants for their contribution to the roundtables. Among the sessions was the presentation of the results of the report "Circular Economy in Québec – Economic opportunities and impacts", which is outlined below.

3.1 Highlighting economic opportunities and impacts

In March 2018, the Research Group on Globalization and Management of Technology (GMT, *Polytechnique Montréal*), in collaboration with the EDDEC Institute, released a study on the circular economy in Québec. This had been conducted as part of a mandate from the *Conseil du patronat du Québec* (CPQ), the Québec Business Council on the Environment (CPEQ) and *Éco Entreprises Québec* (ÉEQ).

The objective of the "Circular Economy in Québec-Economic opportunities and impacts" report was to carry out a scientific and grey literature review to **identify the economic and environmental impacts of the circular economy, as well as the barriers and legislative levers that could serve in the transition toward a circular economy.** Case studies were elaborated and focused on five organizations that are active in Québec. A preliminary study was also undertaken to determine the economic sectors with strong potential in the province.

This report presented the first large-scale study on circular economy in Québec and constituted the first step in a two-fold research project. The initial phase pinpoints the province's economic sectors with significant circularity potential. The planned second phase (yet to be financed) will aim to specify the results through macroeconomic studies[31].

Indeed, a more in-depth evaluation is required to determine the sectors with short-, medium- and long-term circularization potential, identify the most promising sub-sectors, as well as qualify the significance of the impact of their transformation on the province's economy.

The first report's findings are key in providing guidance for the government priorities in regulation and financing.

Sectors with significant potential in Québec

A preliminary analysis to identify sectors with high potential in Québec was conducted by combining results from the literature and the 2014 Supply and Use Tables released by Statistics Canada. The sectors were selected based on a review of studies on the impacts of CE.

The research highlights that among the most promising sectors in Québec in terms of percentage of GDP are:

Those sectors hold good circularization potential since major environmental and economic gains seem possible.

Though the recyclable materials (7.49%) and textile (3.52%) sectors, or the agricultural and forestry sectors (2.00%) carry less relative weight in Québec, there are still possible gains, such as water savings and forest resource optimization.

Positive impacts of CE on employment and economic activity

Most economic studies in the literature review show that a CE can lead to GDP growth and job creation, which would compensate for losses in more traditional sectors. In addition, wasting fewer resources and adopting new consumption patterns could lead to savings for individuals and businesses.

Potential issues: rebound effects

The economic studies analysed in this research highlight that while increased resource efficiency in a CE generates GDP growth, this growth can lead to a rebound effect which takes place when material efficiency gains are offset because they lead to greater consumption and environmental impacts.

Recommendations for a more efficient transition to the circular economy in Québec

Extend and deepen knowledge

- There is still a significant amount of research to be conducted to ensure that the transition to a circular economy generates the expected benefits. Modeling – i.e. going beyond the literature review – is required to gather a better understanding of the characteristics that are specific to Québec. Modelling will also better guide the choice of strategies and sectors that are prioritized, as it would allow to better anticipate impacts such as GDP growth, job creation and greenhouse gas reduction.

Provide support to the market and organizations

- Awareness campaigns and targeted training programs are necessary to ensure stakeholders' participation in a transition to a circular economy
- Financial support and incentive programs, as well as appropriate taxation and favourable legislation, should be fully carried out to help boost public and private investment
- The development of strategies, analytical tools, and financial and regulatory solutions are key to identify high-potential material flows and determine new uses and market opportunities to foster the entrepreneurial potential of a circular economy

Regulation, tax system and other levers available to governments to foster CE

Regulation	End-of-life regulations	Residual materials management	▸ Using the life cycle approach ▸ Ban on landfill and incineration sites ▸ Ban on waste exports
		Resource efficiency	▸ Reuse and recycling ▸ Biodegradable materials processing ▸ Chemical fertilizer elimination/reduction ▸ Water management ▸ Extended producer responsibility (EPR)
	Environmental management	Industrial production	▸ Process, product and service improvements
		Hazardous substances	▸ Reduction in use ▸ Increase in control
		Renewable resources	▸ Increase in renewable energy sources ▸ Energy efficiency
	Standards	Ecodesign	▸ Setting minimum requirements
		Labelling	▸ Validation of product origin
		Standards	▸ Minimum quality guarantee
	Procurement policies	Public procurement	▸ Purchasing by government authorities based on responsible or green procurement policies
Tax system	Tax measures	Residual materials management	▸ Extended producer responsibility (EPR) ▸ Extended consumer responsibility ▸ Carbon market
		Taxation	▸ Landfill tax ▸ Ecotax (e.g. taxation of non-renewable resources)
Government support	Support and funding	Information	▸ Determination of best practices ▸ Awareness building among stakeholders
		Funding	▸ Direct funding ▸ Support in the search for funding ▸ Research and development support ▸ Waste exchange

Source: "Circular economy in Québec: economic opportunities and impacts", March 2018

3.2 Informing policymaking for the collaborative economy

In 2018, researchers from the EDDEC Institute Collaborative and Performance Economy Laboratory *(Lab)* collaborated in the production of recommendations presented to the Government of Québec's appointed working group on collaborative economy (GTEC).

The members of the *Lab* presented a total of three reports: one on the impact of Big Data on the collaborative economy[32] ; one on the socio-economic approach to the collaborative economy[33] and a white paper written by the EDDEC Institute[34].

This last document proposed a number of lines of thoughts, some of which have been referred to in the GTEC report. It underlined the importance of conducting an inter- and multi- disciplinary analysis of the collaborative economy (i.e. its diverse forms and applications), as well as including the collaborative economy as part of a larger circular economic transition program for the province.

The recommendations were the following:

- **Establish a provincial collaborative research structure** as an open innovative platform, and a one-stop-shop for researchers and practitioners, that includes an educational mandate. It would also study the implementation of the provincial government recommendations as well as analyze the related impacts.
- **Define the meaning of a collaborative economy in the Québec-specific context,** considering its socio-economic characteristics
- **Identify international regulatory and legal frameworks to learn from best practices**
- **Research all social changes and movements** linked to the implementation of a collaborative economy
- **Research further the environmental, economic, and social impacts associated, in particular the adverse effects**

Additionally, the *Lab* contributed to the advance of the knowledge in the field of collaborative economy[35]. This enabled four Masters students and PhD candidates from *Université de Montréal, Polytechnique Montréal* and *HEC Montréal,* supervised by members of the *Lab,* to lead research projects.

The research projects delved into the collaborative and sharing economies through various fields of expertise:

1. **"Collaborative consumption and sustainability: lifting the veil on unforeseen adverse effects"**[36]

- The objective of the research was to answer the overarching question: **how does a collaborative economy support the transition towards a sustainable society?**

Key Findings

The study reveals that:

- The benefits of most collaborative initiatives based on such platforms are uncertain, considering the crucial role of web platforms in collaborative consumption models and their lack of transparency
- Most collaborative consumption models could trigger some sort of traditional rebound effect (i.e., the shift of consumption)
- The original purpose of those platforms (i.e. to maximize the use of existing material assets) may become forgotten, thus deriving toward business as usual, in the light of the – sometime consequent – financial benefits that providers gain from collaborative consumption models

2. **"A general purpose multiagent based model of *giving*, *receiving*, and *reciprocating* and an application to collaborative economy"**[37]

Based on the work of the French anthropologist Marcel Mauss and the sociologist Luc Racine, **this research presents the modelling of a normative dimension of gift-giving within a population, namely the obligation to reciprocate.** It explains the anthropological basis of "Giving, receiving, and reciprocating" which is then analysed via a mathematical model that emulates a multiagent system. The research articulated the limits of the tool to model the collaborative economy.

3. "What do we talk about when we talk about the sharing economy?"[38]

This research aimed to display various definitions given to the emerging economic trend named the "sharing economy". It explored these definitions through a selective review of the literature and a brief analysis of three interviews conducted with Montréal-based actors of the sharing economy, from which it offers preliminary insights for a sociological understanding of the phenomenon in the province of Québec. The research offers preliminary considerations on the relevancy of rooting future sociological analysis into local socio-historical context to provide a better understanding of such economic activities.

Key Findings

The study reveals that:

- Definitions of the sharing economy are highly variable with regards to the presence or absence of information and communication technologies (ICTs); centralized or decentralized governance; private or collective property; and the variety of types of activities it can be found in
- While the literature widely characterizes this phenomenon as "novel", insights shared by interviewees suggest that it may be best understood as a continuation or a reformulation of economic activities that have existed in other forms in the past

CHAPTER 4

MEASURING PROGRESS

In its *Plan d'action pour la croissance et les technologies propres 2018-2023* (PACTP) launched in 2018, the *Ministère de l'économie et de l'innovation* clearly identified the absence of an official definition, as well as a shortage of official statistics, to measure the progress of a green economy. These shortcomings were presented as obstacles for the evaluation of provincial action.

The report of the *Institut de la statistique du Québec* released in the summer of 2020 proposes a structured measuring framework and identifies indicators in order to address this issue.

This *Cadre conceptuel et indicateurs pour la mesure de l'économie verte*[39] is written in three parts:

1. **Analysis** of the differences and similarities between the definitions of green economy, green growth and clean growth, in relation to the founding concept of a sustainable development. The visual representation of a circular economy used in this report is the one developed by the multi-stakeholder roundtable *(Pôle)* established by the EDDEC Institute. The analysis then identifies three approaches to reach the 6 proposed key objectives that are present in all three definitions: clean technologies, eco-responsible business practices and the circular economy.
2. **Identification** of three areas to focus on in order to measure the green economy:
    i. Green transformation of the economy
    ii. Economic pressure on the environment
    iii. Global wealth, the state of natural capital, and social progress
3. **Presentation** of a total of 68 indicators, of which 44 are directly linked to the circular economy. A list of 13 key indicators is derived from these that seem most relevant to contribute to the measure of the PACTP.

The report also provides a comparison of circular economy indicators between Europe, France, Netherlands, Germany, China, and Japan, in order to illustrate the variety of measuring options.

CONCLUSION

In a fast-changing world where the availability of many resources has already become challenging, research also provides the information that is crucial to convince organizations to make the transition as early as possible.

With climate change-related issues looming over the future of many economic or industrial endeavours, carrying forward studies on the economic impacts of transitioning (or not transitioning) to a circular economy for any industry, value chain, province, or region is as important as taking a deeper look at the origin of GHG emissions and strategies on how to lower them.

The necessary transformative evolution of our societies cannot be achieved without supporting frameworks. Indeed, strong signals and adapted policies are often necessary to allow for long term planning. Forward-thinking managers recognise that they cannot improve what they cannot measure. The recent development of a clear framework and indicators for evaluation of progress will also contribute to a quicker transition to circular practices in Québec.

As the saying goes, "If you build it, they will come". But if you do not communicate that you are indeed building, or what it is that you are building, the interval between the rise of early adopters and the awakening of laggards may be too long for a more sustainable society to be developed. New business models, available tools, and successful case studies must be communicated to various stakeholders powerfully and effectively.

> Research is paramount in providing the right data and tools to assess the opportunities and impacts of a transition to circularity in various sectors of the economy.

Endnotes

1 *Métaux et économie circulaire au Québec*

2 Led by the EDDEC Institute, with *Institut de l'économie circulaire, Mairie de Paris, Association Orée, Institut Montaigne,* ADEME, *Université de Nantes*

3 *Cartographie des acteurs et des initiatives en économie circulaire sur le territoire de la Ville de Montréal*

4 Government of Québec appointed workgroup on collaborative economy (GTEC)

5 "Circular Economy Research Landscape in Canada", March 2019, Emmanuel Raufflet, Mélanie McDonald, Daniel Normandin, Manon Boiteux, Sabrina Roy-Pelletier

6 Refer to Section II, Chapter 1 of this report.

7 *Institut du développement durable, de l'environnement et de l'économie circulaire.* Refer to Section I of this report.

8 "Circular Economy Research Landscape in Canada", March 2019, Emmanuel Raufflet, Mélanie McDonald, Daniel Normandin, Manon Boiteux, Sabrina Roy-Pelletier

9 Adapted from *Cartographie des acteurs et des initiatives en économie circulaire sur le territoire de l'agglomération de Montréal.* Final version, September 2017. Franck Scherrer, Christophe Abrassart, Victorine Crahes and Caroline Cyr

10 Professor Christophe Abrassart, Faculty of Planning, *Université de Montréal,* Professor Franck Scherrer, Associate Dean, Research, discovery, creation and innovation Vice-Rectorate at *Université de Montréal* and Full Professor at the Urban Planning and Landscape Architecture School

11 Professor Emmanuel Raufflet, Department Of Management, *HEC Montréal*

12 Ouishare (2016). *Cartographie des initiatives collaboratives du Québec.*

13 *Programme de recherche en partenariat sur le développement durable du secteur minier*

14 *Métaux et économie circulaire au Québec,* 2018, EDDEC Institute and its institutional partners

15 Data available at the time of the study

16 The majority of copper available in Québec is imported concentrated copper.

17 SPEDE: *Système de Plafonnement et d'Échange de Droits d'émission de gaz à Effet de serre du Québec*

18 Refer to Section II, Chapter 3, subsection 3.2 of this report

19 *Programme d'aide visant les débouchés de matières résiduelles des ICI* (APDICI)

20 Pineau, P.-O., Gauthier, P., Whitmore, J., Normandin, D., Beaudoin, L. et Beaulieu, J. 2019. *Potentiel de l'économie circulaire sur les réductions d'émissions de gaz à effet de serre des émetteurs industriels québécois : Volet 1 – Portrait et pistes de réduction des émissions de gaz à effet de serre industrielles au Québec, Chaire de gestion du secteur de l'énergie, HEC Montréal.*

21 The report was prepared by the Chair in Energy Sector Management of *HEC Montréal,* in collaboration with the EDDEC Institute, the CIRAIG, *Polytechnique Montréal* and the CTTÉI, thanks to the financing by the Québec research Funds and the *Fonds vert of the Ministère de l'Environnementt de la Lutte contre les changements climatiques* (MELCC), in collaboration with the *Ministère de l'Économie et de l'innovation* (MEI). Partnerships were also established with the *Fédération des chambres de commerce du Québec* (FCCQ), Québec Business Council on the Environment (*Conseil Patronal de l'environnement du Québec* - CPEQ) and the *Conseil du patronat du Québec* (CPQ)

22 Guerche, H., 2020. *Obstacles aux stratégies d'économie circulaire et aux synergies pour la réduction des GES dans les industries du ciment et de l'aluminium, Rapports d'étude de la Chaire de gestion du secteur de l'énergie, HEC Montréal,* numéro 5-2020, octobre 2020. It is one of the study reports produced by the Chair. Those are undertaken by students supervised by *HEC Montréal* professors, and are aimed to provide a basis for information and exchanges.

23 *"Le gaspillage alimentaire au Québec L'analyse de flux de matière: une méthode de quantification",* Julien Pedneault, Toucan Solutions. The research is not a thesis – the depth of the analysis should be considered with caution.

24 *Vente de fruits et légumes « moches » en épicerie : Regard critique selon la perspective de l'économie circulaire et collaborative,* Jonathan Deschenes and JoAnne Labrecque *(HEC Montréal),* with the collaboration of Martine Vézina *(HEC Montréal),* Sophie Morin and Paul Sabourin *(Université de Montréal)*

25 CEGEP is a French acronym that stands for *Collège d'enseignement général et professionnel,* known as a general and vocational college. They are public institutions and represent the first level of higher education, dubbed post-secondary education, in Québec

26 Refer to Section II, Chapter 2, subsection 2.2 of this report

27 Refer to the case study in this report *Synergie Québec* – Key components to building a community of practice

28 Natural Sciences and Engineering Research Council of Canada (NSERC). (2014, May 20). Julien Beaulieu, from Chairholder Profile. Retrieved from https://www.nserc-crsng.gc.ca/Chairholders-TitulairesDeChaire/Chairholder-Titulaire_eng.asp?pid=1076

29 Québec Government Strategy on sustainable development 2022-2027

30 In collaboration with *I-EDDEC Dialogue & Transfert,* the Chair of Energy Sector Management at *HEC Montréal, Université Laval* and *Polytechnique Montréal.* https://www.cirano.qc.ca/files/uploads/files/20200804_Ateliereconomiecirculaire_programme.pdf

31 "Circular Economy in Québec – Economic Opportunities and Impacts"

32 *Quelques enjeux sur les données massives (Big Data) dans le cadre de l'économie collaborative au Québec – Recommandations au Groupe de travail sur l'économie collaborative (GTEC),* Didier Fayon, PhD candidate in sociology, *Université de Montréal,* April 2018

33 *Une approche socioéconomique de l'économie collaborative au Québec - Recommandations au Groupe de travail sur l'économie collaborative (GTEC),* Professor Paul Sabourin, Sociology Department, *Université de Montréal* and Professor Martine Vézina, Department of Management, *HEC Montréal,* April 2018

34 *Recommandations de l'Institut EDDEC au Groupe de travail sur l'économie collaborative (GTEC),* Stéphanie Jagou, Senior projects manager (EDDEC Institute) and members of the *Lab,* April 2018

35 Thanks to the donation of $20,000 from a private foundation.

36 To be published in 2021. Julien Walzberg and Geoffrey Lonca, PhD candidates at *Polytechnique Montréal,* supervised by Professor Jonathan Deschenes and Verena Gruber, Associate professor, Department of Marketing, *HEC Montréal*

37 *Modèle à base d'agents d'une économie de partage basée sur les concepts de donner, recevoir et rendre* by Didier Fayon, PhD candidate in sociology at *Université de Montréal,* and Aïda Benzaria, undergraduate in industrial engineering at *Polytechnique Montréal,* supervised by Professor Jean-Marc Frayret *(Polytechnique Montréal),* with the contribution of Professor Paul Sabourin *(Université de Montréal)* and Professor Jonathan Deschênes *(HEC Montréal).*

38 *De quoi parle-t-on quand on parle d'économie collaborative? Une amorce à l'étude du phénomène dans une perspective sociologique.* Louis Rivet Préfontaine, PhD candidate in sociology at *Université de Montréal,* supervised by Professor Paul Sabourin, Sociology Department, *Université de Montréal,* and Professor Martine Vézina, Department of Management, *HEC Montréal.*

39 *Institut de la statistique du Québec* (2020). *Cadre conceptuel et indicateurs pour la mesure de l'économie verte. Rapport remis au comité directeur de la mesure de l'économie verte, [En ligne],* 70 p.

SECTION 4

COMMUNICATING THE CIRCULAR ECONOMY

ENGAGING INFLUENCERS AND RALLYING CHAMPIONS

4

Disclaimer: Given the extent of initiatives having taken place in Québec since 2015, this report does not claim to provide the reader with an exhaustive review. It aims at featuring some of the key elements that contributed to initiating a transition to a circular economy in the province, in particular linked to the experience of the EDDEC Institute.

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INTRODUCTION

Effectively communicating the need for, and promise of, the circular economy is necessary to making this essential transition. Shaping public narratives, seeding ideas amongst key audiences, and sharing information and stories in a compelling way is critical to propelling people and organizations towards circularity. By developing smart strategies and tactics, clearly defining influencers and audiences, communicators advanced circularity as a concept in Québec.

Communicating the story of the circular economy in Québec has been no small feat. Back in 2015, North America was largely yet to discover the model, not to mention how to define it and apply it locally. The concept was then developing in a limited number of industrial sectors and in a handful of countries, like Germany, the Netherlands, China or Japan.

Establishing a common understanding between researchers, practitioners, civil society, and governments was a first milestone. Researching and showcasing the benefits of implementation was the second necessary step to produce the data required in order to convince wider audiences of the potential of the CE. It also triggered further participation and action at various levels. The third step was about engaging innovators and rallying champions.

From the common definition of a CE by the *Pôle*, messages started to trickle down in various sectors. First, tools and content that was intended to mobilize professional audiences were developed. Second, practitioners started to adapt key messages for their own audiences, in their industrial sector or value chain. Third, in parallel, the EDDEC Institute initiated a promotional program establishing interdisciplinary bridges between the academic community and the civil society.

Concerted outreach efforts have contributed to the development of the *Assises québécoises de l'économie circulaire*, the *QuébecCirculaire.org* hub, and the Massive Open Online Course (MOOC). In turn, those initiatives have helped to establish connections between early adopters and other stakeholders and create a momentum in the province. Since 2015, this organic bottom-up promotional approach has also led to the essential engagement of governmental bodies to support the transition.

MAIN **MILESTONES**

2015

- Conference: Circular economy session at Americana Environmental forum and International trade show for environmental technologies
- Publication of the first article of a series in Novae.ca

2016

- Conference: Three circular economy sessions at the 11th *Salon des Technologies environnementales du Québec* (TEQ)
- Conference: "Transition to a circular economy: opportunities and challenges for Québec and Canada", with Walter Stahel, visiting professor at the EDDEC Institute
- Definition of the circular economy by the multi-stakeholder roundtable *(Pôle)*
- Launch of a researchers' collective book "Circular Economy: An inevitable transition"[1]
- Interview on RDI from Radio Canada TV in *Zone economie*

2017

- Creation of the *Pôle*'s Communication Committee
- EDDEC Debate: "Reconciling growth and the circular economy" with Dominique Bourg
- EDDEC Debate: "Systemic accounting and planetary limits" with Didier Babin, visiting professor
- Funding: The Québec Ministry of Energy and Natural Resources (MERN) funds the research project on strategic metals and circular economy in Québec[2]
- Unveiling of the preliminary research results for the circularity of metals at the annual *Québec Mines* congress
- Broadcast of TV Documentaries featuring the circular economy
- Publication of special features in the fall of 2017 in the business-oriented magazine *Les Affaires*

2018

- Creation of the graphical representation of CE by the EDDEC Institute and RECYC-QUÉBEC
- EDDEC Debate: "Challenges of carbon pricing", with Christian de Perthuis, visiting professor
- Launch of the *HEC Montréal Createurs de valeurs* documentary on the circular economy
- Conference: First Edition of the *Assises québécoises de l'économie circulaire*
- Launch of *QuébecCirculaire.org* hub
- Promotion of 10 short videos featuring circular economy champions in the province
- Launch of the report "Circular Economy in Québec – Economic opportunities and impacts"
- Unveiling of final reports for the circularity of strategic metals
- Launch of ÉÉQ Packplay 2 competition on the ecodesign strategy

2019

- Opening of the first francophone MOOC on Circular Economy in North America, developed by the EDDEC Institute
- Launch of the "Circular economy in action" communication campaign by RECYC-QUÉBEC
- Broadcast of the CBC TV documentary *Tes déchets, ma richesse.*

2020

- Internal release of the *Pôle*'s Communication Committee communication plan
- Launch of a communication campaign by ÉÉQ on the ecodesign strategy
- Development of the "Synergy Compendium" by the CTTÉI

Acronyms are listed on page 12.

CHAPTER 1

DEFINITION

ESTABLISHING A COMMON UNDERSTANDING

Communicating a new economic model to a wide variety of audiences can be challenging. In the case of the circular economy, communication professionals have had to first avoid a number of identified pitfalls, such as solely defining the CE by some of its strategies or tools, or not differentiating it from other emerging economic approaches[3].

Communicators also needed to initiate interest in various audiences that existed outside of a limited community of early-adopters. Achieving this at a provincial scale required providing easy-to-understand information and considerable financial resources. The novelty of the circular economy model also meant that it was not possible for communication professionals to piggy-back on other long-running, well-established outreach programs, nor to draw on messages that had been repeated endlessly.

It was quite a different endeavour than, say, communicating about the fight against climate change, an issue that has now been debated for decades worldwide, and about which audiences have a foundation of knowledge.

In the province of Québec in 2015, as elsewhere in Canada, the circular economy was just a concept discussed between insiders. Examples and visualisations were yet to be developed, and the CE had yet to gather a wide base of supporters. Communication professionals found themselves in a challenging situation, where governments were not financing initiatives or public communication strategies in CE, nor signaling that this was of interest for any industrial sector or value chain.

Hence, from the onset, it was a rather organic bottom-up approach that dominated communication about the CE in Québec, and it was initially spearheaded by the *Pôle* and its Communication Committee[4].

1.1 Developing a definition of a circular economy for Québec

Defining a common language was one of the main objectives of the *Pôle* in its mission to mobilize and rally Québec practitioners to foster enabling conditions for the transition.

In the spring of 2016, its members released a co-designed definition:

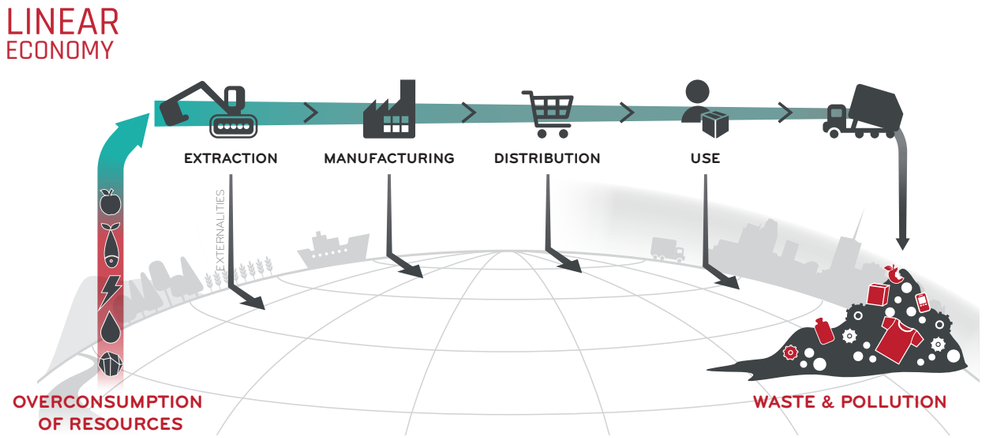
"A circular economy is a production, exchange and consumption system which optimizes the use of resources at all stages in the life cycle of a good or a service, in a circular logic, while reducing the environmental footprint and contributing to the well-being of individuals and communities."

This ensured the establishment of a strong common understanding upon which various initiatives could be undertaken. Over time, it has proven to be the cornerstone of the province's efforts to transition to a circular economy.

1.2 Creating a visual representation

The Communication Committee expressed the co-designed definition of a CE through a visual representation that could be easily understood by a great variety of stakeholders[5]. The 12 strategies featured in the resulting graphic have been divided into four hierarchized families that illustrate circular loops at different stages of the life cycle. The visual representation has been translated into English.

At the request of the organic matter and food waste management team of RECYC-QUÉBEC, the graphic has also been adapted for the food sector. It is currently used as a conceptual basis for the agri-food sector in the *Symbiose agroalimentaire Montérégie*. It is also used in an educational capacity for circular economy students at the Masters of environmental sciences[6] at *Université de Sherbrooke*. It has been used in particular in a student essay as a tool to help develop circular economy strategies to remediate food deserts.



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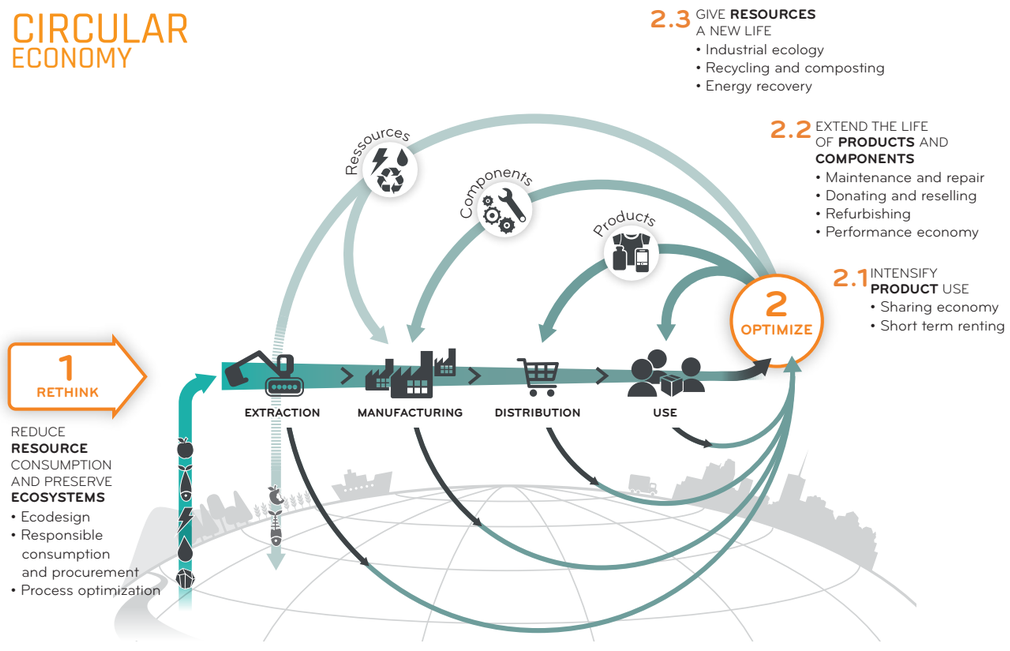

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1.3 Evaluating the needs and key messages for targeted audiences

The Communication Committee produced a preliminary 2020-2022 Communication Plan for the *Pôle*. This has been an internal tool to structure a common vision for outreach strategies among its members. Its overall objective is to inform, promote, and encourage adoption of a common vision of CE in Québec, while nurturing networking opportunities between CE actors.

Extensive preliminary work was conducted to assess the information and communication needs of the three priority target audiences: companies, municipalities, and government bodies.

At the end of 2020, only a few of the proposed communications activities had been implemented due to lack of financing. However, given the increased interest in CE and increased funding possibilities, the work shall resume in 2021.

The plan will consider how, in the context of the COVID-19 pandemic and the subsequent economic recovery, there has been an evolution in the public perceptions for the need for a transition to a circular economy.

Members of the Communication Committee (2020)

- *Bureau de coordination du développement durable, Ministère de l'Environnement et de la Lutte contre les changements climatiques*
- *Centre de transfert technologique en écologie industrielle* (CTTÉI)
- *Éco Entreprises Québec* (ÉEQ)
- Fondaction
- *Fonds d'action québécois pour le développement durable* (FAQDD)
- EDDEC Institute
- *Les Évadés* communication agency
- *Regroupement national des conseils régionaux de l'environnement du Québec* (RNCREQ)
- RECYC-QUÉBEC (Committee moderator)

Focus groups held in 2019 and 2020 highlighted a number of concerns and questions, including:

CHAPTER 2

ENGAGEMENT
SECTOR AND STRATEGY-FOCUSED COMMUNICATION

Once a common definition of the circular economy had been established, practitioners – and partners of the *Pôle* among them – started to adapt outreach tools targeted to their audiences.

The concept of a CE started trickling down from academia to various industrial and commercial audiences. Communication strategies were mainly devised by organizations for their partners in the value chain, or by industrial associations for their members. And they – quite logically – focused on the core aspects of their own respective businesses, putting forward approaches or strategies most adapted to their sector of activities, or most relevant to their organization's mission. The research projects that have taken place during those years helped fuel these efforts by providing solid data and convincing arguments[7].

With the exception of the 2016-2018 study on the circularity of strategic metals commissioned by the MERN[8], the lack of public financing at the time hindered industry-wide communication strategies and also contributed to the creation and implementation of organic, industry-led outreach approaches.

Proof of concept was still required, and lots of convincing needed to be done before triggering interest and attracting an increasing number of supporters. Reminiscent of change management approaches, the objective was for a professional community or ecosystem to evolve new ways of thinking about their resources and processes, and their waste. The ultimate objective was for network members and business partners to adapt their business models to this new economic model.

2.1 Communication focused on circularity strategies

The CTTÉI, ÉEQ, and RECYC-QUÉBEC were focused on communicating about three primary areas: industrial symbiosis, ecodesign, and reduction, reuse, recycling and recovery strategies.

Each of these three areas had specific target audiences identified, as explored below. There were, however, commonalities to the communications approaches for all three areas. They all also included components targeted to a younger audience, in an effort to change the system sustainably by engaging younger generations.

2.1.1 Industrial symbiosis strategy

For over 20 years, the *Centre de transfert technologique en écologie industrielle* (CTTÉI) has provided industrial ecology solutions and has fostered a network of industrial symbiosis in Québec[9]. Through its initiative, *Synergie Québec*, thousands of organizations were brought together, allowing for the documentation of over 6,500 material flows.

Target audiences

There are two primary audiences: i) industries, industrial parks, and municipalities, and ii) students, as the CTTÉI is based in an educational institution. Activities and communication tools have been adapted to respond to the respective needs and interests of these two audiences.

Communication strategies

Industries, industrial parks, and municipalities: showcasing the benefits

- Among many other communication activities, the early creation of an "Industrial Symbiosis Guide" has been a valuable asset in advancing the promotion of this circular economy strategy. To foster quicker adoption of the CE in industrial practices, the guide provides methodological and operational tools.

- Released in spring of 2021, the first "Synergy Compendium" is a document in which 25 companies and organizations provide figures on the impact of their business synergies. Through 11 concrete cases, the CTTÉI presents successful partnerships, whether for residual materials, under-utilized equipment, labor, or transportation. The aim of the document is to inspire political and business decision-makers, economic development, environmental protection and social economy organizations, educational institutions, and the general public by providing unexpected ideas and featuring inspiring opportunities.

- The CTTEI also participates in numerous panels, symposiums, and industry conferences to communicate to provincial audiences.
- In-depth communications have also been pushed to specific audiences, for example with articles written in magazines like for *Vecteur Environnement*[10], published by the biggest environmental professionals' network in the province, *Réseau Environnement*. The CTTÉI also reached out to an international academic audience with an article in the magazine of the ACFAS congress, which is the largest multidisciplinary gathering of knowledge and research in the French-speaking world, that welcomes thousands of researchers and research users from some 30 countries.

College and university students: learning while playing

- The CTTÉI developed a card game that simulates the exchange of residual materials flows between various stakeholders. This allowed for understanding barriers to the implementation of symbioses on a given territory or for a given good or service, as well as illustrated the great variety of synergies that can be achieved.
- Various conferences and sessions have also been given at university level, for example during the Circular Economy Summer School. The simulation game has also been used in this context.

Strong internal communication enables quick reactions

When the COVID-19 pandemic started, industrial organizations had to adapt to meet urgent needs. Through the community of practice established with *Synergie Québec*, the symbioses' facilitators were quick to forge win-win partnerships to get access to new materials[11]. This led in some cases to a change in the mission and objectives of some symbioses, for example as they soon became experts in urgently-needed sanitary equipment.

> "The circular economy is emerging as a major tool for recovery."
>
> **Jennifer Pinna,** circular economy advisor at the CTTÉI and Community facilitator

2.1.2 Ecodesign strategy

Éco Entreprises Québec (ÉEQ) is a private non-profit organization that represents the companies that place containers, packaging, and printed materials on the market in Québec. It is their responsibility to finance the costs of effective and efficient municipal curbside recycling services. For its 3,400 members, ÉEQ optimizes the curbside recycling value chain and implements innovative approaches. As part of its mission, ÉEQ also advances the ecodesign of packaging.

In 2016, ÉEQ identified curbside recycling as a telling example of the circular economy. As a member of the *Pôle* and its Communication committee, it has actively participated in the definition of a CE for Québec.

The objective of the organization is to become THE reference in Québec for the ecodesign of packaging.

Supporting its members in the transition

In the fall of 2020, ÉEQ set up a two-phase comprehensive communication strategy to raise awareness on ecodesign as a strategy of a CE and to support its members in the transition. This included providing access to information, case studies, guides, and tools via a redesigned website: **ecoconception.eeq.ca**.

Écoconception et économie circulaire

That portal is positioned as the tool of choice to communicate, primarily to ÉEQ members, the key message:

Ecodesign is a founding concept of a circular economy and constitutes one of the key elements of a modernization of curbside recycling.

Main Target audiences

- Members
- Start-ups who are at the stage of conceiving the packaging of their products
- Packaging development agencies

Manufacturers, university professors and research chairs were also targeted as part of the packaging value chain. The messages were relayed throughout a number of partners, including business associations and professional networks as well as key influencers.

Communication strategies

Key messages were developed to clearly communicate the benefits of ecodesign strategies.

These messages focused on enabling competitive advantages and steady competitiveness; allowing for a reduced environmental footprint; and the ability to lead to cost reductions for procurement.

Calls for initiatives were launched to invite stories to be showcased on the ecoconception.eeq.ca hub. Members were encouraged to collaborate actively to ensure that the hub became and remained the one resource to which audiences would turn.

A communication strategy in two phases

The communications strategy was developed to rollout out in two distinct phases, with a soft launch and then an intensified promotion of the hub.

Phase one (2020): Soft launch

- Specific email signatures
- Targeted newsletters
- Pre-registration for an ecodesign-related newsletter (to be launched in 2021)
- Promotional video to be used in events and on social networks
- Social networks promotion (LinkedIn)
- Creation of a media kit for partnering business associations

Phase two (2021): Intensified hub promotion

- Interactive virtual assessments for packaging proposed by ÉEQ members
- Recurring elements in ÉÉQ newsletter
- Partnerships with selected media and media relations
- Strategic and intensive use of social media, including targeted communicator kits for business and design influencers, as well as several promotional tools
- Showcasing examples to bring CE to life

Stimulating innovation through education: The Packplay 2 competition

ÉÉQ also turned to young generations of designers to stimulate innovation and address the problem at its roots: if future professionals carry on designing without questioning the ways of the past, packaging will continue not using an optimized amount of resources, and may not be recyclable – resulting in the sustained accumulation of waste in landfills and the environment.

The Packplay concept relies on the creativity of students from around the world to support packaging ecodesign. An initiative of the *École de design de l'Université du Québec à Montréal* (UQAM) and ÉEQ, the project's three components were established:

- An international competition for design schools
- An exhibition of the winning projects
- A course book on packaging ecodesign that revisits the projects submitted to the competition

Driven by life cycle thinking, the competition encouraged participants to consider the environmental impacts of their packaging, from sourcing to end of life.

A GREAT SUCCESS

The Packplay design competition attracted:

- **181** projects
- Submissions by **19** schools and universities
- Representation from **11** countries (Canada, US, France, Switzerland. Belgium, Germany, Sweden, Finland, Portugal and India)

ÉEQ also published in 2018 the bilingual document titled "Do we need another package?" in collaboration with the graphic design department of UQAM.

> "ÉEQ and I wanted to create a bilingual pedagogical tool that experts could use to design ecoresponsible packaging. We have written a work that will certainly become a reference for the industry and designers."
>
> **Sylvain Allard,** Professor and Director of the *École de design de l'UQAM*

2.1.3 Reduction, reuse, recycling and recovery strategies

RECYQ-QUÉBEC is a provincial organization whose objectives are to promote, develop, and encourage the reduction, reuse, recycling and recovery of containers, packaging, materials or products, as well as their valorization from a resource conservation perspective.

All of RECYC-QUÉBEC's communication initiatives stem directly from its mission and its "2019-2024 Action Plan". Since 2015, the circular economy is at the heart of its daily activities, and takes many forms as it is integrated into all measures.

To lead Québec to reduce, reuse, recycle, and recover residual materials in a model of circular economy, and to fight against climate change, RECYC-QUÉBEC generates numerous messages to a multitude of target audiences and stakeholders. These include information dissemination, awareness and education campaigns, calls for proposals, financial support, and the implementation of innovative initiatives.

As a pivotal player, the organization also proactively engages local and national public relations initiatives. For example, a **"Circularity Gap Report for Québec"** is planned for release in the spring of 2021[13].

Target audiences
RECYC-QUÉBEC has three primary target audiences: citizens, municipalities, and industrial, commercial and institutional (ICI) stakeholders. Overall, they seek to democratize, demystify, and popularize the circular economy (and its strategies) with approaches tailored to its target audiences.

Examples of social media posts for the *L'Économie circulaire en action!* campaign.

Communicational strategies
Citizens: Raising awareness

- Social network creation of dedicated hashtags and specific campaigns:
  - » *L'économie circulaire en action!*
  - » *Réal et Lise,* two characters that present the reduction and recycling strategies
- Media partnerships:
  - » To fight food waste, with Ricardo Media and the National Zero Waste Council for the Canada-wide campaign "Love food, hate waste"
  - » For the creation of a reparability rating in the analysis of various products, with the magazine *Protégez-vous*
  - » To engage young people, a partnership with *Les Débrouillards* geared to teenagers, with the magazine *Les Explorateurs* to engage children, and an article on CE in Curium, a science, technology, and society magazine geared towards 14-17 years-old kids

Municipalities
As one example, RECYC-QUÉBEC provides municipalities with turnkey toolkits on the topics of food waste, organic matter, and reduction/reuse during the Holiday season.

Industrial, commercial, and institutional stakeholders

- Communication through workshops offered by RECYQ-QUÉBEC experts
- Speaking engagements at targeted regional or sectorial events, on specific circular economy strategies
- Articles in industry-specific magazines or environment-oriented magazines like *Vecteur environment* in Québec

RECYC-QUÉBEC also develops or participates in initiatives that reach all of its target audiences at once. Three examples are explored further in this report: the *Assises québécoises de l'économie circulaire, QuébecCirculaire.org* hub, and the MOOC.

2.2 Sector-specific communication

In parallel to strategy-specific communications, sector-specific practitioners have joined forces to communicate about the advantages of the transition to a circular economy in various industrial sectors. The government of Québec also funded and promoted a three-year program to focus on the opportunities in the mining sector.

2.2.1 The "Circular Economy in Québec – Economic opportunities and impacts" report: A concerted initiative

The research[14] released in March 2018 pinpointed a number of key sectors where a CE would be very beneficial, and highlighted the province's economic sectors with significant circularity potential.

The objective was to help identify the economic and environmental impacts of CE, as well as the barriers and legislative levers that could serve in the transition to a new economic model. It was aimed at showcasing the potential contribution of circularity to the prosperity of the province. Through case studies, the research focused on five strategies: recycling, remanufacturing and reconditioning, performance economy, industrial symbiosis and the collaborative economy.

Target audiences
This report reflects the outcome of a concerted approach undertaken by three industry and commercial key actors in the province, namely the *Conseil du patronat du Québec* (CPQ), the Québec Business Council on the Environment (CPEQ) and *Éco Entreprises Québec* (ÉEQ), targeting their many members in the province.

Communicational objectives
The bilingual communication strategy was crafted between those three actors to ensure a stronger, wider, and deeper impact on the industrial and commercial stakeholders in Québec, with the aim of favoring CE emergence and stimulating public and private investment. An additional objective was to send a strong signal to the various levels of government that they should put in place enabling regulatory, fiscal, and financial measures to support businesses and institutions in their efforts for a transition to a circular economy. The CPQ, CPEQ and ÉEQ also advocated for the need of a model for Québec, based on specific data, in order to better predict the national benefits (GDP growth, job creation and greenhouse gas reduction).

Tools
- A joint press release was published and distributed to a wide media base in the province
- The research report was unveiled during a public event gathering over 150 participants from industries, commerce and institutions (ICI)
- A public relations campaign was devised and interviews conducted with various media to ensure the widest possible reach
- An editorial was co-signed in *Le Soleil*, the French language daily that mainly covers the area of Québec city, where the provincial parliament is located

Key messages
The key messages associated with the report articulated how a circular economy brings about:
- Productivity, efficiency and profitability gains
- Reduced social and environmental costs
- Stimulation of innovation
- Strong entrepreneurial potential
- Numerous business opportunities, creating added value from "waste"
- A need to adapt to new consumer expectations
- Alignment with global efforts to reduce the impact of human activity

Widely covered in the media of the province, the report has been referred to in various contexts and represents one of the stepping stones towards the development of other initiatives.

2.2.2 The *Métaux et économie circulaire au Québec* research: A government-led initiative

Aiming to explore the potential for circularity for some strategic metals extracted in the province, the Québec Ministry of Energy and Natural Resources (MERN) funded the EDDEC Institute and its academic partners for a research project on metals and circular economy in Québec. The project focused on three metals that are predominant in the province: iron, copper and lithium. At the time, this represented one of the most significant contributions from research on the circular economy in Canada[15].

A specific communication strategy was designed by the MERN and its partners to promote the report, and ensured that the results were broadcasted to a large audience and made easily available online.

Target audiences
The primary target audiences were mining industry stakeholders and the metal value chain actors.

Communication strategy
The strategy supported the gradual release of the various reports and components of the research, from 2016 to the unveiling of the final report in 2018. Although the research spanned across three years, making strategic information available at different occasions progressively raised awareness among various stakeholders. This started the slow but vital process of corporate behavioural change, possibly helping industry leaders in their strategic decision-making process.

Objectives
- Raising awareness about circular economy among industry stakeholders in the province
- Informing industry actors on the best practices around the world
- Validating the potential for selected strategies in Québec
- Showcasing the benefits of the implementation of circularity strategies

Tools
- Press release geared to all media, including regional weeklies to ensure the widest coverage possible in the province and in often-remote mining regions
- Press conference at the emblematic site of the *Maison du développement durable* in Montréal, in presence of the Province's then Minister of the MERN, M. Pierre Arcand and the then Minister of Higher Education, Mrs. Hélène David, as well as a number of key mining industry leaders
- Communications on the websites of the MERN and of research partners, and via social networks and targeted newsletters at the occasion of each release of report findings
- Workshop to engage with industry leaders at the *Québec Mines* congress in 2016 and gather their feedback on the potential of selected strategies
- Unveiling of the progress report and presentation of the preliminary research results at the annual *Québec Mines* congress in 2017

Key messages
The overall message behind the study was that a transition to a CE for the three metals considered in the research is a necessity, since in a business-as-usual scenario, by 2030 the demand was then forecasted to grow 30 times for lithium, and increase three-fold for copper and iron.

Messages were then tailored according to the recommendations presented in the various elements of the report, and according to the barriers to the implementation of CE it identified[16].

This research has informed the new "Québec Plan for the Development of Critical and Strategic Minerals: future resources for a greener Québec", unveiled in October 2020.

CHAPTER 3

CONNECTION
BUILDING BRIDGES BETWEEN RESEARCH AND CIVIL SOCIETY

The EDDEC Institute established the *Pôle* and with its members it led to the co-creation of the definition of a circular economy in Québec as well as its graphic representation[17]. One of the seven priorities of the EDDEC Institute research program was to increase the understanding of the CE model. To do so, it set out to foster knowledge transfer[18] and awareness raising activities.

Communication objectives
The EDDEC Institute acted as the engineer of bridges between the academic and research world on one side, and the industry, commercial and institution (ICI) practitioners and governments on the other side. The overall objective was to raise awareness to foster a transition to a CE in the province of Québec, and to develop and disseminate fact-based information for key decision-making by a variety of stakeholders.

Target audiences
Its communication strategy was geared towards three main target audiences: researchers and students, industry and commercial leaders, and government bodies. For the latter, relationships were established with a number of ministries, and from 2017 on, communication about CE was also funnelled through the *Groupe interministériel sur l'économie circulaire* (GIEC), a group of representatives from 13 Government of Québec's ministries and state companies. A public debate was also organised in connection to the 2018 provincial elections.

Quick Facts

From 2015 to 2020, members of the EDDEC Institute team:

- Participated in over **125** media interviews in Québec-wide media
- Contributed to **3** documentaries
- Organized and participated in about **100** conferences, roundtables, panels, webinars, workshops and events on *Campus Montréal* as well as ones geared to the general public, in Québec, Canada, and France

Tools
The EDDEC Institute's main communication tools were its newsletter, targeting either researchers and students on *Campus Montréal* or practitioners, as well as its website and social networks. Its initiatives were coordinated by one of the project managers, on a part-time basis, and were supported by the communication departments of the three universities on *Campus Montréal (Polytechnique Montréal, HEC Montréal* and *Université de Montréal).*

Key messages
The key messages built on the working assumptions established in 2014, at the set up of the EDDEC Institute, as a foundation for moving forward[19], including:

- The linear economy is unsustainable and it is urgent to go beyond a waste-based economic model
- The circular economy is an umbrella concept

Among other messages, the EDDEC emphasised the prioritization of CE strategies along the life-cycle of products and services and the potential of rebound effects.

One other important underlying message was that the EDDEC Institute was a non-partisan actor, neutral in the sense that it had no economic nor politic interest in pushing forward one strategy rather than another. The focus was always on the logic of the proposed circular economy model and the hierarchy of the possible strategies.

3.1 Publication of a researchers' collective book: "Circular Economy: An inevitable transition"[20]

In 2016, the EDDEC Institute led the production of a collective book with researchers from *Campus Montréal.* The objective was to present the considerations of 47 researchers from various fields of expertise to provide an interdisciplinary view of what circular economy may mean and imply. The fields of expertise represented were varied and included chemical and industrial engineering, economics, geography, anthropology, philosophy, and management. It was geared towards a non-scientific public and allowed for a thorough presentation of the real need for a change in paradigm, from linear to circular. The book was designed from inception to be freely available online to a wider audience, with printed copies available for a fee. It has been used as a resource book for post-secondary courses and has also been publicized and often downloaded abroad thanks to its promotion on the *QuébecCirculaire.org* hub.

3.2 Visiting Fellows' program and conferences

Initiated in 2016, this program aimed at fostering international links between researchers on the subject of CE, and had an interdisciplinary approach. The first visiting fellow was Walter Stahel, one of the founders of the concept of a circular economy[21]. The founding father of the performance economy, he is also the Founder and Director of the Product-Life Institute.

In the two following years of the program, five other visiting fellows, experts in their respective fields, established work relationships and initiated research projects with researchers on *Campus Montréal.*

VISITING FELLOW PROGRAM

Public conferences and research workshops have been held with:

2016

Walter Stahel. Widely recognized as one of the key thinkers of the circular economy and the founding father of the Performance economy. Founder and Director of The Product-Life Institute.

2017

Prof. Dominique Bourg. French philosopher and professor emeritus at the Faculty of Geosciences and Environment of the *Université de Lausanne* (Switzerland).

Didier Babin. President of the French National Program Committee for the "Man and Biosphere" (MAB) of UNESCO.

2018

Christian de Perthuis. Economist, Professor of Economics at University Paris-Dauphine and Head of the Climate Economics Chair. Member of the CEDD, the advisory committee of the French Minister of Environment.

Dr. Rafael Ziegler. GETIDOS fellow from Germany. Now professor *(HEC Montréal)* and guest professor (Institute of Philosophy, *Université de Montréal*).

Aristide Athanassiadis. Doctor in urban planning, *Université libre de Bruxelles* and Senior Researcher at the *École Polytechnique Fédérale de Lausanne* (HERUS).

3.3 Proactive development and participation in various events

One key strategy implemented was to create or take opportunities to present and discuss CE. Over five years, the list of conferences, roundtables, panels, webinars, workshops, and events organized by the EDDEC Institute, or other events it participated in, spans Québec, Canada and France and is too long to detail.

The main purpose was to target and raise awareness in current and future key decision-makers in the fields that bear the strongest need for – and those with the strongest potential benefits from – a transition to a circular economy. For example, building and construction, mining and textile industries, urban development, and so on.

Among the key presentations, and those with the widest reach, are:

- Sessions at Americana Environmental forum and International trade show for environmental technologies as well as *Salon des Technologies environnementales du Québec* (TEQ) over several editions of the events
- Participation in the *Assises de l'Économie circulaire* in France
- Moderation of a workshop at the Global Social Economy Forum in 2016
- Moderation of a workshop at the 2017 Sustainable Development Forum of Victoriaville, a flagship event in the province
- The first engineering congress in CE in Québec, *Conference at Genium 360: Rencontres de génie 2018: L'économie circulaire et innovation*

A number of other conferences, webinars and presentations have been co-organized with members of the *Pôle*, and some also targeted specific industries or stakeholders, for example the Canada Green Building Council.

3.4 Develop or support position papers and white papers

The circular economy report released by the *Conseil jeunesse de Montréal* is a good example of this strategy. The *Conseil* has an advisory role with the municipality and the City's Executive Committee, expressing the concerns of 12- to 30-year-old citizens. Both the academic and executive directors of the EDDEC Institute signed the preface of this report that was promoted via a press release and a press conference in February 2020. The recommendations made in this well-documented position paper are believed to be what the City of Montréal should implement in order to not only lead the way, but also to enable future generations to scale up and accelerate this essential transition.

A number of white papers have also been produced, for example the report presented to the Government of Québec's appointed workgroup on collaborative economy (GTEC) or at the occasion of a private consultation with Québec's National Assembly in 2015, on the subject of the integration of CE in the 2015-2020 provincial strategy for sustainable development.

An article on circularity was included in "Québec *Économique 8* – Sustainable Development in the context of climate change" *(Le développement durable à l'ère des changements climatiques),* a book co-written by over 20 researchers from *Campus Montréal* and other Québec universities, published in 2019 by the CIRANO.

3.5 Connecting with the media

Reaching out to wider audiences often meant getting the media involved. From 2015 to 2020, the EDDEC Institute participated in over 125 interviews in Québec-wide media and contributed to three documentaries, in particular in 2017 with the *savoir. média Série UniVERT urbain*, as well as with the 52 minutes documentary *Tes déchets, ma richesse* available online.

One stepping stone was the partnership with a sustainable development-oriented media, renowned in Québec, Novae.ca. A series of articles were published in 2015 and 2016 illustrating the need for a circular economy, the collaborative economy strategy, and the role of the government on the implementation of key regulations and financing.

More often than not though, the EDDEC Institute media strategy was to put forward specialists and practitioners rather than be the main protagonist. Relations with some prominent media have been valued, in particular with the TV channel RDI from Radio Canada with iconic presenter Gérald Fillion in *Zone economie* or more recently with a Radio Canada *ICI première* iconic presenter Michel Désautels.

Print media were also instrumental in raising awareness, for example with special features in the fall of 2017 in the business-oriented magazine *Les Affaires*, as well as articles in the most-read French dailies, *La Presse* and *Le Devoir*. Op-eds were also used on a number of occasions for specific topics, like the one in the *Journal de Québec* on the subject of the economic recovery in the spring of 2020. Targeting this media was instrumental as this is the most read daily newspaper in the region where the Québec parliament sits. All news from EDDEC Institute or its partners were also relayed on the international platform Mediaterre, and on *QuébecCirculaire.org*. This strategy also enabled information and news to be relayed in many sector-specific or regional as well as international media.

The various media available on *Campus Montréal*, such as university newsletters, sustainable development departments activities on campus, and informational screenings have been leveraged. In particular, the EDDEC Institute played a key role in the development of the 2018 *Createurs de valeurs* documentary, implemented by *HEC Montréal* students. Also, a special feature was run in *HEC Montréal* management magazine, *Revue Gestion,* in December 2020, that reached a number of decision-makers in the province.

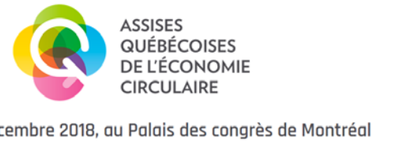
Implementing several complementary communications tactics at once allowed for greater outreach in the province, and strongly contributed to raising awareness on the circular economy, advocating for the need for a transition.

CHAPTER 4
CONVERGENCE
BUILDING BRIDGES BETWEEN PRACTITIONERS AND THE GENERAL PUBLIC

Strong CE-generic or sector-specific communication strategies, combined with the increasing availability of research to a wider audience, laid a fertile ground for the inception of three initiatives that have been instrumental in raising awareness in the general public: the *Assises québécoises de l'économie circulaire,* the development of the *QuébecCirculaire.org* hub, and the MOOC.

4.1 The *Assises québécoises de l'économie circulaire*

The first edition of this event took place on December 5, 2018. It was organized by RECYC-QUÉBEC, in collaboration with the *Ministère de l'économie et de l'innovation* and the EDDEC Institute. It reached over 400



managers and leaders from diverse sectors of society. The scope of this first day-long session was both Canadian and international. A varied program featured some 20 speakers from Québec, France, Belgium, the Netherlands, and Great Britain. An opening note was presented by the Ellen MacArthur Foundation featuring their achievements in the U.K. with industries and governments, and the French ADEME focused on the future of CE in Europe. The then-recently created Circular Economy Leadership Canada as well as initiatives by the National Zero Waste Council were also presented.

Themes included some of the CE strategies implemented at the time in the province, as well as implementation at the local and municipal levels or for a value-chain. Some upstream strategies at the beginning of the life-cycle, such as reduction and ecodesign, were also explored. One objective of the conference was to be interactive and gather collective intelligence, in particular with a session on how to mobilize communities to go forward.

Target audiences
Practitioners from all fields and ICI were the targeted audience for the event, as well as municipalities and the general public.

Key messages
- In less than five years, Québec has become a North American leader in the transition to a CE
- The circular economy allows us to be bold and innovative
- CE is a model where economic growth and the fight against climate change go hand-in-hand
- Each of the strategies brings its share of opportunities and benefits for Québecers
- Most studies show that a circularized economy can increase GDP and create many local jobs, offsetting losses in more traditional sectors
- The reduction of resource waste and the adoption of new consumption behaviors could save money for individuals and companies

Communication strategies
The event was promoted by RECYC-QUÉBEC and its partners, and covered by the province's media. It was a first event of its kind, and designed to be the Québec equivalent of the event held in France since 2014, *Les Assises de l'économie circulaire* organised by ADEME.

Promotional videos
In parallel, a series of 10 one-minute long videos featuring testimonies of early adopters and key promoters was produced by the EDDEC Institute, co-financed by the *Ministère de l'Économie et de l'Innovation*. The objective was to encourage followers to join the CE movement and to showcase the current champions of circularity. The videos featured a variety of industries, key stakeholders in fostering implementation, and CE strategies. Some of the videos were presented during the *Assises* and some were shot during the event itself, as it gathered the key decision-makers and CE innovators of the province. The intention was to build upon the momentum of the event, and to have a more lasting effect by showcasing them after the one-day event. They were featured on *QuébecCirculaire.org* and also in specific post-event newsletters. Influencers were also targeted to circulate them to their audiences and networks.

Promotional videos	
Conseil du patronat du Québec (CPQ)	Advocating for the transition to a CE towards its members, the industries
GenFoot Kamik	Ecodesign, re-use, recycling
Cascades	Recycling
Spa Poséidon	Remanufacturing
PME Montréal	Supporting the ecosystem and facilitating symbioses
Fromagerie Boivin	Valorization
Ville de Victoriaville	Territorial implementation
CTTÉI	*Symbioses (La Materiothèque)*
Group SEB	Recycling, Reuse
Guillaume Lavoie	Collaborative economy (GTEC president)

The first edition of the *Assises québécoises de l'économie circulaire* was a success. It helped promote the model and strategies of the circular economy to new audiences and the general public, and generated a lot of enthusiasm. A summary of the event is available online. The event is programmed to take place on a regular basis, but due to the pandemic, the 2020 edition was postponed to 2021.

Not to be missed!
Two half-day virtual exchanges to learn about the evolution of the circular economy in Québec and elsewhere in the world, and learn from experts from the construction, agri-food, textile and mobility sectors. Assessment and support sessions facilitated by the CTTÉI and *Synergie Québec* will be available.

ASSISES QUÉBÉCOISES DE L'ÉCONOMIE CIRCULAIRE
2E ÉDITION
26 et 27 mai 2021

4.2 *QuébecCirculaire.org:* The online hub

QuébecCirculaire.org is an online hub for the various circular economy initiatives emerging in Québec, and for advancing the knowledge of a community of practice via shared tools and experiences. It was launched during the *Assises québécoises de l'économie circulaire,* in December 2018. The hub is part of the European network *economiecirculaire.org*, which has over 4,400 members. Also available in English, circulareconomy.org is an entry portal to a network of regional platforms.

QuébecCirculaire.org is one of the flagship initiatives of the *Pôle*. Its development had been announced at a press conference within the framework of the Alternate Meetings of Québec and French Prime Ministers and the signing of a ministerial cooperation agreement between France and Québec. It is financed by both private and public partners, and it aims at being the one stop shop on circular economy in Québec.

Target audiences
Practitioners from all fields and industry, commercial, and institutional sectors are the primary audiences, as well as decision-makers at all government levels, and innovators. The hub also provides information adapted for the general public.

Communication strategies
The objective of *QuébecCirculaire.org* is to create a forum for the exchange of information, and gather collective knowledge to drive a real change in the economic model. This contrasts to other initiatives related to the circular economy, in which the information that emerges is often fragmented by types of strategies, regions, people involved, and sectors of activity. Therefore, the hub itself is a powerful communication tool, and aims to foster communities of practice and networking in support of new initiatives. In 2020, a province-wide contest was launched to identify CE initiatives to be showcased on the hub. This was a way to increase the information database on the platform as well as raise awareness. The contest was communicated extensively via social networks and also via partners. Over 40 organisations participated, most of them SMEs and not-for-profit initiatives.

4.3 The Massive Open Online Course (MOOC): "Circular Economy: An inevitable transition"

The first francophone MOOC[22] on circular economy in North America was spearheaded by the EDDEC Institute and launched in the spring of 2019. This is the first project to be jointly supported by the *Université de Montréal, Polytechnique Montréal* and *HEC Montréal.* RECYC-QUÉBEC is also a founding partner.

This course is intended for students, professionals, or decision-makers working in public administration, business, or non-profit organizations. Its four modules present how the application of circular economy strategies can contribute to addressing growing resource concerns, as well as which economic, environmental and social benefits can emerge. The benefits and challenges of implementing the CE model are explored through case studies, video clips, and podcasts delivered by some 50 circular economy experts, business leaders, entrepreneurs, and researchers from leading universities in Québec and Europe. Participants are challenged to develop a critical view of their impact and the role they can play in the transition to the CE.

> The combination of those three elements – flagship events, online CE community and information hub, and online free training – has tremendously helped to raise awareness in the province since 2018.

CONCLUSION

Since 2015, communicators have made a lot of headway in establishing the concept of the circular economy in the province of Québec. Whether via organization-supported or multi-organization concerted efforts, practitioners now are at minimum aware of the existence of this new economic model, of the need for business adaptation in the view of the scarcity of resources, and of the opportunities and potential benefits that may arise from a transition to a circular economy.

The variety of strategies used, activities implemented, and tools made available, together with a constant-if-moderate governmental support, have helped lay a strong base of awareness. While underfinanced, this organic bottom-up approach evolved rather intuitively with a variety of actors. It led to solid results because of the collaborative work of experienced professionals.

These efforts are bearing fruit, as seen in initiatives such as the setting up of a training session in December 2020 with senior civil servants at the request of the provincial government, which gathered 140 participants from various ministries. Further evidence is the upcoming 2022-2027 provincial sustainable strategy, which took circular economy into consideration in the consultation processes, and which will include strong CE references.

Change is a lengthy process, however, and transformational change takes even longer. The road for a real transition to occur remains long. As key players incorporate the principles of CE into their core missions, competition appears to be emerging between the strategies put forward by different actors, and may result in contradictory messages for practitioners as well as for the general public. It will be essential that the overall message remains clear, and that the hierarchy of strategies and approaches put forward follows the life cycle approach. Put differently, for optimized and timely results, it is essential that strategies that are concerned with reducing the resource consumption and preserving ecosystems are truly put forward. It is paramount to keep in mind that the best waste is the one that is not created.

> "Although a number of sustainable development actors still show some mistrust towards this new 'buzz word', the circular economy fosters strong interest from a variety of stakeholders. Vigilance is therefore necessary to ensure the cohesion of the message, and a reframing might be necessary to go back to the founding principles of the model, and not fragment its application according to its strategies".
>
> **Nicolas Girard,** CEO, *Fonds d'action québécois pour le développement durable*

To that end, different actors should join forces, as has been demonstrated in the narratives that have been shaped to fight against climate change. Communication professionals could create a space for dialogue or a CE-dedicated community of practice to further the work developed by the Communication Committee of the *Pôle*. This would allow the creation of common definitions, aligned key messages, pooled resources, and complementary strategies that create a larger impact together than any one communicator could achieve alone.

Endnotes

1 *L'économie circulaire: une transition incontournable – PUM*
2 *Métaux et économie circulaire au Québec*
3 Refer to Section II, Chapter 1, subsection 1.4.1 of this report
4 Refer to Section II, Chapter 1 of this report
5 A number of visual representations had been previously elaborated by researchers on *Campus Montréal*. This was the most accomplished graph, representing the co-development with practitioners.
6 ENV 832 – *Économie circulaire appliquée, Maîtrise en environnement (M. Env.) Gestion de l'environnement et économie circulaire*
7 Refer to Section III of this report
8 Refer to Section III of this report
9 Refer to "*Synergie-Québec* – Key components to building a community of practice about industrial symbioses" case study in this report
10 *Symbioses industrielles : Évolution des projets de Synergie Québec, Vecteur Environnement*, September 2019.
11 Refer to "*Synergie-Québec* – Key components to building a community of practice about industrial symbioses" case study in this report
12 Packaging ecodesign – A modernized portal to provide better guidance for companies https://www.eeq.ca/en/packaging-ecodesign-a-modernized-portal-to-provide-better-guidance-for-companies-2/
13 It will be released during the 2021 Edition of *Les Assises québcoises de l'économie circulaire*
14 Refer to Section II, Chapter 3, subsection 3.1 of this report
15 Refer to Section III, Chapter 2, subsection 2.2 of this report
16 Refer to Section III, Chapter 2, subsection 2.2 of this report
17 Refer to Section I of this report
18 Refer to Section III, Chapter 1 of this report
19 Refer to Section I of this report
20 *L'Économie circulaire, une transition incontournable* (PUM)
21 Walter Stahel was also awarded a Doctorate honoris causa by the *Université de Montréal* at the occasion of his visit on *Campus Montréal*. He also gave an interview to Radio Canada's *Téléjournal*.
22 *Formation en ligne ouverte à tous (FLOT) : L'économie circulaire, une transition incontournable*

SECTION 5

EDUCATING FOR A TRANSITION TO THE CIRCULAR ECONOMY

5

Disclaimer: Given the extent of initiatives having taken place in Québec since 2015, this report does not claim to provide the reader with an exhaustive review. It aims at featuring some of the key elements that contributed to initiating a transition to a circular economy in the province, in particular linked to the experience of the EDDEC Institute.

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INTRODUCTION

Informing and educating diverse audiences about the circular economy cannot happen overnight.

It is about a shift in economic paradigm, and a shift in business models. It is about a change in values and behaviors. It is about deeply rooting a transition towards a more sustainable and resilient society. Learning about circularity is only a little short from learning about revolutionizing our daily lives.

It requires academics, practitioners, and communicators to come together to research, understand, and showcase the benefits of this new economic model. But it also means educating next generations so that, instead of looking for ways to "minimize the bad" of linear economies, future initiatives in all sectors and businesses lead to real, meaningful sustainable development.

In Québec, the EDDEC Institute started this quiet revolution one step at a time, on *Campus Montréal*. The depth and scope of education offered has steadily increased over time. The road has been filled with exciting endeavors: from short guest presentations in existing courses to the development of for-credit graduate programs in universities, the creation of a collective book and the offering of one of the first francophone MOOCs on circular economy worldwide. The implementation of summer schools in turn allowed for the reinforcement of bridges between practitioners and researchers, as well as between students from diverse academic disciplinary backgrounds. In parallel, a number of professional training initiatives have been established, either single-handedly or as a result of partnerships, focused on a number of circular strategies.

These diverse training opportunities have meant that target audiences have gradually grown to be more educated about the circular economy. This chapter explores how the concept of a CE is making its way into academic circles and formal curricula, as well as other educational approaches that are happening outside of the walls of post-secondary institutions.

Through specific real-world examples, this chapter[2] emphasizes the importance of building circularity into existing educational frameworks, while also developing innovative new programs that meet the growing and evolving need for an education in circularity principles and implementation. Key successes and lessons learned are investigated so that academics and educators can learn from the Québec experience as they expand CE education in the rest of Canada.

Note: For the purpose of this report, activities like one-hour webinars or presentations have been considered informational sessions, and as such, are not the focus of the present Section.

MAIN **MILESTONES**

2014

- Launch of CE-oriented educational programs at *Polytechnique Montréal:* Microprogram in Circular Economy and options in the DESS in Sustainable Development as well as in the Master's degree in Industrial Engineering
- First edition of TD scholarships for students on *Campus Montréal*

2016

- Launch of the collective book "Circular Economy: An inevitable transition"[1]
- First edition of the annual EDDEC Institute CE Summer School

2017

- EDDEC Institute CE Summer School
- Summer Seminar "Circular + Social Economy & The City" *(Université de Montréal)*
- Launch of the SECE, a university-based conference exchange system on sustainable development and circular economy developed by the EDDEC Institute

2018

- EDDEC Institute CE Summer School
- First session of a new circular economy course at *Université de Sherbrooke* (ENV827 – *Projet appliqué en économie circulaire*)

2019

- EDDEC Institute CE Summer School
- Launching of the two first sessions of the first francophone MOOC on Circular Economy in North America, developed by the EDDEC Institute
- First Edition of the *Ville, territoire, économie circulaire* summer school *(Université de Montréal)*
- *HEC Montréal*'s Executive Education structure offers its first training on the CE, in collaboration with the EDDEC Institute

2020

- EDDEC Institute CE Summer School – First edition held online
- Third and fourth sessions of the EDDEC Institute MOOC on Circular Economy
- Launch at *HEC Montréal* of an undergraduate sustainable development Certificate program featuring a course dedicated to circularity

Acronyms are listed on page 12.

CHAPTER 1

RAISING INTEREST
CONNECTING WITH EXISTING UNIVERSITY PROGRAMS

As the EDDEC Institute was developing its research program on the circular economy[3], researchers and professors became increasingly aware of this new model and started to refer to it in their existing programs. Sustainable development departments as well as students' associations also provided a number of opportunities for students to get acquainted with the CE.

Raising interest on campus:

- Guest speaking opportunities
- Training resources
- Activities geared towards students
- Public conferences by visiting fellows
- Research scholarships for students

At a glance	
Polytechnique Montréal	• "Introduction to mechanical engineering", in MEC1110 Integrative project, undergraduate course, from 2015, for several sessions; • "Solid waste and residual energy", in the Chemical Engineering Department.
HEC Montréal	• "Sustainable development and management: issues and practices", D.E.S.S. in Sustainable Development; • "Responsible marketing" at the B.A.A. in Marketing (also offered in the blended option in Sustainable Development).
Université de Montréal (UdeM)	• Annual Environmental Forum, Specialized graduate diploma, D.E.S.S. in Environment and Sustainable Development • Intervention workshop (URB 6020), Master's Degree in Urban Planning

1.1 Guest speaking opportunities

From 2014 to 2019, invitations have been extended to the EDDEC Institute team members from universities on *Campus Montréal*[4], to present short sessions on the circular economy as guest speakers. Although the sessions mostly occurred in graduate programs related to sustainability, a strong interest was also emerging in engineering programs. At this early stage, the sessions bore a strong resemblance to elaborate information sessions rather than being formal training sessions.

Presentations to the Sustainability Departments of each university on campus also contributed to brainstorm ideas for the development of potential training opportunities within existing programs.

1.2 Training tools

The collective book "Circular Economy: An inevitable transition"[5] was provided to researchers and professors for inclusion in their recommended or mandatory readings for students. This book is part of a pilot project for the publication of open access digital books, in collaboration with the *Direction des bibliothèques de l'Université de Montréal*. The PDF and ePub formats are freely downloadable.

The production of this book was initiated and managed by the EDDEC Institute. A team of 47 researchers from *Campus Montréal* introduced the implications of a transition to a CE in their fields of expertise and disciplines, including the environment; industrial and chemical engineering; management; economics; geography; anthropology and philosophy. The book has also become a mandatory reading for the participants of the Circular Economy Summer School[6]. In an accessible language, over some 200 pages, the authors took stock of the need to turn towards a model that respects the planet's limits and contributes to the well-being of individuals and communities.

The book is divided into six sections:

1. Why the circular economy
2. Circularity strategies
3. Implementation modes: by value chains (agriculture, forestry, aeronautics, textile), by resources, by product, organization or in a given region
4. Actors mobilization, including ecotaxation, regulations and training
5. Existing tools and resources
6. Limits and ways to improve the model

1.3 Campus activities geared towards students

Sustainable development departments of universities on *Campus Montréal* developed a complete agenda for outreach activities geared towards students every year, and students' associations also organized yearly events. Those were often great opportunities to present the circular economy model.

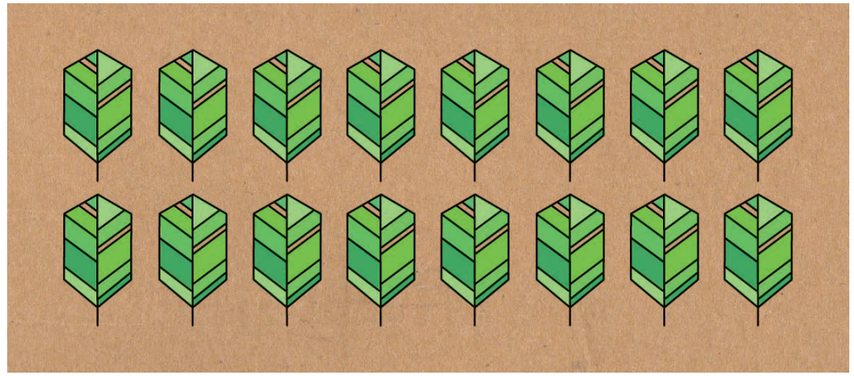
The EDDEC Institute also collaborated with the Students Roundtable in EDDEC to define joint programming between the student associations on campus and to pool their efforts. The *Douzaine du développement durable* was one example of the concerted initiatives and activities that were organized, allowing for the presentation of several circularity strategies. For example, in 2020 a *Réparothon (Repair Café)* was organized, featuring repair and maintenance strategies[7].

The Annual Environmental Forum organized in 2018 by students from the Specialized graduate diploma (D.E.S.S. in Environment and sustainable development) of UdeM offered another opportunity to introduce the circular economy model to students from various backgrounds.

1.4 Public roundtables with Visiting Fellows

Initiated in 2016, the Visiting Fellows program aimed at fostering international links between researchers on the subject of the circular economy with an interdisciplinary approach[8].

A total of six visiting fellows, experts in their respective fields, have given lectures as guest speakers in classes as well as participated in roundtables and conferences organized on *Campus Montréal*. These events allowed students to benefit from different perspectives on the circular economy and learn about its links to a sustainable development from international and interdisciplinary panels of experts.



Source: FAÉCUM, *Douzaine du développement durable* 2020

1.5 Research scholarships for students

Opportunities for financed research projects are one way to raise interest in students. The EDDEC Institute created two programs, but there are other scholarship programs that encourage entrepreneurship, like, for example, the Pierre Péladeau bursaries.

- **TD scholarship for Sustainable Development and CE**
  In 2015, as part of the financial partnership with TD Bank, an annual research scholarship program was established. The objective was to foster interest among professors who would supervise the work of undergraduate and graduate university students. Projects were submitted according to guidelines established by a multi-academic and interdisciplinary advisory committee. A strict selection process ensured that funded projects were clearly fostering interdisciplinarity in fields of research related to the protection of the environment, sustainable development, and the circular economy.

  When the program ended, 18 bursaries had received a total of $220,000.

Examples of CE-focused research projects

- Giving a second life to cardboard and glass containers – Upcycling using the skills of students from a variety of disciplines
- New ways of recovering the City of Montréal's waste – Production of waste-derived fuels through mechanical-biological biological treatment

- **The Collaborative and Performance Economy Laboratory *(Lab)***
  Thanks to the donation of $20,000 CAD from a private foundation, in 2018 the *Lab* attributed scholarships to collaborative economy research projects led by four Masters students and PhD candidates from *Université de Montréal, Polytechnique Montréal* and *HEC Montréal* who were co-supervised by interdisciplinary teams of professors[9].

On *Campus Montréal,* the EDDEC Institute also fostered the creation of interdisciplinary research projects and organized regular activities to mobilize the academic community at the student level. For example, a one-day research workshop gathered researchers and students to engage in dialogue on the future of the implementation of a circular economy in Québec[10].

- **Sponsoring entrepreneurship**
  The Pierre-Péladeau bursaries is a scholarship program created by the multinational Québecor in 1999. Québec entrepreneurs enrolled in graduate as well as undergraduate university programs, regardless of their field of study or of the sector of activity of their company, are awarded scholarships that aim to stimulate the creation of businesses in the province. The financial support is aimed at the start-up phase for innovative projects. Four scholarships of $100,000, $50,000, $35,000, and $15,000 are awarded each year, by a jury composed of members of the business community.

In the 2020 edition, two CE-oriented projects received prizes, in recognition of the work of *HEC Montréal* students:

- **Boomerang:** fighting against food waste by collecting brewing residues from microbreweries and spent grains
- **Évéa:** second-hand clothing rental service for babies and young children (0 to 4 years old)

CHAPTER 2

EXPERIMENTATION
INTEGRATING THE CE IN STUDENTS' PROJECTS

2.1 Integrated projects

Systemic thinking and interdisciplinary multi-stakeholder management are among the underlying values required for activating a circular economy. Introducing these into integrated projects has proven to be an excellent way for students to experience this firsthand. It enables them to learn by doing. Some programs include group projects, but this can be taken further by weaving mandatory projects across more than one program, or one university.

The following are some examples.

Northern communities

Following the 2018 CE Summer School, the EDDEC Institute was approached by a Nordic pole of innovation[11] to mobilize a multidisciplinary team of researchers to identify solutions for northern housing. A research project was put together. The project was informed with data sourced from *Campus Montréal* students' projects that occurred over the course of the year, and was implemented with 21 undergraduate students from *HEC Montréal* (management) and *Polytechnique Montréal* (engineering and industrial design).

Three themes were explored to identify resourceful solutions based on circular economy principles: the housing, food and mobility issues on the selected territory.

The PolyFab Normand Brais

An interuniversity and interdisciplinary study project was created on *Campus Montréal* in collaboration with the PolyFab Normand Brais on waste reduction of FabLab 3D printing. It aimed at developing a global strategy for managing the "waste" from 3D printing production (PLA [Polylactic Acid] and ABS [Acrylonitrile Butadiene Styrene]) and plastics processing. These explored the reduce, recycle, and reuse strategies as well as the collaborative economy approach. It won financial support of $4,500 by the *Polytechnique Montréal* Fund for Sustainable Initiatives. Students came from a variety of course backgrounds, including sustainable development and management, project management, economics, operations and logistics, and mechanical engineering.

The objectives were to:

- Optimize the use of resources in circulation, converting them into new material for a new production cycle
- Reduce waste at the source and at the end of use, via the deployment of a plastic shredding machine and a compression machine
- Evaluate the relevance of the implementation and the related return on investment
- Evaluate the potential use of these machines and processes in a collaborative economy with other laboratories and workshops of *Polytechnique Montréal*
- Evaluate the possible transposition of these scenarios on a larger scale (collaborative development with the various FabLabs in Montréal, the province and the FabLab network)
- Evaluate the possible recovery of several waste products from different sources on a local scale as a complementary initiative (plastic bottles, for example)
- Contribute to showcase examples of the circular economy implementation on campus

The students who partook in this initiative learned to apply a more systemic approach to their proposals. Being from diverse academic backgrounds, they also faced communication challenges that they had not envisioned, quite like what professional face while trying to implement circularity concepts and methods into their organization.

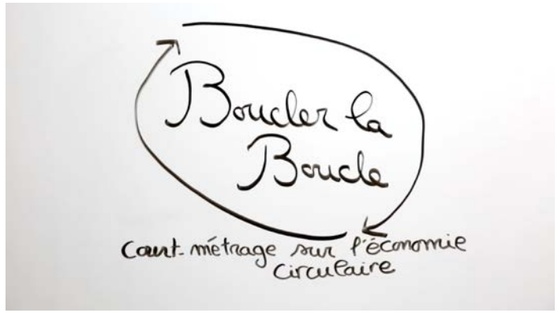
2.2 *Boucler la boucle:* A student-self-organized documentary

The academic project *Créateurs de valeurs* is led by *HEC Montréal* students. Its objective is to produce and broadcast a series of interviews that spotlight the visionary ideas of creators in the field of Sustainable Development in Québec. For example, in 2017, the chosen topic was Social Innovation.

For the 2018 edition, the students developed a short documentary on the implementation of the circular economy, showcasing four organizations. Under the supervision of Sasha Gadhiri, Associate Professor and Professor Emmanuel Raufflet (Department of Management, *HEC Montréal*), the 20 minutes documentary video starts with an introduction to the concept of a CE with Daniel Normandin (Executive Director, EDDEC Institute) and Sonia Gagné (Director, RECYC-QUÉBEC).

It showcases four strategies implemented by start-ups in the province:

- Re-use, with the transformation of food waste into gourmet food *(La Transformerie)*
- Repairing and reconditioning small electronics or clothing *(Repair Café)*



- Renting, with a service tailored to rent work and evening clothes for women *(Station Service)*
- Valorizing waste, with the use of spent grain from brewing for farming animal food *(Synergie Économique Laurentides, Le Baril Roulant)*

This short documentary was broadly promoted and has also been used as an introduction tool in classes. Some excerpts are included in the MOOC later led and developed by the EDDEC Institute.

CHAPTER 3

DEDICATED TRAINING PROGRAMS
SUMMER SCHOOLS AND THE MOOC

Education for the circular economy expanded over the course of five years from single sessions given in existing programs to outside of *Campus Montréal* with dedicated summer schools and a MOOC.

3.1 The EDDEC summer school

The EDDEC Institute joined forces with the Montréal Centre for International Studies, a community of scholars who study international affairs, to offer a summer school on the theme of the circular economy. The first edition of the "Circular Economy: An inevitable transition" summer school was held in 2016, and it has taken place annually since. Over 30 speakers, both researchers and practitioners, present their field of expertise in this 3-credit course.

Combining theory, scenarios, and case studies, this school allows practitioners, students, and researchers to:

- Understand the foundations and principles of the CE
- Know the main circularity strategies and understand their potential as well as related challenges
- Explore the deployment of circularity strategies at different scales (territory, sector, resource, organization, products)
- Identify the actors involved in the implementation of the CE, their needs, the obstacles they encounter and specific policy levers
- Know the main laws, tools and resources available to facilitate CE deployment (e.g. laws, eco-taxation, material flow analysis, ecodesign, reverse logistics)
- Reflect on ways to enrich this new economic model
- Network with a great number of diverse actors
- Visit the sites of some key actors in the circular economy in Montréal[12]

The fourth edition in 2020 was adapted due to the COVID-19 pandemic, and was delivered virtually over a period of three weeks, alternating days with synchronous sessions and days off. It piggy-backed on the momentum created by the recent first edition of the *Assises québécoises de l'économie circulaire*, as well as the launch of *QuébecCirculaire.org* hub, to offer real life examples for students to develop their end-of-program case study, such as *ÉcoScéno* (circular economy and culture) and Insertech (Maintenance and repair of IT equipment)[13].

Key success points

Based upon the evaluations received over time, the participants identified key areas of value:

- The diversity of backgrounds of the speakers and of the subject matter specialization presented
- Sessions with a restricted number of participants that supported more interactivity
- The hands-on aspect of the activities
- The choice of on-site visits
- The participation of professionals in the field, both as students and speakers
- The period selected to hold the summer school (May or early June)

A great success from its first edition: a **90%** satisfaction rate

The excellent reviews as well as the availability of the school online have led to an increase of attendees, and from 30 students initially, the summer school now accommodates some 50 participants, whether students or practitioners.

In 2021, the summer school will be held online, in collaboration with Professor Mathias Glaus, from ÉTS, the university which hosts the newly-created CERIEC.

3.2 Specialized summer school: Circular economy and cities

At the end of 2016, the Summer Seminar "Circular + Social Economy & The City", dedicated to the implementation of CE at the municipal level, was developed by *Université de Montréal*. It attracted a number of international students, via the International Forum of Public Universities, which brings together 21 institutions from around the world to share their strengths and exchange knowledge.

Building on the success of this event, a first *Ville, territoire, économie circulaire* summer school was held in 2019, and was delivered in three countries: Canada (Montréal, June 17-22), France (Paris, June 23-26), and Belgium (Bruxelles, June 27-30). This summer school was the result of a rich collaboration between the *Université de Montréal,* the EDDEC Institute, IFSTTAR[14], the *Université Paris-Est Marne-La-Vallée,* the *Université Libre de Bruxelles;* and the University of Geneva.

This interdisciplinary credit program aimed to initiate and train 40 international students in innovative methods for local implementation of the CE. Focused in the field, with many onsite visits and an immersive experience, it strongly promoted interdisciplinarity and allowed for a systemic approach of the complex issues surrounding the transition to a circular economy in cities.

Students had to shoot a five-minute documentary that aimed in particular to:

- Bring together cross-cutting and transdisciplinary themes on the implementation of the CE at a local scale
- Adopt a comparative perspective of the circular economy in the three cities visited

This activity proved to bring about decisive learnings for participants. Unfortunately, both the 2020 and 2021 editions were cancelled because of the COVID-19 pandemic.

3.3 The MOOC: A major step forward

This first francophone Massive Open Online Course on Circular Economy in North America was spearheaded by the EDDEC Institute and released for the first time in the spring of 2019.

This is the first project of its kind jointly supported by the *Université de Montréal*, *Polytechnique Montréal*, and *HEC Montréal*. It was developed over a year by a team comprised of a manager and a coordinator, and supported by two academic advisors specialized in digital learning environments. It also drew on a technical team for the production of video and audio content.

This free online course[15] is intended for students, professionals, or decision-makers working in public administration, business, or non-profit organizations. It is open to anyone in the world who can understand content presented in French. Participants can receive a certificate of completion.

The MOOC is organized into four modules:

- ***Module 1: Introduction to the circular economy***
  Environmental, economic, and social issues related to resources and our current linear production-consumption system. Principles and strategies of the CE.

- ***Module 2: New business models and opportunities***
  The key steps of a CE implementation plan in an organization. Motivations, steps, and potential benefits. Theoretical framework, and testimonials from business representatives.

- ***Module 3: Engaging your value chain***
  The principles of the CE in the context of a value chain. Issues, strategies, and initiatives applied within some key sectors (such as food, energy, metals, plastics, textiles, construction). The importance of inter-organizational collaboration across the value chain to circularize resources and practices.

- ***Module 4: Deploying the circular economy in a region***
  The primary role of the region in the deployment of the circular economy. Theoretical framework of urban planning and local economic development. Definition of the notion of region that is relevant for the CE. Tools for regional deployment as well as preferred strategies.

The content is provided through case studies, video clips and podcasts delivered by over 50 circular economy experts, business leaders, entrepreneurs and researchers from leading universities in Québec and Europe.

The MOOC aims at:

- Presenting how CE strategies can contribute to addressing growing resource issues
- Showcasing what economic, environmental and social benefits can emerge
- Underlining the benefits and challenges of implementing the CE model

Participants are challenged to develop a critical view of their impact and the role they can play in the transition to the CE.

As circularity strategies are implemented, research programs continue, and the concept of CE progressively becomes better known to a wider public, the MOOC will undergo modifications to adapt to the evolving landscape. Additional modules may emerge, focusing on some of the circularity strategies. It is the CERIEC who will be undertaking future development of the content.

3.4 Other initiatives

In collaboration with the members of its Training Committee, the EDDEC Institute developed an online lecture exchange system that allowed teachers from the three universities on *Campus Montréal* to "trade" an hour of lecture related to their expertise for an hour of their colleagues' expertise. The objective was for students to access knowledge and skills from several disciplines, something that proves often difficult in the usual monodisciplinary teaching. This "barter" did not involve any financial compensation and did not alter the normal teaching duties of the participants. This innovative pilot project and easy-to-use platform was launched in the fall of 2016. It was however discontinued due to a lack of financing required for promotion.

MOOC KEY FACTS

58 speakers and experts
99 videos and podcasts
4 editions
5,475 participants
60 countries represented
Over **30%** of participants are from Canada

COVID-19 impact

- 1,710 participants during the summer 2020 edition, an increase of 11% from 2019
- 92% satisfaction rate
- A slight increase in participants with college education or lower
- For many participants this course serves as a gateway to more meaningful careers

Lessons learned

- Learners expressed a desire for more practical and operational content, and suggested that themes could be further interconnected
- Opening the four modules at once was favoured as opposed to one module every two weeks
- It was shown that content must dig deeper into the implementation itself, as the CE gains traction with various audiences

CHAPTER 4

UNIVERSITY PROGRAMS
INCORPORATING CE AT VARIABLE SPEED

From having guest speakers presenting into existing courses to the development of dedicated programs, a number of universities have proven to be proactive. However, as creating new academic programs is a lengthy process that can span over several years, only a small number of CE-focused programs have been developed to date.

Nonetheless, a number of specific courses, varying in scope and target audiences, have been however introduced into existing programs in several Universities of Québec. Only the most preeminent ones are listed in this report.

4.1 Spearheading CE-focused education

While most universities in Québec were only getting acquainted with the principles of circularity, *Polytechnique Montréal* spearheaded the creation of programs focused on the circular economy as early as 2014.

Polytechnique Montréal

Polytechnique Montréal has created educational programs in circular economy, aiming for students to acquire knowledge in sustainable development, coupled with a life cycle perspective and an understanding of market rules.

A dedicated program was created: the Microprogram in Circular Economy (9 credits).

Options were also introduced in other sustainable development programs in order to offer a full academic undergraduate path towards CE education:

- DESS in Sustainable Development – option Circular Economy (30 credits)
- Modular Master's degree in Industrial Engineering – Circular Economy option (45 credits)

The academic path is intended for, among others:

- Students who have recently graduated with a bachelor's degree and who, after a first professional experience, wish to specialize
- Professional executives from private, public or parapublic companies who wish to complete their training

Most of the courses are offered in the late afternoon or evening in consideration of the time constraints of candidates who are already in the workforce.

Université de Sherbrooke

In 2018, the existing Master's degree in Environment course (graduate program) was adapted to include a new training curriculum on the circular economy. It aims to train professionals capable of mobilizing and coordinating actors within various regions in order to establish industrial partnerships and create collaborative spaces. This training is based on concrete cases proposed by organizations working on specific projects. Many graduates then work for Regional County Municipalities or municipalities to establish and develop synergies between businesses and organizations in the same region[16].

From 2018 to 2020, students who wanted to take the newly added course, "Applied Project in Circular Economy (ENV827)" had to first be registered to the Master's degree. The course was given during the Fall session only, and welcomed a total of 13 students in two sessions.

Since 2020 however, the course – renamed "Applied Circular Economy (ENV 832)"– is open to parallel admissions and the general public in continuing education. It welcomed 48 students in its first edition, demonstrating the importance of making it more widely available, and also leveraging the rising interest in the circular economy. Two cohorts were then formed, as the course started to be offered in the summer as well as the fall session. Being designed and facilitated as an online course from its inception, this offering is well adapted to the realities the COVID-19 pandemic has brought about in the academic world.

4.2 A developping trend in various programs

The circular economy model is also introduced in a variety of courses in a number of universities across the province, like Laval University, Concordia University and McGill University. Although there are no circular economy-dedicated programs available in those universities as of yet, they are paving the way to a better understanding and implementation of circularity principles.

Among the universities that have steadily increased the integration of CE-related courses in existing programs are *HEC Montréal* and *Université de Montréal*.

HEC Montréal

- Graduate studies courses were adapted[17] in the Microprogram in Management and Sustainable Development (15 credits), in the D.E.S.S., as well as in the Masters degree (45 credits)
- An undergraduate sustainable development Certificate program (30 credits) was launched for the 2020 fall session and features a course dedicated to circularity. The first edition welcomed 40 students
- An optional CE-centred course will be added in 2021 in both the D.E.S.S. and the Masters degree
- Via its Executive Education structure, *HEC Montréal* also offered its first training on the circular economy back in 2019, in collaboration with the EDDEC Institute

Université de Montréal

At *Université de Montréal,* the CE has been included in graduate programs, in particular in:

- The D.E.S.S. in Environment and Sustainable Development (30 credits), a collaboration of the Faculty of Arts and Sciences, the Faculty of Planning, the Faculty of Law and the School of Public Health. This program offers a balance between general interdisciplinary training in environment and sustainability (Anthropology, Chemistry, Communication, Demography, Geography, Philosophy, Psychology, Biological sciences, Political science, Sociology) and five options of specialized training
- The D.E.S.S. in Strategic ecodesign (30 credits), which is a unique program in Canada, developed in cooperation between the *Université de Montréal*'s School of Design and *Polytechnique Montréal,* with the support of *HEC Montréal.* It focuses on one strategy of the circular economy – ecodesign – through a multidisciplinary approach combining design, engineering, and management
- Specific courses, for example Life Cycle Analysis, Ecodesign strategies, and Economic factors of the circular economy

CHAPTER 5

NON-ACADEMIC TRAINING
FOCUSING ON STRATEGIES

The CE-oriented non-academic training currently proposed in Québec is, not surprisingly, more often than not strategy-focused since it is developed and facilitated by professional organizations according to their core mission and objectives. Aside from the training sessions developed by the EDDEC Institute with some partners, the majority of the training implemented in the province seems to have evolved around a number of selected strategies: ecodesign, industrial symbiosis, and recycling, some of which are featured below.

5.1. Training focused on the CE model

A number of half-days to one-day training sessions have been co-developed by the EDDEC Institute and its partners, and facilitated by the EDDEC team[18]. Examples include the Regional council for environment and sustainable development of the Outaouais' program *Synergie Outaouais*, the CTTÉI's training on symbiosis, and initiatives with the Québec section of the Solid Waste Association of North America (SQ-SWANA).

A session was also provided at the first engineering congress in CE in Québec, Conference at *Genium 360: Rencontres de génie 2018: L'économie circulaire et innovation*.

More recently, training sessions were also developed in collaboration with the *PME Montréal* network for its newly-hired employees, as well as a number of communities, municipalities, and Regional County Municipalities like *Vaudreuil-Soulanges* (with *Comité21*), the *Vallée du Richelieu*, and *Lanaudière Économique*. Training was also developed with *Territoires innovants en économie sociale et solidaire* (TIESS), to focus on the links between the cooperative business model and the circular economy.

5.2 Strategy-focused training and tools

5.2.1 Ecodesign

Boomerang
The *Institut de développement de produits* (IDP), in Montréal, focuses on ecodesign. Its flagship course is called Boomerang. The initiative is designed to create a mobilizing effect within an organization. It therefore requires a minimum of two registrations per company, for example one person from the marketing department and one from R&D department. The program includes action training with team work as well as a workshop to implement an action plan in the company. The program runs with five to six participating companies over a six-month period, and is comprised of three main steps:

1. Networking: 3 one-day workshops
2. Customized workshop: a half-day in-company
3. Networking periodic meetings

The initiative is based on 3 pillars:

1. **Identification and measurement:** Simplified LCA tool | Stakeholder expectations | Company and market context
2. **Analysis and innovation:** Environmental impact of a product | Development of prospective scenarios
3. **Deployment and improvement:** Responsible innovation strategy | Implementation of improvement projects

The training aims to help understand the benefits of reducing the carbon footprint, using a simplified life cycle analysis, exploring opportunities (such as cost reduction and raw material selection) and developing strategies for responsible innovation. Organizations can also obtain personalized coaching for certain projects.

> "Introducing ecodesign into companies is crucial, because this approach is very much upstream of the circular economy, which increases its impact tenfold."
>
> **Philippine Loth,** Project manager at IDP[19]

Eco-responsibility in the performing arts
The *Conseil québécois du théatre* promotes in its 2020-2021 training catalogue a dedicated program on ecodesign and ecoresponsibility with the organization *Écoscéno*. This training session aims to provide artistic directors, general managers, administrative managers, and scenic designers with concrete tools for dealing with environmental responsibility issues in their professional environment.

The first session should be held in 2021, and will aim to:

1. Question current practices and recommend alternatives
2. Present the principles of ecodesign, eco-responsibility and circular economy
3. Help identify levers to support the integration of these principles into practices
4. Help communicate better eco-responsible actions to the public and partners

"Do we need another package?"
ÉEQ published in 2018 the bilingual course manual in collaboration with UQAM at the occasion of the Competition Packplay 2[20]. It provides educational content on packaging ecodesign and includes a catalogue of the student projects submitted to the Packplay 2 competition. The book, which aims to be included on the reading lists of several design programs, provides an overview of the packaging development process – from materials selection to production, conditioning to distribution, and use to end of life – and highlights best practices. ÉÉQ has also developed a number of tools on the ecodesign circular strategy geared towards its members. In 2021, ÉEQ will participate in the development and delivery of a module on ecodesign in the new certification program on social impact strategies offered by Novae.

5.2.2 Industrial Symbiosis

In 2018, the CTTÉI and the CPEQ partnered to develop an Industrial Ecology training module: *Écologie industrielle, comment passer à l'action?* It consists of a guide as well as a PowerPoint presentation.

This training was developed at the request of the *Ministère de l'économie et de l'innovation* (MEI) and financed by both MEI and the *Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques* (MDDELCC). It was delivered to CPEQ member companies during a provincial tour, and was then made available online free of charge.

This training presents, in a simplified manner, the steps necessary to achieve synergies from the perspective of a facilitator, be it a regional development agency or an industrial ecology consultant. It is a roadmap on how to develop synergies. The steps are not detailed, so other complementary tools are listedin the training guide.

Objectives:

- Demonstrate the relevance of industrial ecology
- Create interest for synergies and industrial symbiosis among regions, industrial parks and Québec companies
- Provide tools for the application of industrial ecology

This training also allows identification of whether the company meets level 2 of the ICI ON RECYCLE! program of RECYC-QUÉBEC. Companies become familiar with a series of actions based on the 3RV hierarchy, i.e. reduce, reuse, recycle and valorize. The objective is to take stock of the company's practices and to identify possible improvements.

The training is divided into three segments:

- **Is your company doing industrial ecology?**
  General concept of industrial ecology. Testimony from a local company or a selected video. Different tools of industrial ecology, illustrated with concrete examples.
- **How to create synergies**
  Examples of synergies between companies in Québec. Companies identify their needs in raw materials, energy and resources (inputs) as well as their waste (outputs) in order to identify potential synergies. Various simple and affordable industrial ecology tools are presented.
- **Industrial Symbiosis**[21]
  Presentation of the concept. Relevance of the model. Local and international examples to help identify the issues and the major steps in implementing a symbiosis. Companies identify potential synergies among themselves thus creating the basis for a possible industrial symbiosis.

Each segment presents testimonies, concrete examples, training content, and practical exercises to facilitate the implementation of industrial ecology in companies.

A two-day training has also been developed, especially targeted to the symbiosis facilitators and initiators. The number of trainees can be up to 12 in each territory, and about 30 people are trained as an average per year.

Coming up in 2021: Moderation of an industrial and territorial symbiosis training program
In recent years, the number of territorial initiatives in circular economy as well as industrial symbiosis initiatives has been rapidly growing. Increasingly specialized methodologies have been co-created by the CTTÉI and *Synergie Québec*. This program will transfer to newly appointed local symbiosis facilitators the most up-to-date tools to support the organizations in their region.

5.2.3 Reduction

RECYC-QUÉBEC is committed to implementing structuring measures coupled with financial support for projects aimed at the prevention and reduction of residual materials at the source. As part of the efforts to achieve this commitment, the organization began with a major consultation exercise. A joint committee was formed, made up of some twenty representatives from various organizations: commercial, associative, institutional, municipal, and governmental sectors. This process led to the adoption of the first action plan devoted exclusively to the reduction of waste at the source.

The action plan focusses on three priority sectors:

1. The fight against food waste
2. Eco-management practices on construction, renovation, and demolition sites in the building sector
3. Sustainable solutions to disposable cutlery in fast-food restaurants and during events

As part of the tools developed, a data sheet was produced which presents the international context, Québec-specific data, influencing factors and trends, how to measure reduction, and initiatives supported by RECYC-QUÉBEC, as well as tips to reduce at the source.

A series of training sessions on the management of organic matter was also developed and toured the province in the summer and fall of 2019. This one-day training session was offered free of charge and aimed primarily to prepare municipal managers of small- and medium-sized municipalities to implement organic waste management activities according to their specific context.

5.3 Tool directories

Two main directories have been established in the province:

- **The *QuébecCirculaire.org* hub** refers to over 100 resources sourced both locally and internationally. An initial selection was done by the EDDEC Institute in 2018. The tools were categorized according to the level of change they implied or enabled within an organization. They also included turnkey tools, such as those helping to conceive of a business model that is compatible with a circular economy. Students were recruited to conduct this research and propose adaptations to Québec realities. Members of the Committee tested a number of tools in order to validate what adaptations would be relevant[22].

- **The *Fonds écoleader*** lists a great number of tools that are essential to transitioning to a circular economy. Several are sourced outside of Québec, but often are of Canadian origin – for example, tools from the National Zero Waste Council in Vancouver.

CONCLUSION

Research, communication, and education have to work hand in hand when it comes to presenting the concept of circularity to diverse audiences.

Just as researchers, and then communication specialists, had to stress the difference – and complementarity – of the circular economy approach to other concepts (like the blue economy, green growth, and sustainable development), professors and trainers had to embed new content in their courses, and adapt their lectures. These research studies and communication tools formed the necessary material upon which this new knowledge can be passed on.

The academic world evolves at a rather ponderous pace when it comes to creating new programs. It is interesting therefore to see how professors have found ways to implement creative adjustments in a relatively short period of time, as they themselves had to first gather sufficient knowledge and understanding of the circular economy, and then resourcefully integrate that knowledge into existing frameworks and academic structures.

In particular, interdisciplinarity and systemic thinking themselves – two concepts inherent to the implementation of a circular economy – are only slowly making their ways into academic circles, and from there into curricula.

Some might also argue that, unlike topics such as mathematics or history, the circular economy is a concept that is still in development, and that its boundaries, the potential rebound effects of some strategies, and the challenges the transition represents are being defined more clearly with every passing year. And that makes it all the more difficult to embed the basics into an existing program.

Research action seems paramount to foster education and a transition, with real applied projects for students. There is also a great potential to be tapped in educating young entrepreneurs on university campuses, as the circular economy presents many opportunities for innovation in diverse fields.

Other educational institutions must be involved in a global effort, and collaborations must be established. Jean-Philippe Harvey, an assistant professor specializing in metallurgy in the Department of Chemical Engineering at *Polytechnique Montréal*, stresses, "A lot of new processes are invented in universities, but it's often CEGEPs that train the people who will use them in companies, so we have to move forward together."[23,24]

As target audiences become more aware of the circular economy, in-depth specialized training must also be developed, whether in or outside of the academic world, and build upon multiscale experiences worldwide. This shall become the next step in the education for the circular economy in the province, and it should also be implemented beyond Québec's borders.

Endnotes

1 L'économie circulaire: une transition incontournable – PUM
2 For the purpose of this report, activities like one-hour webinars or presentations have been considered informational sessions, and as such, are not the focus of the present Section.
3 Refer to Section III, Chapter 1 of this report
4 The EDDEC Institute team was also invited to present the CE model in other universities in Québec.
5 *L'économie circulaire, une transition incontournable* (PUM)
6 Refer to Chapter 3, subsection 3.1 of this Section of the report
7 Refer to Insertech case study in this report
8 Refer to Section IV, Chapter 3 of this report
9 Refer to Section III, Chapter 3, subsection 3.2 of this report
10 *Économie circulaire : état des lieux et trajectoires pour le futur,* 2017
11 Refer to Section II, Chapter 3, subsection 3.2 of this report
12 Since 2020, the summer school has fully shifted online, and its format has consequently evolved
13 Refer to Insertech case study in this report
14 The French Institute of science and technology for transport, development and networks (Université Gustave Eiffel)
15 RECYC-QUÉBEC is a founding partner. A private Foundation also supported the initiative with a 30,000$ donation.
16 Adapted from *Revue Gestion*, December 2020, *HEC Montréal*
17 Refer to Section V, Chapter 1, subsection 1.1 of this report
18 Refer to Section II, Chapter 2, subsection 2.3 of this report
19 Adapted from *Revue Gestion*, December 2020, *HEC Montréal*
20 Refer to Section IV of this report
21 Refer to *Synergie Québec* case study of this report
22 Refer to Section II, Chapter 1, subsection 1.4.2 of this report
23 CEGEP is a French acronym that stands for *Collège d'enseignement général et professionnel*, known as a general and vocational college. They are public institutions and represent the first level of higher education, dubbed post-secondary education, in Québec.
24 Adapted from *Revue Gestion*, December 2020, *HEC Montréal*

CS1

CASE STUDY

SYNERGIE QUÉBEC

BUILDING A COMMUNITY OF PRACTICE AROUND INDUSTRIAL SYMBIOSES

Disclaimer: Given the extent of initiatives having taken place in Québec since 2015, this report does not claim to provide the reader with an exhaustive review. It aims at featuring some of the key elements that contributed to initiating a transition to a circular economy in the province, in particular linked to the experience of the EDDEC Institute.

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MAIN **MILESTONES**

1999
Foundation of the *Centre de transfert technologique en écologie industrielle* (CTTÉI)

2005
Collaboration with RECYC-QUÉBEC on a residual materials exchange platform

2008
Symbiose Bécancour, the home first industrial symbiosis project

2009
Synergie Lanaudière, the second industrial symbiosis project

2012
Addition of two new symbiosis projects (in Brome-Missisquoi and Kamouraska)

2013
Publication of the guide "Creating an Industrial Symbiosis"

2014
Addition of a new symbiosis project (Montréal)

Creation of the *Bourse des résidus industriels du Québec*

2015
The CTTÉI joins the *Pôle,* the Québec multi-stakeholder roundtable on circular economy

2016
Circular economy summer school, a first collaboration with the EDDEC Institute

First edition of RECYC-QUÉBEC's Call for proposals for the CE transition for financing industrial symbiosis projects in Québec (APTEC)

2017
Participation in the call for proposals for a transition towards circular economy (APTEC)

2019
Creation of Research Chair on Industrial and Territorial Ecology (CRÉIT)

Research article published in *Vecteur Environnement*

2020
Second edition of RECYC-QUÉBEC's Call for proposals for the CE transition (APTEC)

Acronyms are listed on page 12.

Overview of *Synergie Québec*

Created
2014

Led by
Centre de transfert technologique en écologie industrielle (CTTÉI)

Mission
Synergie Québec is a community of practice on industrial ecology and circular economy that unites industrial symbiosis projects, allowing them to connect across the province

Circular economy strategy
Industrial ecology

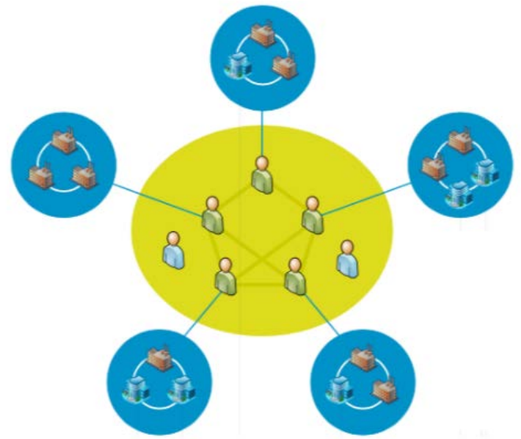
SYNERGIE Québec

Industrial ecology

Industrial ecology is a multidisciplinary approach that optimizes the use of natural resources in industrial processes. Seeking inspiration from natural cycles, where nature constantly reuses energy and resources, industrial ecology applies a similar principle to value chains and residual materials.

More specifically, industrial symbiosis is a network of businesses and collectivities that are exchanging materials, by-products, water, energy, and innovative practices. Industrial symbiosis may be autonomous or facilitated by a third-party agent.

In Québec, the *Synergie Québec* network brings together over 20 industrial symbiosis initiatives. The CTTÉI leads this community.



***Synergie Québec* community of practice**

- *SYNERGIE QUÉBEC* COMMUNITY OF PRACTICE
- INDUSTRIAL SYMBIOSIS
- BUSINESS (PRODUCTS)
- BUSINESS (SERVICES)
- FACILITATORS
- CTTÉI EXPERTS

Adapted from CTTÉI

Key Takeaways

Collaboration is key

- The desire to come together, work on common goals, and share knowledge led to creating the community of practice

Project facilitators keep the industrial symbioses alive

- They are the core of the community and play an essential role in industrial symbiosis projects

Long-term financing and financial security facilitate industrial symbiosis projects

- For their deployment and maintenance, industrial symbiosis projects need financial stability over time

Documentation of benefits and indicators are success factors

- Documenting industrial symbioses' impact is beneficial, as facilitators can use the data to share information amongst participating organizations, initiate collaborations, or secure financing

Being part of an industrial symbiosis helps to be resilient in uncertain times

- Project facilitators adapted during unprecedented times and played a crucial role in assisting organizations in getting quick access to essential materials to continue operations

CASE STUDY BACKGROUND

Industrial symbioses are strategic clusters of organizations that propel businesses towards sustainable practices by facilitating the exchange of resources, such as water, energy, by-products, and innovative methods. These exchanges of materials are called *synergies*. Industrial symbiosis brings economic, environmental, and social benefits.

Economically, businesses benefit from waste reduction, cost reduction in both materials and waste management, new markets for by-products, and networking opportunities.

Environmentally, there are reduced materials needed, as well as reduced impacts on natural resources, reduced greenhouse gas emissions, less waste accumulating in landfills, and lower risks of contamination.

Socially, new jobs and partnerships are created, with increased participation from stakeholders.

Industrial symbioses establish a network of businesses that can move towards sustainable practices by forging connections.

For over 20 years, the *Centre de transfert technologique en écologie industrielle* (CTTÉI) has provided innovative and practical industrial ecology solutions, becoming a circular economy leader in Québec. The goal of the CTTÉI is to use applied research to increase the performance of businesses and enliven communities.

This case study aims first to illustrate how the CTTÉI fostered a network of industrial symbiosis in Québec, and as a result, how circular economy loops were created and implemented. Early on, the CTTÉI has participated in industrial symbiosis projects to facilitate the management and recovery of residual waste from different firms' operations. In 2014, the CTTÉI created *Synergie Québec* to unite industrial symbiosis projects that had previously been operating individually. This allowed for various symbioses to connect across the province and constituted the birth of a community of practice on industrial ecology and circular economy. With its Research Chair on Industrial and Territorial Ecology (CRÉIT), the CTTÉI fuels some of the industrial symbiosis projects of *Synergie Québec.*

Through *Synergie Québec,* thousands of organizations have been brought together, allowing for the documentation of over 6,500 material flows.

In its second part, this case study profiles the conditions and tactics that created success in building a province-wide community of practice focussed on industrial symbiosis. It examines how the approach of project facilitators also contributed to the community's success. The need for long-term financing and the benefits of thorough documentation are also illustrated.

1. FROM STAND-ALONE ACTORS TO *SYNERGIE QUÉBEC*

1.1 The *Centre de transfert technologique en écologie industrielle* (CTTÉI)

Established in 1999, the CTTÉI was created thanks to a collaboration between the CEGEP Sorel-Tracy[3], the *Centre de recherche en environnement UQAM-Sorel-Tracy,* and six local companies from the region of Bas-Richelieu. Following their participation in the first "International Conference on Industrial Ecology" held in Sorel-Tracy, these key players wanted to set a course to implement sustainable practices.

In 2002, the CTTÉI was recognized by the *Ministère de l'Éducation, du Loisir et du Sport* (MELS) as a college-based technology transfer centre and, upon inception, its aim was to divert materials from landfills in order to reduce the environmental footprint of industrial companies[5-6].

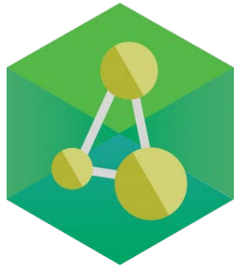
The CTTÉI is renowned for its expertise in industrial waste recovery, clean technologies, and industrial symbiosis. It has been supporting the technological and social innovations of businesses through research, assistance, information, and technical training[7].

Each industrial symbiosis project that the CTTÉI supports is carried out by an independent organization that leads an initiative in its respective territory. From the start, the CTTÉI's clientele has been quite diverse, including companies, municipalities, and industrial parks, ranging from SMEs to significant greenhouse gas emitters. Over time, the CTTÉI's mission has evolved into improving companies and communities' performance through research and development in industrial ecology.

THE CTTÉI'S EXPERTISE

INDUSTRIAL WASTE RECOVERY:
Identifying innovative outlets for residual material

CLEAN TECHNOLOGIES:
Creating treatment solutions that respect green chemistry principles



INDUSTRIAL SYMBIOSIS:
Developing and sharing innovative ways to increase the life span of resources by exchanging materials, by-products, equipment, or intangible assets

In 2005, the CTTÉI and RECYC-QUÉBEC collaborated on an exchange platform for residual materials called the *Bourse des résidus industriels du Québec* (BRIQ). A decade later, the service evolved to include members of the *Regroupement des récupérateurs et des recycleurs de matériaux de construction et de démolition du Québec* (3R MCDQ). Members were granted free access to this tool to motivate them find value in their construction, renovations and demolition (CRD) residual materials. While RECYC-QUÉBEC provided financial support to 3R MCDQ members, the CTTÉI offered them scientific support for two years. Managed by the CTTÉI, the exchange platform facilitated the interconnection of organizations and offered technical assistance to businesses to recover their industrial waste[9].

In the early 2000s, the CTTÉI also collaborated with the *Société du parc industriel et portuaire de Bécancour* (SPIPB) on a project to improve residual material management. Partnering with Alcoa and NI Corporation, the CTTÉI participated in the creation of the *Carrefour de valorisation des sous-produits industriels*. It is an organization aimed at optimizing the management of residual materials from companies in the industrial park of Bécancour[10]. In this early project, the CTTÉI was conducting assessments to estimate and map material deposits.

Symbiose Bécancour

Symbiose Bécancour became one of the CTTÉI's first projects when, in 2008, twelve businesses committed to sharing information about their activities, needs, and the materials they wanted to exchange within the Bécancour park. This allowed the CTTÉI to identify potential synergies. Throughout this project, the CTTÉI helped identify around 50 synergies between the industrial park's participating firms and provided training and technical support.

As a result of their participation, these firms are estimated to have saved $1,6 M per year and reduced greenhouse gases by 2,000 t CO_2-eq per year. The CTTÉI also suggested implementing complementary industrial activities to optimize the synergies within the territory, such as a paper plant, a biodiesel production plant, a cogeneration plant, and a lead transformer.

> **This first project also helped the CTTÉI identify critical steps in creating industrial symbioses and better understand stakeholders' interactions, such as between facilitators, organizations, and ministries.**

Synergie Lanaudière

A local development centre named the *Centre local de développement de L'Assomption* initiated an industrial symbiosis project in the region of Lanaudière in 2009[11]. This project was designed to offer businesses a new way to increase their productivity and environmental performance in the area. The CTTÉI's role in the project was to conduct assessments and help identify potential networks between firms in the region. Directed by *Lanaudière Économique*, the *Synergie Lanaudière* initiative allowed for the identification of 285 synergies within 158 participating businesses. From 2009 to 2013, the established material flows saved more than 130,000 tonnes of industrial waste. For the year 2018 only, *Synergie Lanaudière* created or developed 45 synergies gathering together 349 participating organizations. This represents savings of over $52,000 and a reduction of greenhouse gases by 380 t CO_2-eq within the region of Lanaudière[12].

By 2014, three more territories supported by the CTTÉI initiated industrial symbiosis projects in Québec[13].

At the time, the totaling five symbioses that were collaborating with the CTTÉI worked separately, and the CTTÉI team identified the potential benefits that a concerted approach would bring if they instead collaborated.

This is how, with the CEGEP Sorel-Tracy, the CTTÉI came to developing *Synergie Québec*, a network of industrial and territorial symbiosis projects in Québec.

Synergie Québec shaped up with each additional project, and the participating symbioses financed its creation.

Summary of the two first industrial symbiosis projects

Symbiosis project	Initiators	Type of site	Number of participating businesses	Number of identified synergies	Results
			From 2008 to 2013		
Symbiose Bécancour	*Société du parc industriel de Bécancour* (SPIB)	Industrial park	12	50	• Savings: $1,6 M per year • GHG reductions: 2,000 t CO_2-eq per year
			From 2009 to 2013		
Synergie Lanaudière	*Centre local de développement de l'Assomption*	Administrative region	158	285	Industrial waste avoided: 130,000 tonnes
			In 2018		
			349	45	• Savings: $52,000 • GHG reductions: 380 t CO_2-eq

1.2 *Synergie Québec*

Synergie Québec is a living laboratory dedicated to a network of industrial symbioses across the province of Québec. It is a network that promotes collaboration and co-creation, serving as a means to exchange resources, waste products, water, energy, innovation, and knowledge between businesses. Bringing together project coordinators and facilitators from the represented symbioses, the CTTÉI team encourages community members to meet in person twice a year to discuss their projects, joint issues, and best practices. Members are encouraged to find solutions for unmet problems within their group and help new community members get up to speed and easily make connections. To orchestrate the *Synergie Québec* community and facilitate the transition to a circular economy, the CTTÉI provides applied research services, workshops, tools, and communication support.

SYNERGIE QUÉBEC IN NUMBERS

22 symbiosis projects

850 completed synergies

2,700 participating firms

6,500 material flows documented

1.2.1 Early collaboration as a key factor for success

In the first symbiosis projects, facilitators identified potential synergies by analyzing the metabolism of different industrial actors, such as manufacturing companies from various sectors of activity, in order to see which materials could be exchanged within a territory. However, it became apparent that some of the participating firms would not implement all of the suggested approaches. A study conducted in 2014 shed light on the reasons why these synergies were disregarded[14].

The CTTÉI understood that technical and organizational constraints, such as contaminant sensitivity, the number of available materials, or authorization required by organizations' managers, needed to be considered early on. Inspired from the National Industrial Symbiosis Program (NISP) in the United Kingdom, the facilitators of the symbioses started to lead quick-wins workshops, where organizations' managers convened in-person to identify and validate preliminary synergies.

These workshops have proven to be very efficient. They allow the organizations to discuss materials they need and their residual materials directly with other firms.

LESSONS LEARNED

- **Not all the identified synergies will be implemented by organizations**
  Organization and technical constraints need to be taken into consideration
- **Leading quick-wins workshops is essential**
  These workshops allow organizations' managers to meet in order to identify and validate preliminary synergies themselves

Quick-win workshops

Source: CTTÉI

1.2.2 Tools supporting the implementation of symbioses

Three tools are currently made available to *Synergie Québec*'s members through a paid membership:

Online platform compiling each territory's data

The online platform offers decision-support tools for project facilitators to identify and compute data on each territory. Thanks to simplified accounting methods, facilitators can generate valuable information to monitor the symbiosis' performance. This information enables facilitators to provide powerful arguments to convince other organizations to participate in the symbiosis. This platform also helps identify potential synergies, such as the exchange of resources, including water, energy, residual matter, unsold goods, storage space, or workforce.

Greenhouse gas reduction calculator for industrial synergies

The greenhouse gases reduction calculator was developed under a research program of the *Fonds de recherche du Québec – Nature et technologies* (FRQNT). It helps to estimate the greenhouse gas reductions that occur when residual materials are exchanged. The CTTÉI team members validate the information that project facilitators input into the calculator.

A global system of indicators evaluating the outcomes of each symbiosis

The CTTÉI also offers a global system of indicators to *Synergie Québec* community members, which evaluates the impact of synergies one by one. Information compiled on the number of greenhouse gases avoided, the amount of water reduced, or the amount of material diverted from landfills provides information on the impacts of synergies in all spheres of sustainable development.

1.2.3 Analysis of the collected data

The CTTÉI analyzes the data collected by facilitators and publishes it in an annual report. The data is also made available in the *Recueil de Synergies*, a compilation of the facilitators' economic, environmental, and social development activities about the symbiosis projects they lead. Communicating accomplishments, constraints, and advantages of projects is integral to the success of *Synergie Québec*. It allows for mitigating certain risks, such as a lack of support from stakeholders, poor collaboration, or reluctance from certain firms to provide data.

Key Takeaways

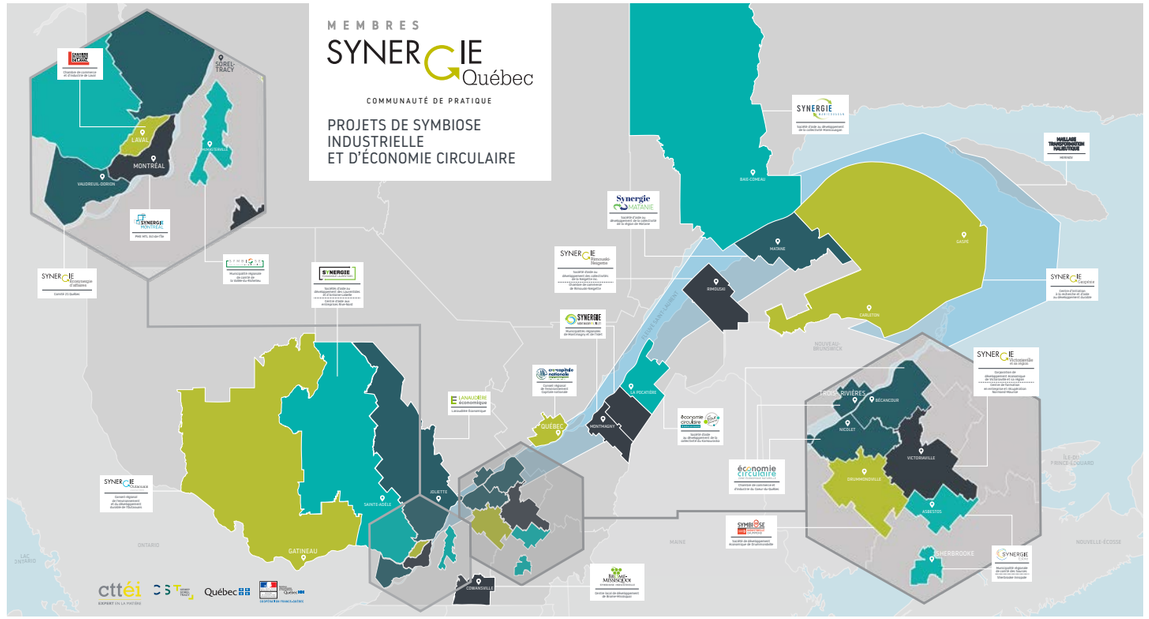
Communicating the results of a project, whether they reflect achievements or challenges, is part of *Synergie Québec*'s success. Communication allows the mitigation of certain risks, such as:

- A lack of support from different stakeholders
- Poor collaboration
- Reluctance from some organizations to participate in the project and provide data

1.2.4 Symbiosis projects in *Synergie Québec*

In 2020, *Synergie Québec* represented 22 symbiosis projects, 2,700 participating organizations, and 850 synergies in the province of Québec[15]. Alongside the constant growth of industrial symbiosis projects, there has also been a tendency for symbioses to merge. These mergers occur when multiple regions that already have a symbiosis start exchanging materials amongst each other. Working with a territorial approach, these symbioses' facilitators combine their strengths and efforts to develop new circular economy loops or expand existing ones. For example, three independent symbioses in Kamouraska, Matane, and Rimouski have merged under *Synergie Bas-St-Laurent*.

Map of the symbioses in the province*



*Two symbioses are not included in this illustration, as they were formed later. Source: CTTÉI

1.3 People at the core

Synergie Québec's network gathered a total of 50 facilitators in 2020. Project facilitators are essential to the operation of the *Synergie Québec* community, and they play a crucial role in the deployment of any symbiosis.

Facilitators:

- Create a collaborative environment in the symbioses by organizing activities that help raise awareness and educate industrial actors as well as regional ones
- Identify potential synergies, lead workshops, and carry out audits of the organizations they work with
- Guide the various stakeholders in the compliance process and in the project's technical, economic, social, and regulatory validation

> **"Taking into consideration human factors and relationships as well as providing support services are the core components of our approach and its success. From technical and scientific specialists, we have also become collaborative work experts."**
>
> **Claude Maheux-Picard,** Executive Director, CTTÉI

In the past, the facilitators had an engineer-type background in which methodical and analytical skills were paramount. However, over time, project facilitators' required profile has evolved and now includes greater interpersonal skills.

An open-minded and resilient attitude is key to fostering new connections. Project facilitators demonstrating solid interpersonal skills and a strong knowledge of sustainable development have stronger chances to succeed. Their responsibilities require them to be friendly and outgoing, with good public speaking skills, since they aim to unite people and compel engagement.

The CTTÉI does not participate in the recruitment of facilitators but suggests criteria for project leaders. The organization also offers training and provides each facilitator with guidelines and best practices.

"One of the interesting points regarding communities of practice is that all members are different. This is no exception in the *Synergie Québec* community, where the project facilitators have varied backgrounds and hold diverse positions in their respective symbiosis. Members do not necessarily see issues in the same manner nor share the same objectives. Contrasting perspectives help raise awareness of what is happening on a larger scale. It helps make us better practitioners."

Melissa Stoia, Director of Sustainable Development and Circular Economy at *PME MTL Est-de-l'Île* and Coordinator at *Synergie Montréal*

Project facilitators at a glance

2. FUNDING FOR LONG-TERM TRANSFORMATION

Since the inception of the first symbiosis project in Bécancour in 2008, various public organizations have participated in the development of industrial symbioses in the province by funding projects. These groups include the *Ministère de l'Économie et de l'Innovation*, the *Ministère des Relations internationales et de la Francophonie*, local economic development agencies, Canada Economic Development for Québec Regions (CED) and RECYQ-QUÉBEC.

Funding is generally allocated in the form of short-term funds, calls for projects, or action plans:

- From 2017 to 2019, several symbioses were funded thanks to the first edition of the *Appel de propositions pour la transition vers l'économie circulaire* (APTEC) of RECYC-QUÉBEC. This call for projects aimed to financially support industrial symbioses' facilitation to promote the application of the 3RV principle[16] in industries, businesses, and institutions. To the benefit of thousands of organizations and project facilitators, the first edition of the APTEC distributed $2.3M between 14 industrial symbiosis projects across Québec, of which 13 were members of *Synergie Québec*. In 2020, RECYC-QUÉBEC launched the second edition of the APTEC. It had a budget of about $2.9M and aimed to financially support well-developed organizations within symbioses to encourage a transition to the circular economy.
- Since 2017, the Regional Relief and Recovery Fund (RRRF) of the *Ministère des Affaires municipales et de l'Habitation* (MAHM) has supported many symbioses and development projects aligned with its regional priorities.
- In February 2020, the 2019-2024 action plan of the *Politique québécoise de gestion des matières résiduelles* was launched with a budget of over $100M. The plan includes five measures and 23 actions contributing to diverse CE strategies. One of its key proposals is to contribute to the deployment of a circular economy by consolidating territorial symbioses.

Many CE professionals believe that there is a need for a transition from short-term to long-term financing models. During the online World Circular Economy Forum held in September 2020, a common theme was the need for long-term financing to support projects and ensure their stability. For example, limited funding has led some *Synergie Québec* symbioses to lay off their facilitators due to budget constraints.

Since governmental objectives may change following an election, a framework needs to be established by the powers in place to ensure CE projects' permanence.

3. APPLIED RESEARCH AND THE CIRCULAR ECONOMY

CTTÉI's mission is to increase the performance of businesses and communities through R&D. Its team provides scientific and technical support to the *Synergie Québec* community. By conducting laboratory analyses or sharing its expertise, the CTTÉI supports the industrial symbioses' activities and processes.

3.1 Collaborating with circular economy actors

In 2015, the CTTÉI became a member of the *Pôle*[17], the multi-stakeholder roundtable on circular economy led by the EDDEC Institute. The organization later collaborated with other members towards defining the concept of CE. Partaking in various initiatives of the *Pôle* has proven very helpful in establishing industrial symbiosis as a vital strategy of a CE. It also helped in communicating to industrial organizations that the actions of CTTÉI form part of a concerted effort in their ecosystems and that complementary circular economy strategies could be implemented.

3.2 From climate change management to battery recycling

In 2017, the CTTÉI and researchers initially gathered by the EDDEC Institute collaborated to estimate potential industrial greenhouse gas reductions by applying strategies related to the circular economy. The collaborators issued a report where they presented an overview of direct industrial greenhouse gas emissions, a portrait of the leading industrial sub-sectors, and emissions reduction pathways[18].

In 2019, the CTTÉI put into practice its expertise in industrial waste recovery in a project mandated by the *Centre national en électrochimie et en technologies environnementales* (CNETE) to develop solutions for battery recycling. Along with other research centres, the CTTÉI also contributed to developing clean technologies to identify and assess Québec's greenhouse gas reduction potential in the industrial sector to establish circularity strategies for significant emitters in the province.

3.3 The research Chair: supporting synergies through research

Funded by the Natural Sciences and Engineering Research Council of Canada (NSERC), the CTTÉI has obtained a Research Chair on Industrial and Territorial Ecology (CRÉIT) in 2019. With a funding of $500,000 over five years, this Chair aims to deepen knowledge on circular economy. The team comprises professor-researchers and experts in engineering, computer science, economics, and social sciences[19]. Managed in collaboration with the CEGEP Sorel-Tracy, the CRÉIT supports Québec businesses' transition towards a circular economy by focusing on industrial metabolism, the emergence of industrial synergies, and territorial metabolism[20]. Strongly linked to *Synergie Québec*, the CRÉIT fuels different projects that the CTTÉI oversees and works on and, among other tasks, supports the facilitators of symbiosis projects with tools and information.

Private and public partners have been involved with the Chair's project from the start. Private partners are particularly interested in testing the developed tools in their operations. Their feedback is collected to fine-tune the tools and methodology and make improvements where necessary.

The CRÉIT also collaborates with the computer training program of the CEGEP Sorel-Tracy to create computerized tools. The CRÉIT contributed to many projects, such as:

- The creation of an industrial symbiosis within the CEGEP Sorel-Tracy
- The establishment of circularity indicators for CTTÉI projects
- The adaptation of the Material Flow Cost Accounting (MFCA), an environmental accounting instrument, to Québec context
- The creation of *Valoripédia*, a waste recovery database[21]

4. EDUCATION FOR THE FUTURE

Partnerships with educational institutions are critical to the CTTÉI's development. These relationships with specialized teams complement the more general expertise of the CTTÉI while providing educational institutions' laboratories with the opportunity to carry out applied projects .

The CTTÉI frequently collaborates with the CEGEP Sorel-Tracy, with other *Centres collégiaux de transfert de technologie* (CCTT) such as the *Centre d'étude en responsabilité sociale et écocitoyenneté* (CERSÉ) and the National Centre of Environmental Technology (CNETE), as well as with some universities such as the *Université de Sherbrooke*, the *Université Laval*, *Polytechnique Montréal*, *HEC Montréal*, the *Université du Québec à Trois-Rivières* and the Ivey School of Business.

4.1 Partnerships with educational institutions

With the CEGEP Sorel-Tracy, and in collaboration with the CRÉIT, Myriam Beauchesne, Professor of Human Sciences, studies CEGEP students' behavioral change and their perspectives on circular economy. At a college level, the CTTÉI is also working with the CERSÉ of the *Collège de Rosemont* to accelerate social responsibility innovation in organizations.

In the early 2000s, an ongoing collaboration has also been established with the *Centre universitaire de formation en environnement* (CUFE) of the *Université de Sherbrooke*, as part of the training of future environmental professionals[23]. More recently, the CTTÉI collaborated with the CUFE to create the conference *Rendez-vous de l'économie circulaire* that put into focus the local symbiosis called *Synergie Estrie*. This event, featuring brainstorming sessions and roundtables on selected CE strategies, concluded with a pitching contest where participants could win 15 hours of coaching for their initiative, provided by the CTTÉI[24].

Since 2016, the CTTÉI has provided yearly seminars on industrial ecology and symbiosis training during the EDDEC Institute summer school. In 2018, the CTTÉI and the EDDEC Institute also put together proposals for training within the symbioses network [25].

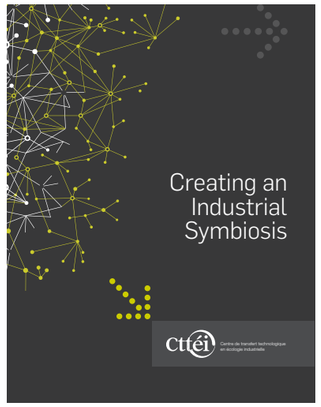
4.2 Gamification of industrial symbiosis

Targeting a college and university audience, the CTTÉI raises awareness with younger generations. Students engage in symbiosis "games" with simulated streams of residual materials, and through these exercises, they learn about the many complex aspects that make up a symbiosis. Students learn about different industrial symbioses through examples and experience social and organizational realities via simulations.

5. COMMUNICATING RESULTS TO MOBILIZE STAKEHOLDERS

5.1 From surveying to facilitating

The CTTÉI's role has evolved since its inception. To identify potential synergies, the CTTÉI's team used to conduct surveys and contact businesses to see what waste materials they wished to dispose of. The organization would also assess industrial companies' interest in using other organizations' residual materials in their operations. The CTTÉI no longer conducts synergy analysis due to the physical distance between the different symbioses and the importance of being locally present.

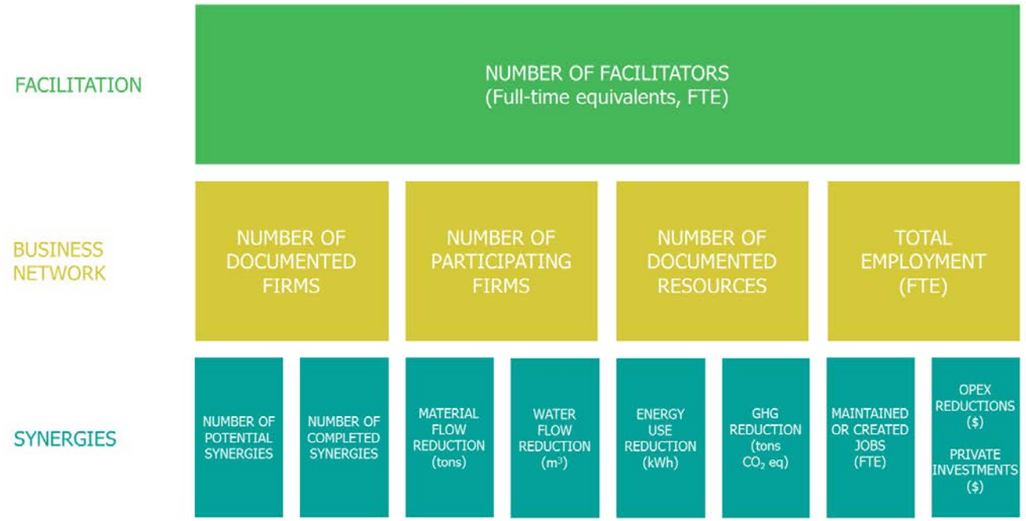


In place, the CTTÉI now provides facilitators with training, and the organization has developed a guide to Creating an Industrial Symbiosis. Launched in 2013, the guide is intended to help expand industrial symbiosis projects. The guide provides methodological and operational tools needed to undertake an industrial symbiosis project in the province, and it allows readers to learn from CTTÉI's experience. Each project is unique, but the many recommendations and resources proposed in the manual help users optimize their efforts and avoid missteps. Local organizations, such as regional municipality counties (MRC) and Community Futures Development Corporations (SADC), have a better understanding of their ecosystem and know how to conduct their analysis.

5.2 Selecting and measuring indicators

In 2015, *Orée*, a French association partnering with the CTTÉI, investigated ways to measure the impacts of industrial symbioses and their evolution. *Orée* developed two tools: COMETHE, a guide on implementing industrial symbioses, and ELIPSE, a system of indicators showing the performance of symbiosis projects and serving as a self-diagnosis. The latter comprises 61 indicators articulated in three points: multi-stakeholder cooperation, local wealth, and circularity loops. During a workshop held by ORÉE in Québec, project facilitators prioritized the indicators to create a version of the system adapted to *Synergie Québec* projects. The exercise led to the selection of 14 indicators to monitor industrial symbioses in Québec.

Performance indicators



5.3 Showcasing the benefits

Developing an industrial symbiosis project can be a lengthy process: it can take several months before forming working alliances. Part of the success of projects comes from communicating the results and showcasing examples regularly. It is essential to collect and document data that facilitators can use to share information with participating organizations, initiate collaborations, and obtain financing.

Looking back at their accomplishments in their first projects, the CTTÉI team realized that the benefits of industrial symbioses are not only economical, with benefits such as material cost reduction, waste management cost reduction, or new markets development for by-products. These benefits can also be environmental, with a reduced need for new extracted material, reduced impacts on natural resources, or greenhouse gas reduction. Organizations can also observe social benefits through increased stakeholders' participation, new partnerships, new employment opportunities, or an improved corporate image.

Realizing this helped the CTTÉI shape new narratives and contributed to the implementation of more significant projects as well as to identify future improvements to mobilize an increased number of stakeholders.

6. BUSINESS AGILITY IN TIMES OF COVID-19

Worldwide, 2020 was filled with challenges for society and economies. The CTTÉI was very agile to help businesses in the face of this turmoil. It played an essential role in the resilience and the economic development of industrial organizations by implementing new circularity loops and recovering residual materials. The *Synergie Québec* community members quickly adapted to face the scarcity of various items usually traded internationally. They were supported in their adaptations by the symbioses' facilitators.

When the pandemic started, organizations had urgent needs to meet. The symbioses' facilitators were quick in helping them get access to various materials. Some symbioses saw their roles change as they became experts in sanitary measures, and the symbiosis served as a social link between organizations, offering consulting services and training.

A distillery making alcohol-based hand sanitizers

Source: Distillerie de la Chaufferie

A striking example of an organization that quickly adapted to the pandemic is the *Distillerie de la Chaufferie* in Granby, which used its facilities and expertise to produce alcohol-based hand sanitizers.

Early in the pandemic, the *Distillerie de la Chaufferie* decided to use its primary input, rye, to meet the urgent need for disinfectant alcohol. The distillery wanted to do its part in the face of the shortage and joined forces with a group of distilleries to put pressure on Health Canada for approval of their hand sanitizer recipe. Health Canada approved their formula in less than a week, which would have taken months in ordinary circumstances.

Once the recipe was approved, their goal was to produce as much alcohol as possible and fast. Quickly realizing that rye wasn't the best material to generate such quantities of hand sanitizers in a short period, the distillery contacted its local symbiosis to find raw materials to prepare the alcohol. Ugo Forcier, Facilitator of the *Symbiose agroalimentaire Montérégie*, and Johanne Tanguay, Director of TransformAction, rapidly launched a call for proposals to find sweet components for fermentation.

In a few days, they received more than 50 offers of materials such as molasses, syrups, vegetables, whey, and fruits. The *Distillerie de La Chaufferie* chose to use the molasses produced by Gestion P.A.S, a solution that resulted in **a productivity gain of 30%.** With 17,000 liters of molasses, they were able to produce 9,350 liters of disinfectant. As a result, 24 tonnes of rye were saved, 6,9 t CO_2-eq of greenhouse gas emissions were avoided, and savings worth $7,500 were made[26].

"The service we received was more than we could have hoped for. Sometimes, we spoke with Ugo [the facilitator] three or four times a day; he was always available and motivated to find solutions to our needs. Now that the world has readjusted, there is not much demand for alcohol for hand sanitizers. However, we are still working with the symbiosis on another project we will be releasing in the next few months. We're thrilled with the help we've received from the symbiosis and the connections they have provided."
Vincent Van Horn, Master Distiller at the *Distillerie de la Chaufferie*

17,000 L OF REPURPOSED MOLASSES LED TO :

9,350	24	6.9	$7,500
litres of disinfectant produced	tonnes of rye saved	tonnes of CO_2 equivalent avoided	in savings

CONCLUSION

While the implementation of some circularity loops may seem intuitive and the setting-up of a symbiosis project seem straightforward, collaboration is paramount to its success. For various and diverse organizations to collaborate towards a common goal, exchange best practices, and share essential information, it takes more than convincing arguments such as the prospect of increased revenue or reduced costs.

Building a community of practice around industrial symbioses like *Synergie Québec* takes a deep understanding of a community and its ecosystem of actors.

Project facilitators play an essential role in the community since they bridge the gap between various industrial symbioses, supporting the organizations locally. They are the ones that keep the community alive, and their role is not to be underestimated. The combination of solid interpersonal skills and strong knowledge of industrial ecology makes them a vital component of the setting up and the success of industrial symbiosis projects.

Like for many industrial activities, a long-term vision is required, and for symbioses, this means stable funding for their development and maintenance. Given the recent pandemic, industrial symbioses have shown that agility and collaboration are crucial to innovation. This might be the last proof needed for governments to invest further in industrial symbiosis as an efficient way to transition towards a circular economy.

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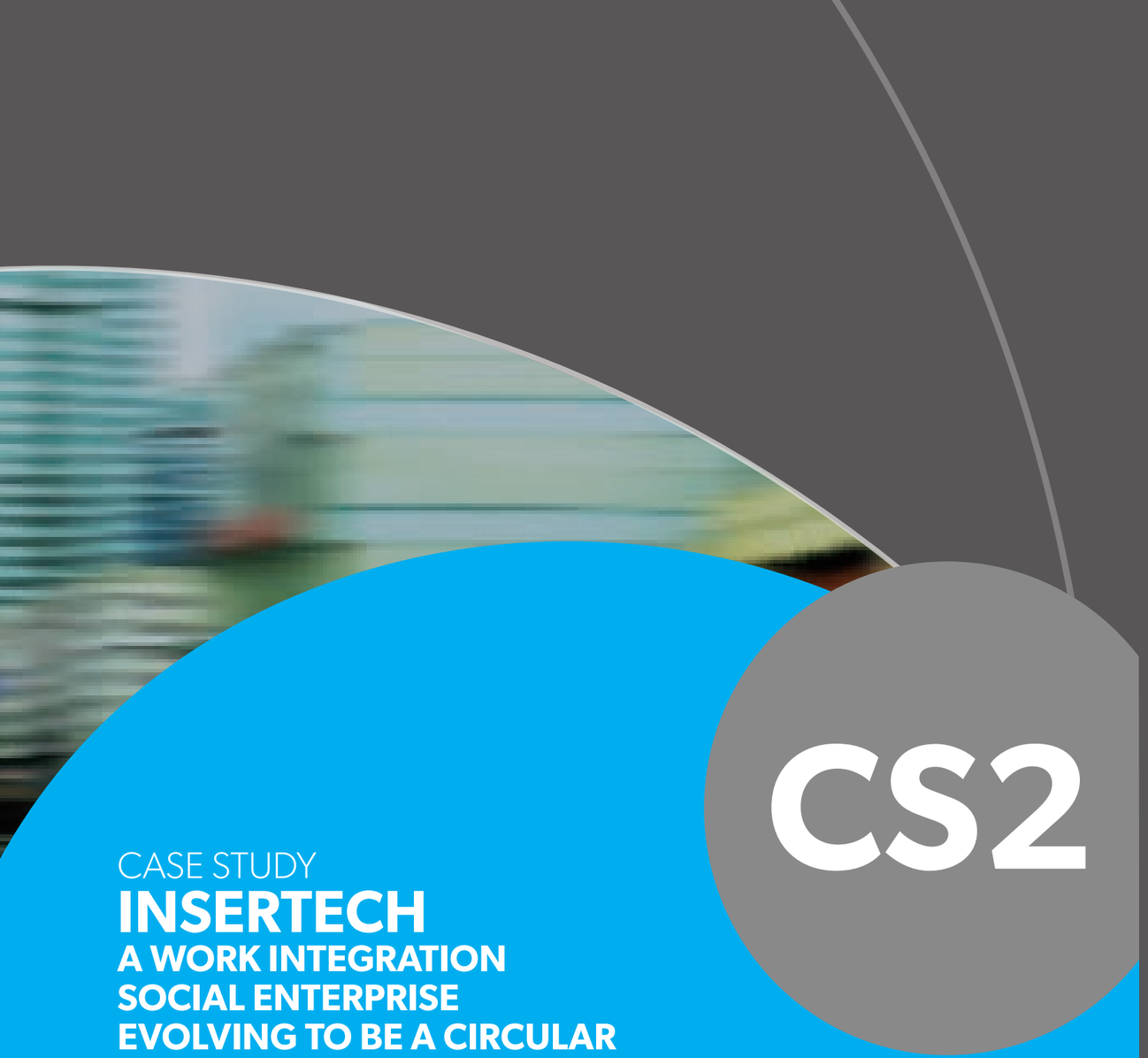

CS2

CASE STUDY

INSERTECH

A WORK INTEGRATION SOCIAL ENTERPRISE EVOLVING TO BE A CIRCULAR ECONOMY LEADER

Disclaimer: Given the extent of initiatives having taken place in Québec since 2015, this report does not claim to provide the reader with an exhaustive review. It aims at featuring some of the key elements that contributed to initiating a transition to a circular economy in the province, in particular linked to the experience of the EDDEC Institute.

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MAIN **MILESTONES**

1997
Creation of CIFER Angus, a non-profit social integration organization

1998
Start of CIFER Angus' activities

2000
CIFER Angus becomes Insertech Angus

Insertech Angus joins the *Collectif des entreprises d'insertion du Québec*

2001
Insertech is recognized as a Work Integration Social Enterprise (WISE) by *Services Québec*

2009
The development of an environmental systems certification process begins (ISO 14 001)

2013
ISO 14 001 certification obtained

The Regulation respecting the recovery and reclamation of products by enterprises comes into effect in Québec

2012
Electronics reuse and refurbishing standard approval by the Recycler Qualification Office, as a Reuser and Refurbisher

Insertech commissions the CIRAIG and the *Groupe AGECO* for an environmental and social life cycle assessment (LCA)

Insertech becomes a Refurbisher recognized by the EPRA-Québec program

2015
First *Réparothon* (also known as Restart Party)

2016
Deployment of an IT Service Centre for the Community

2019
Participation in the consultation by the *Office de la protection du consommateur* to revise the Consumer Protection Act

Acronyms are listed on page 12.

Overview of Insertech

Created[1]
1997 (initially named CIFER Angus)
Start of activities: 1998

Status
Non-profit social integration organization

Number of employees
25 full-time employees

Mission
Train unemployed young adults to refurbish IT equipment collected from other organizations and give a second life to unused materials such as computers, cellphones, and tablets

Circular economy strategies
Reconditioning, Responsible procurement and consumption, Rental and Maintenance and Repair

Funding partners
The Société de développement Angus (SDA), the *Corporation de développement économique communautaire de Rosemont-Petite-Patrie*, the *Collège de Rosemont* and the *Commission scolaire de Montréal*

Number of people trained
1,350 young adults trained since 1998

INSERTECH
TECHNOS ET ENGAGES

Reconditioning

Insertech's circularity journey started with applying the reconditioning strategy, which involves restoring IT equipment to an almost new and fully functioning condition. After collecting, transporting, and disassembling the products, their components are checked and cleaned to ensure they operate correctly and they are replaced when needed. After reassembling their parts, reconditioned computers are put back on the market[2].

Maintenance and repair

By maintaining and repairing IT equipment, Insertech extends the life cycle of electronic goods. Since the environmental and social impacts of goods are not always considered by manufacturers, repairing often costs more than purchasing a new similar product[4]. Insertech contributes to consumers' attitude change by offering technical services at its workshops, such as installation, maintenance, data recovery, and transfer.

Responsible consumption and procurement

The circular economy encourages responsible consumption and procurement initiatives by proposing new purchasing criteria focused on optimizing IT equipment. Insertech recognizes the needs of individuals and organizations whose devices have reparability issues and may be subject to premature obsolescence. Insertech also offers training on how to operate computers, cellphones, and tablets optimally[3], in order to extend their useful life. Furthermore, the organization encourages consumers to be mindful only to purchase what they need.

Rental

Insertech eliminates the unnecessary purchase of products used only occasionally by renting out IT equipment to individuals and organizations for a fixed period.

Key takeaways

Environmental values help organizations adapt and strive in competitive markets

- A solid ecological mandate is an asset that can lead an organization to position itself better in a highly competitive context like IT

A technological watch is essential for market adaptation

- IT companies must actively and closely monitor the technology industry to anticipate significant evolutions requiring the adaptation of their products or services

Circularity strategies are complementary to the efficient implementation of social missions

- The socially-oriented organizations that combine their mission with a CE approach may significantly impact all three sustainable development spheres, social, environmental and economical

At a consumer level, community events can encourage sustainable consumption

- Companies can organize free events in the communities, such as repair events, to encourage sustainable consumption and increase mutual assistance between participants and organizations

CASE STUDY BACKGROUND

A committee composed of 21 representatives from the business world, the non-profit sector, and public institutions, all came together to revitalize the *Technopôle Angus* sector in Montréal. Their goal was to bring social and economic prosperity back to an abandoned industrial site in Montréal[6] through an urban revitalization project.

The *Technopôle* is a social innovation lab that provides solutions to some of eastern Montréal's social issues, such as unemployment and poverty. As part of the project, the revitalization committee formed Insertech to promote youth integration in the job market.

Five fields of training were offered to the program participants joining Insertech: computer equipment assembly, electronics, office work, warehouse inventory management, sales, and customer service.

Image source: Insertech

The 26-week long program has the following features and benefits[7]:

- Employee status for participants who work 35 hours per week
- Supervision in carrying out the work
- Individualized psychosocial support
- Introduction to standard office tools
- Education on topics such as first aid, budgeting, and work standards
- Training on job searching or how to return to studies
- Training certificate by the *Ministère de l'Éducation*
- A follow-up to consolidate the acquired knowledge, two years after the end of the training

A social integration company

Since it combines a training mission with a non-profit economic activity, Insertech joined the *Collectif des entreprises d'insertion du Québec* (CEIQ), a group of work integration social enterprises. Member organizations of the CEIQ provide support to individuals facing severe difficulties in the job market and help them fight poverty and social exclusion. Insertech was officially recognized by *Services Québec* (then named *Emploi-Québec*) in 2001. This status allows Insertech to receive financial support from the Government of Québec.

> **"We looked at the dropout rates of young people in surrounding neighborhoods. Studies validated the socioeconomic needs of the area. It was rather intuitive for us to think that repairing computers would develop youth's skills and that it would be an interesting and socially useful activity for them."**
>
> **Agnès Beaulieu,** former General Manager of Insertech (1998-2021)

1. STRATEGIC ENVIRONMENTAL POSITIONING

As early as 2009, Insertech included an environmental-protection component in its mission. This was motivated by a desire to expand the scope of products and services offered. Furthermore, this environmental alignment was influenced by high competition in the IT equipment repair market and supply issues in repairable equipment. Although the organizational culture was already based on the social pillar of sustainable development, the Insertech team believed that this increased environmental focus would improve its strategic positioning.

A big step in this new strategic direction was to hire a temporary environmental officer, who led an assessment of Insertech's operations to implement an environmental management system. Among the deliverables:

- The team was trained on sustainability
- A green committee was created
- Working processes that help reduce the negative environmental impact of activities were implemented

To further its environmental protection efforts, the organization requested a life cycle assessment (LCA) on one of its products. It also had to comply with a new regulation that affected the electronic products industry in Québec[8]. Insertech also started building its reputation as an environmental leader by receiving many awards and distinctions.

> **"We became increasingly aware that our activities had environmental impacts. However, we knew we could improve in this area. That's when a shift in our perspective was initiated and when we realized that we were, in fact, truly implementing sustainable development."**
>
> **Agnès Beaulieu,** former General Manager of Insertech (1998-2021)

1.1 The impact of extended producer responsibility

When the Canadian Council of the Ministers of the Environment (CCME) adopted the Canada-Wide Action Plan for Extended Producer Responsibility in 2009, provinces and territories slowly started to implement an extended producer responsibility (EPR) approach. The purpose of EPR is to transfer responsibility for managing residual materials generated by consuming various products to the companies responsible for marketing them in a given location.

In Québec, the Regulation respecting the recovery and reclamation of products by enterprises officially came into effect in 2011. Even though this regulation requires companies to follow the 3RV hierarchy in selecting management options for their discarded electronic products, many organizations prioritize sending their old equipment to recycling facilities instead of finding a way to reuse them.

The Electronic Products Recycling Association (EPRA) is an industry-led and national organization operating regulated e-recycling programs in nine Canadian provinces. It manages the administration of more than 7,500 stewardship programs and provides access to over 2,500 drop-off locations for end-of-life electronics.

In the province, EPRA-Québec's activities show that businesses and customers prefer recycling over reuse. For example, in 2019, EPRA-Québec had collected 20,153 tonnes of end-of-life electronics, from which 18,602 tonnes were directed to recycling, and only 1,551 tonnes were reused[9]. With more than 90% of end-of-life electronics collected in Québec being sent to recycling, there remains room to raise awareness with companies and consumers to prioritize the hierarchy suggested by life cycle analysis.

Summary of collected end-of-life electronics in Québec

Source: EPRA's 2019 Annual Report

The introduction of this new regulation in 2011 disrupted the electronics market due to the new responsibility given to producers. With a strategic vision, Insertech obtained environmental standards certification such as the ISO 14 001 to pursue its activities when the EPR regulation would become official in Québec. Indeed, to continue benefiting from the market, small players like Insertech had no choice but to obtain environmental certifications in order to remain an outlet for companies who donate their IT equipment.

> **"If we had not integrated an environmental pillar into our mission, I think the organization would have died. I don't believe Insertech would have survived in the particular context instilled by the new regulation. We acquired our reputation by becoming leaders who were convinced that a circular economy brings value to society. Being circular has helped us attract partners, customers, and employees. It's an economic advantage."**
>
> **Agnès Beaulieu,** former General Manager of Insertech (1998-2021)

Regulation respecting the recovery and reclamation of products by enterprises

The regulation targets companies that market sub-products of five categories,[10] one of which is electronic products. These companies are mainly manufacturers or producers, owners or users of trademarks, and first suppliers. They are required to have a recovery and reclamation program for their products at the end-of-life phase or to be a member of an organization with a recovery and reclamation program.

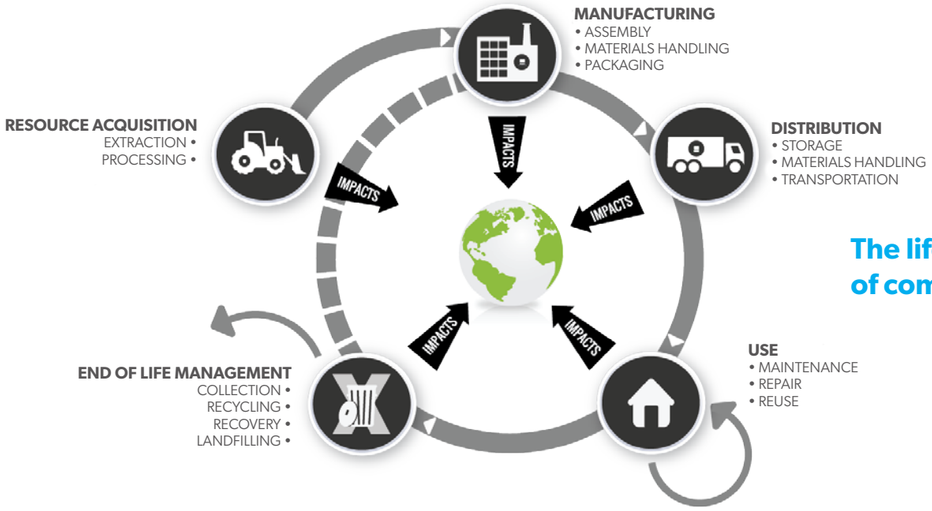
For companies opting for the second option, RECYC-QUÉBEC recognizes the Electronic Products Recycling Association Québec (EPRA-Québec) as the official management organization for the electronic products category. As stipulated by the regulation, the primary obligations of the targeted companies are to:

- Achieve the minimum recovery rates prescribed annually
- Set up a recovery structure (e.g., drop-off points)
- Respect the 3RV hierarchy in residual waste management methods
- Encourage local management of products
- Support information, awareness, and education
- Foster research and development in their sector
- Report on their activities annually to RECYC-QUÉBEC[11]

1.2 Life cycle assessment in favour of a reconditioning strategy

In anticipation of the upcoming new regulation regarding electronic products end-of-life management in Québec, Insertech contracted the CIRAIG and the *Groupe AGECO* in 2011 to conduct an environmental and social life cycle assessment (LCA)[12]. They analyzed two options for end-of-life computer equipment, namely reconditioning for reuse or recycling. The implementation of this new regulation required the 3RV hierarchy to be used unless researchers demonstrated that one method was superior to another from an environmental perspective. The study aimed to validate the 3RV[13] approach for used computer equipment and thus confirmed Insertech's strategic orientation towards the reconditioning strategy[14].

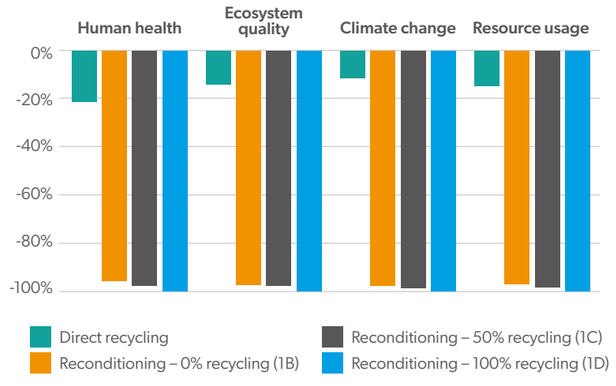
Members of the CIRAIG and the *Groupe AGECO* analyzed four scenarios, ranging from recycling to reconditioning, in four categories: human health, ecosystem quality, climate change, and resource use. The studies showed that the reconditioning options were at least four times more advantageous than recycling from an environmental perspective. The gap was even more significant in the climate change category, where reconditioning provided nine times more benefits than recycling[15].



The life cycle of computers[5]

Comparison of the scores of four scenarios of end-of-life management of computers

The reconditioning scenarios 1B to 1D take into account different rates of recycling at the ultimate end-of-life of the reconditioned equipment. The scenario 1A only involved direct recycling at the end-of-life of the computer.



Adapted from Brodeur & Fagen, 2011

Recycling versus reconditioning: environmental and social benefits comparison[16]

	Recycling	VS	Reconditioning
ENVIRONMENTAL	• Recovery of raw materials in limited supply, such as rare earth metals, precious metals, or plastics		• Reduction of raw materials extraction and consumption to produce new computers and associated environmental impacts • Extension of useful life of equipment • Availability to users with lower performance requirements or lower budgets
SOCIAL	• No data		• Integration of social programs for participants in the job market with related training programs

1.3 Reputation as a result of visionary decisions

Insertech received many awards for its environmental performance, among which the prestigious *Phénix de l'environnement* award in the waste management category. Issued by the *Ministère du Développement durable, de l'Environnement et des Parcs* (now the *Ministère de l'Environnement et de la Lutte contre les changements climatiques*), the *Phénix* are the highest environmental distinction awarded in Québec. They highlight actions aimed at the conservation and sustainable use of resources.

Over the years, Insertech has repaired thousands of IT units and avoided sending tonnes of materials to landfills. Between 2019 and 2020 alone, they reconditioned 7,430 equipment units and diverted 105 metric tonnes of electronic waste from landfills. More specifically, Insertech was able to recover 77% of the laptops it collected during this period. The company also generated 2.1 million dollars by selling reconditioned electronics and offering IT services.

Summary of Insertech's most reconditioned items collected in the Industrial, Commercial and Institutional (ICI) sector (July 1st, 2019 – July 1st, 2020)

	Quantity reused	Quantity recycled	Total quantity	Reuse rate
Computers	2,479	1,080	3,559	69.65%
Laptops	2,727	288	3,015	90.45%
Tablets	111	148	259	42.86%
TOTAL	**5,317**	**1,516**	**6,833**	**77.81%**

INSERTECH'S ENVIRONMENTAL AND ECONOMIC IMPACT FROM 2019 TO 2020[18]

7,430 units of equipment reconditioned

105 metric tonnes of electronic waste diverted from landfills

$2.1 million in revenue

2. ADDING CIRCULAR ECONOMY STRATEGIES

Initially, Insertech was mainly involved in wholesale deals to schools and organizations. Over time, the technology market slowly shifted from wholesale to retail sales. Insertech responded to these changes by opening a boutique where personalized service was offered. Despite renovations, Insertech's office in the Angus Locoshop was becoming too small for its needs, and so Insertech moved to a larger facility. Among other things, the relocation allowed the organization to increase its capacity to receive more people into its training program.

Insertech attracted more customers to its store with an enticing new space, and saw interest in having a one-stop-shop for all technological needs. In its new premises, the Insertech team launched its IT Service Centre, where it offers:

- An online shop with affordable delivery rates to anywhere in the province
- Collection services for companies in Montréal who donate equipment
- Repair workshops for computers, cellphones, and tablets
- Remote technical support
- Rental services
- Computer courses
- Personalized support for seniors
- Activities in the community[19]

Some of the new services offered in the IT centre involved circular economy strategies, which will be explained in this chapter.

2.1 Technological education: Combining digital inclusion with maintenance and repair

Realizing that some customer base segments were underserved, digital inclusion has become a critical focus area for Insertech. As a result, Insertech gears its products to disadvantaged local community members, such as families in need, seniors, or students.

Besides offering repair services in their *boutique,* the team also encourages community members to fix their own electronic items by participating in *Réparothons* (Repair Cafés). These show citizens that if they maintain their equipment well, they can extend its life. Furthermore, as an accredited training organization, Insertech offers online courses on using IT equipment, especially targeting the senior community.

Source: Insertech

2.1.1 *Réparothons*

Inspired by the Restart Party movement in London, Insertech launched its well-known *Réparothons* series in 2015. *Réparothons* are free community events where experienced volunteers help attendees to diagnose and repair their defective devices[20]. These events allow Insertech to expand its outreach and share knowledge about the CE repair strategy in the community. Insertech has successfully hosted over 50 repair events to date, and in 2020 alone, despite the pandemic, the organization hosted 13 classic *Réparothons* and organized five youth *Réparothons* in educational institutions, community organizations, and companies. By taking part in these events, participants learn how to use their IT equipment for a prolonged period and rethink their relationship with electronic devices.

2.1.2 Training for the community

Seeing that the senior population is an audience neglected by technology developers, Insertech offers seniors adapted training to increase their autonomy and help them out of isolation. To do so, Insertech created an online space for the elderly, where they can progress on IT equipment-related topics. The online portal *Espace Aînés* launched in September 2020 and offers introductory courses on using computers, tablets, and initiation on how to surf the Internet. The training has been very popular, especially since the COVID-19 pandemic has hit. Seniors had to rapidly learn how to do online tasks they weren't used to do, such as shopping for groceries by using an app or a website. From 2019 to 2020, Insertech has delivered 158 online classes and taught 2,250 seniors.

2.2 Encouraging responsible consumption

Insertech's staff does upfront education about the durability of electronic products and encourages consumers to make wise decisions when buying a computer, such as buying products adapted to their needs. The team also participates in several sustainability events to educate the community about the environmental impacts of their choices. For example, while at Montréal's zero-waste festival in 2018, Mr. Saad Sebti, Development Coordinator at Insertech, provided simple tips to maintain electronic tools. Among his recommendations to the public, Mr. Sebti suggested frequently cleaning dust out of computers, removing harmful software, optimizing the OS, replacing or upgrading some components, and saving data on hard drives instead of using the cloud, which consumes high levels of energy[21]. He described the proper maintenance of appliances and shared tips on responsible consumption.

2.2.1 Participation in a consultation on the Consumer Protection Act

Insertech participated in a consultation by the *Office de la protection du consommateur* to revise the Québec Consumer Protection Act. In this consultation document, Insertech outlined its perspective on the minimum service life of certain electronic products, the availability of spare parts, repair services, and planned obsolescence[22].

Source: Insertech

2.2.2 A free repair guide

Insertech makes free resources available to the public to help promote more responsible consumption patterns. In its guide[23] *Prolonger la vie de vos ordinateurs,* Insertech shows consumers how to improve the performance of their devices by adequately maintaining them. Detailed step-by-step instructions are also available on Insertech's website about software maintenance and product optimization[24].

Summary of recommendations offered to the *Office de la protection du consommateur*

The durability of household appliances

- Establish minimum operating times for household appliances
- Mandate warranties of reasonable duration

Repairability of goods

- Expand repair parts and services warranty
- Provide more information on the availability of repair parts and services
- Ensure no avoidance of obligations under the availability warranty
- Provide information on the irreparability of goods

Planned obsolescence

- Prohibit manufacturers from engaging in planned obsolescence

Other

- Educate consumers on obsolescence and repairability

3. COLLABORATING WITH COMPANIES

Companies that donate their computer equipment to Insertech are an essential part of its ecosystem.

3.1 Sourcing material: Variable input and flexibility

Donor companies vary in size and can be found in different sectors, such as agri-food or finance. However, the most important donors for Insertech are large organizations, either private or public, since the equipment they donate is usually of high quality and comes in large quantities.

When IT equipment reaches the end of its amortization period, large organizations often renew it. Some companies choose to donate their electronics to Insertech to give them a new life. Depending on the organization's size, this is usually done in batches, and a company may donate material to Insertech two or three times a year or not at all for one year.

As was the case with one of their major partners, the *Société de transport de Montréal* (STM), legal restrictions can complicate some partnerships. As a public entity, the STM was not allowed to give away an asset that still had value. Insertech and the Montréal transit company found a solution: Insertech destroyed the private data stored in the equipment for free, a task usually executed by a third party. In exchange for this service, the company would donate its equipment.

While some partnerships remain informal, Insertech is increasingly entering formal agreements with its partners, particularly regarding the confidentiality of stored data.

With teleworking on the rise due to the COVID-19 pandemic, many companies have equipped their teams with laptops while their desktop computers are gathering dust in the office. Currently, it is from these companies that Insertech tries to source its equipment.

Source: *Énergir*

> **"We had large quantities of computer equipment that was rapidly becoming obsolete, but that was not necessarily out of use. We were looking for a way to give a second life to our electronic products, and we quickly identified Insertech as an interesting solution for recovery. By donating it, we were simultaneously supporting a social integration company dedicated to young people's rehabilitation. It seemed like a win-win partnership."**
>
> **Maryse Lemay,** Senior Advisor in Sustainable Development and Community Involvement, *Énergir*

3.2 An evolution towards training

Insertech understands the value of impactful communications, and has a strong presence on traditional and social media. It implemented outreach campaigns geared towards private and public organizations to entice them to give greater importance to their equipment's second life rather than sending it to recyclers to be destroyed. As demonstrated by a recent campaign released on Earth Day 2021, Insertech focuses on raising awareness among businesses by conveying the message that "reuse is the future." This campaign aims to encourage companies to contribute to the economic recovery and have both a social and an environmental impact by promoting the reuse of their equipment.

As needs evolve and organizations start to show interest in maintenance and repair, Insertech also intends to promote consumption reduction among organizations. Discussions are currently underway with some partners to have Insertech train their team. Once more, Insertech may have to adapt to the evolving market and readjust its services and products accordingly.

> **"We are assessing how Insertech could help STM to upgrade computers instead of replacing them. [In the report we received], we saw that Insertech was able to give 80% of our equipment a second life. For the STM, this equipment could also be useful […]. We are looking at this kind of partnership for the future."**
>
> **André Porlier,** Corporate Manager of Strategic Planning, Sustainable Development and Universal Accessibility, STM

Source: Insertech

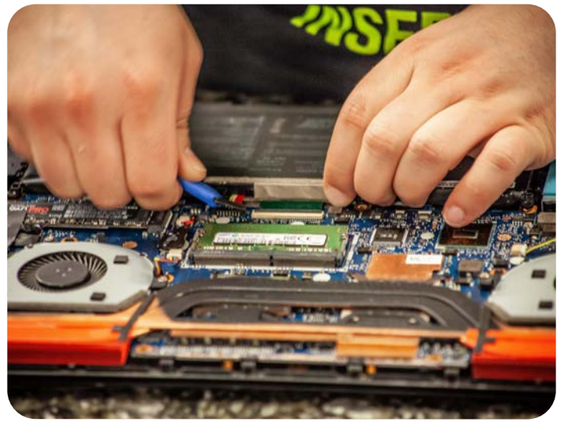
4. WORKING WITH THE COMMUNITY: A SOCIAL TWIST TO THE CIRCULAR ECONOMY

Insertech's vision is to embed further social aspects into the circular economy. To do this, the organization wants to foster collaboration between all community members, from senior citizens to young people, in its work integration program or its community of practice.

To increase community involvement, Insertech intends to make its store more accessible with extended hours, increase its impact with its *Réparothons* and other events for the community, as well as establish more activities between youth and seniors. These activities will reach several hundred people. The goal is to have community members become ambassadors for Insertech among their friends and family.

Concretely, Insertech wants to encourage the community to purchase recovered electronics to reinforce the circular economy. Each year, approximately 45 youth from the insertion program participate in the community-based technology literacy and repair assistance activities at the *Réparothons*. These activities help them develop skills and an increased sense of citizenship. Activities were cancelled in 2020-2021 due to the pandemic.

Insertech is currently reflecting on ways to encourage the community to be more responsible and inclusive with the use of technology.



Source: Insertech

5. BECOMING AN ESSENTIAL SERVICE DURING COVID-19

In 2019 and 2020, Insertech maintained its work integration program for young people and kept practicing its commercial activities. In record time, the company adapted its facilities and operations to comply with public health regulations. Because the government identified it as a priority company due to the nature of its mission, Insertech never had to close its doors during the health crisis.

5.1 Scaling up: From on-site training to online programs throughout Québec

The pandemic proved to be a technological challenge for Insertech. The organization had to transfer its training online, which made it accessible throughout Québec. Since then, groups are filling up quickly, and Insertech can no longer keep up with the demand. The organization is considering hiring trainers to offer its program to a larger audience.

Seniors have also become a new target audience, constantly on the rise. The pandemic has widened the gaps between those that adapted to an increasingly online world and those that did not. Insertech is working to address this new challenge.

5.2 Technical support for companies

The temporary pandemic-related lockdowns contributed to Insertech's new role as a remote technical support service. With the help of the City of Montréal, Insertech launched a new service to help small companies implement telework safely. Companies have turned to Insertech to assist their employees in operating their devices at home while teleworking.

5.3 Increasing demand for equipment

Insertech has also seen an increase in repairs and sales as the demand for low-cost devices and services has seen considerable growth. The company improved its repair expertise to meet the urgent needs of teleworkers, students, and small businesses. It upgraded its sales activities online and started offering remote technical assistance to comply with public health regulations.

However, as companies were closing down or activities were running slower, it was difficult for Insertech to source equipment, which became a tricky challenge. As often in the past, the organization was resilient and started repairing everything it had in its warehouse. This allowed the organization to respond to the increasing demand.

Source: Insertech

6. PLANNING FOR THE FUTURE

Technological developments are constant, and Insertech needs to keep up with the latest advances. It has a team dedicated to keeping an advanced watch on technology, especially by following new software and hardware developments. Under the direction of a new General Manager since February 2021, Marie-France Bellemare, the team is currently preparing a strategic plan for the future of Insertech.

Insertech also wants to open its doors to more technology enthusiasts, such as engineering students. It would be interesting for the organization to find a way to bring together these tech professionals with the young people in its program. Furthermore, the company would like to lead the conversation on green technology and gather several organizations with similar concerns to join the movement.

> **"It appears to me that Insertech has a tremendous understanding and knowledge of information technologies, their uses, and the environmental impacts linked to them. If we want to pursue our mission and increase our positive impact on the life cycle of equipment, this expertise must now be made more accessible to others. Developing service-oriented consulting on technological choices would be an interesting niche to explore."**
>
> **Marie-France Bellemare,** General Manager at Insertech (since 2021)

CONCLUSION

Insertech has a global approach that makes it stand out: it is the only work integration social enterprise that implements circular economy strategies with such an inclusive approach in Québec. As its initial social mission has evolved to include environmental impact mitigation, Insertech has become a circularity pioneer.

Flexibility and creativity have been at the core of this organization's success in the ever-evolving IT world. The new regulation on electronic product end-of-life management has brought many changes in the province, but it only reinforced the initiatives Insertech had already spearheaded. By including more circularity strategies in its business model, the organization endeavours to change the way individuals and companies use, and dispose of, their electronic equipment.

Insertech works at the heart of a community, and the community is at its heart. The values of mutual aid and collaboration are the essence behind its mission and the services it proposes: *Réparothons*, online training, or other resources made available to all, free of charge. The combination of its vision and its resilience puts Insertech at the forefront of the transition to a circular economy.

Endnotes

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9 EPRA (2020). EPRA Annual report 2019. https://epra.ca/wp-content/uploads/annual_reports/english/2019/?page=1

10 Oils, antifreeze, coolants, containers and filters, and other assimilable products; mercury lamps; paints and their containers; batteries; electronic products.

11 RECYC-QUÉBEC (2019). *La responsabilité élargie des producteurs.* Retrived from https://www.recyc-quebec.gouv.qc.ca/sites/default/files/documents/fiche-info-rep.pdf

12 The LCA's functional unit was to manage a thousand computers or CRT or LCD screens in their end-of-life phase from the industrial, commercial, and institutional sector.

13 Reduce, Reuse, Recycle, Valorize.

14 Brodeur, C. & Fagen, S. (2011, April 6). *Rapport d'analyse détaillée : Analyse du cycle de vie environnementale et sociale de deux options de gestion du matériel informatique en fin de vie*. Retrieved from https://www.insertech.ca/wp-content/documents/rapport-acv-2011.pdf

15 The study assumed that the reconditioned equipment replaced new components that would have been purchased if not reconditioned.

16 Adapted from Brodeur, C. & Fagen, S. (2011, April 6). *Rapport d'analyse détaillée : Analyse du cycle de vie environnementale et sociale de deux options de gestion du matériel informatique en fin de vie.* Retrieved from https://www.insertech.ca/wp-content/documents/rapport-acv-2011.pdf

17 Data provided by Insertech. Items are recycled only if they cannot be reused. This table covers some devices only, not all.

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