BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY (BCIT)

STRATEGIC RESEARCH PLAN SUMMARY

BCIT'S RENEWED VISION AND MISSION

VISION: Empowering People. Shaping BC. Inspiring Global Progress.

MISSION: Partnering Learners and Industry for Success through Workforce Development.

With our renewed vision and mission, we are reinforcing our focus on what sets BCIT apart: applied education and integration with industry. We are also challenging ourselves to be more ambitious, more purposeful, and more integrated. We are strengthening our commitment to improving the lives of the people who learn and work at BCIT. We are highlighting our intention to help build new capacity and fuel regeneration as British Columbia adapts to sustain its edge as a place to live and work. We are looking further afield to our ability to lead positive change through the contributions of our alumni and researchers to economic, social, and environmental ventures across the world. At BCIT, we strive to:

- **Achieve excellence:** We strive to achieve excellence in everything we do and to accomplish real and measurable results.
- **Embrace innovation:** We embrace innovation, ignited by imagination and creativity, to improve our approaches, opportunities, and outcomes.
- **Champion diversity and inclusion:** We champion diversity of experiences, ideas, cultures, and perspectives, fostering a community permeated with equality and inclusivity.
- **Pursue collaboration:** We believe in the power of collaboration to amplify our efforts.
- **Engage with respect:** We work from a position of respect for others' expertise, insight, and inherent worth, and we reflect a respect for future generations in our passion for sustainability.

Reconciliation at BCIT

BCIT is located on the unceded territory of the Sḵwxwú7mesh (Squamish), səlilwətaʔɬ (Tsleil-Waututh), and xwməθkwəy̓əm (Musqueam) First Nations. BCIT has been educating and inspiring students for over half a century on their traditional lands and for that, we are grateful. We acknowledge that the relationship with Indigenous peoples in Canada has been troubled and must be reconciled; we are deeply committed to doing our part.

We are guided by the *Truth and Reconciliation Commission's Calls to Actions,* the *United Nations Declaration on the Rights of Indigenous People,* and the *Aboriginal Post-Secondary Education and Training Policy Framework and Action Plan: 2020 Vision for the Future* by the British Columbia Ministry of Advanced Education, Skills, and Training. Reconciliation and Indigenization are priorities for BCIT, and we appreciate our relationship with Indigenous peoples at all levels, across all campuses, throughout the province, and beyond.

We have developed the Strategic Plan in parallel with the formalization of BCIT's Indigenous Vision. The two are mutually reinforcing; together they provide a framework for action and accountability.

Our Strategic Commitments

We have articulated three commitments that represent our primary areas of activity and our accountability to BCIT's primary stakeholders: our learners, our faculty and staff, and our partners. We are intent on being **a people-focused organization** that delivers **future-proof applied education**, amplifying our impact through **globally relevant connections**. These create the structure of our Strategic Plan.

Putting **people** at the core of everything we do is paramount. Our mandate is to educate people, and the people with whom we work are what make BCIT distinct. In a world characterized by uncertainty, we must ensure that BCIT is a place in which all people – learners, faculty, and staff – are continually developing, while feeling valued, supported, and connected.

A focus on **applied education** at all levels of credentialing is what differentiates BCIT from most of our peers. We combine theory and practice in a way that enables our learners to leave BCIT confident and able to have an immediate impact in their work. We must continue to evolve our methodologies to stay ahead of the needs of industry, and we must nurture an environment in which learners and faculty thrive.

Our **connections** beyond BCIT — with industry, peers, and government — strengthen us as an institution. Our

community is enhanced by connecting and supporting learners and employees with different perspectives and experience, whether from within British Columbia or around the world. We live in a world in which partnership is increasingly a requirement for success; BCIT must build and sustain those collaborations that propel us forward, individually and collectively.

Threaded through these commitments is a passionate belief in – and institutional focus on – sustainability. We must support our people with processes and systems that facilitate sustainable ways of working. We must design spaces and facilities that advance the health of the environment and manage them accordingly. And we must work tirelessly with our partners to promote and enable sustainable industry and community practices through our academic and operational endeavours.

Strategic Research Plan Core Objectives

Objective 1: ***People-focused research*** **–** Enhance and expand research at BCIT by fostering and supporting new and existing student and faculty researchers and research programs.

Aims:

1. Strengthen support and services for researchers and research trainees to promote success;
2. Invest in BCIT students and faculty professional development to advance our state of practice and encourage a dynamic culture of research; and
3. Support applied research as a driver to attract and retain excellent faculty, students, and research trainees.

Objective 2: ***Future-proof applied research and research training*** **–** Foster trans-disciplinary research at all levels to advance the state-of-practice in industry while increasing faculty and student knowledge and career readiness.

Aims:

4. Redesign processes, systems, and structures to enhance our agility and effectiveness and to embed sustainability in our research endeavors;
5. Anchor BCIT as a leader in multidisciplinary and integrative research methodologies that ensure job readiness and career mobility; and
6. Cultivate exceptional, diverse, and inclusive research environments and communities through technology and sustainable campus development;

Objective 3: ***Globally relevant research collaborations and partnerships***

- Collaborate with other academic, institutional, and industrial partners to maximize research benefits by taking advantage of the combined knowledge, skills, and infrastructure these partnerships bring; and
- Maximize the economic, educational, and academic benefits of applied research by creating and sustaining effective collaborations that yield the greatest societal value and mutual benefits.

Aims:

7. Infuse Indigenous knowledge and practices throughout the organization and within our partnerships to mobilize broader societal change;
8. Reinvent how we work with industry and peers to drive economic, social, and environmental prosperity in BC, Canada, and beyond; and
9. Foster and sustain an open, engaged, and multicultural community of BCIT researchers, students, and trainees.

BCIT Research Overview

Since its creation in 1964 as an Institute of Technology, BCIT has responded to the needs of industry partners by developing a unique and comprehensive portfolio of trade, technology and degree programs focusing on sectors key to the economic future of BC. For the past 30 years, BCIT has also invested in research and technology development capacity in strategic areas to meet the needs of industry partners and maximize the Institute's impact on economic development and environmental sustainability. Through the vertical integration of research and technology transfer, outcomes include new knowledge, technologies, national and international standards and codes, changes to industry practice and government policy, and training of highly qualified personnel (HQP).

Both training and research capacity have been enhanced by the development of a number of Bachelor's degree programs, and since 2011, have been further advanced with the addition of Master's programs in Applied Science and Engineering. Securing Canada Research Chairs (CRCs) in key strategic areas is providing the foundation for expanding research capacity and impact. The priority areas build upon and enhance existing concentrations of

highly qualified faculty, industry partners, academic collaborators, and state-of-the-art facilities, which all serve the research needs of the local and national community. In this regard, our areas of highest research priority closely align with activities within BCIT's Centre for Applied Research and Innovation (CARI), as well as activities within our Schools of Business and Media, Computing and Academic Studies, Construction and the Environment, Energy, Health Sciences, and Transportation.

Core research infrastructure has been developed, including facilities that are unique in Canada and potentially internationally. As previously stated, one of BCIT's main strategic objectives is to expand collaboration both internally and externally. Due to BCIT's unique position within the university, polytechnic, and college communities, BCIT has been able to develop strategic partnerships with industry, government, Indigenous, and other community groups, as well as national and international post-secondary institutions and researchers. Future CFI funding will be used to augment existing research infrastructure to enhance our existing long-term programs.

As embedded in our BCIT values, we champion diversity of experiences, ideas, cultures, and perspectives, fostering a community permeated with equality and inclusivity. To that end, BCIT is committed to ensuring all employees receive training on equity, diversity, inclusion, and anti-racism. BCIT is actively working to ensure employees come from diverse groups and represent the communities within which we live and work by creating equitable hiring practices to remove systemic barriers and unconscious bias.

BCIT Research Priority Areas

1. The Built Environment

Research strengths in this area include: Architectural Ecology, Building Science, Civil Engineering, Building Construction, Green Roofs, Living Walls, Structural and Earthquake Engineering, Non-Destructive Evaluation of Building Materials, Sustainable Development, and Whole Building Performance. Established research initiatives and facilities include: Building Science Centre of Excellence, Centre for Architectural Ecology, AFRESH House, Building Science Materials and Instrumentation Laboratory, Building Envelope Test Facility, and the Water Penetration Test Chamber.

The Building Science Centre of Excellence was created in 2005. The Centre's vision is to establish BCIT as a key provider of applied building science knowledge, and train graduates through advanced educational programs, leading edge applied research, technology development, and knowledge transfer. Initial infrastructure development and research activities were centered on themes related to the performance of a building as a whole, including the building envelope, its durability and energy performance, and healthy indoor environments.

Research conducted through this Centre advances best practice guidelines and building codes and standards, helps to resolve current and future deficiencies in building design and construction, and improves the overall performance of buildings, thus contributing to sustainable development. Current research capacity includes evaluation of building envelope performance (i.e., hydrothermal, energy, durability) at materials, components, and building systems levels through laboratory and field testing and advanced modeling and computer simulations. A former CRC and an allocation of CGS-M scholarships have allowed BCIT to evolve the Building Science Centre to a higher level and for BCIT to increase its national and international leadership in this area.

2. Information and Communications, Wireless and Sensor Technologies

Research strengths in this area include: Artificial Intelligence, Cellular Gateways and Networks, Cybersecurity, Internet of Things (IoT), Wireless Networks, Software Development, Games Design, Optics and Imaging, Low-Power Smart devices, Edge Computing, Digital Signal Processing, Data Mining and Analysis, Distributed Computing, Network Communication Infrastructure and Protocols, Network Security, and Industrial Network Cybersecurity.

BCIT's Centre for Internet of Things (IoT) has a proven contribution in promoting education, research, and industry support. The Centre promotes research and development of low-power and end-to-end IoT. Optimizing power usage in the IoT data acquisition stage is crucial to the advancement of IoT. With the addition of a Tier 2 CRC in Internet of Things as the Principal Researcher, significant progress can be made in low-power research areas as: ambient electromagnetic and vibration power harvesters for battery-less IoT platforms; battery-less and low-power electromagnetic and smartphone-based IoT sensors; and Tiny Machine Learning (TinyML) for data reduction for different IoT applications. Solutions to these issues will be key to implementation of IoT solutions in BC and Canada.

BCIT is a member of Canada's Digital Technology Supercluster and has engaged in significant related research. For example, our cybersecurity cluster is an interdisciplinary group of researchers and educators focused on the analysis

of secure communications and the development of secure systems. With researchers from Computing, Forensics, and Electrical Engineering, this group has a common interest in exploring technological and policy-based solutions to problems in security. The focus on Cybersecurity in Energy Trading, in particular energy trading in microgrids, allows for a multitude of collaborations with other researchers inside and outside the Institute. It is also a timely research focus with respect to evolving new technologies and arising needs in industry. BCIT will continue to advance the state of practice in security by taking a holistic view, which includes finding vulnerabilities in systems, formal reasoning about security, knowledge-level analysis of deception, and provable guarantees of security. The BCIT research team takes a hands-on approach, ensuring that research activities transition into knowledge mobilization, collaborations with partners in industry, and the development of practical solutions, and sharing these skills with new professionals through education.

3. Biosciences and Human Health

Research strengths in this area include: Safety and Chemical Analysis of Natural Health Products, Provenance and Quality of Agri-foods, Plant and Animal Development using Spatial Modeling, Development and Prototyping of Medical Devices, Orthotics and Prosthetics, Molecular Diagnostics, Application of Translational Genomics, Molecular and Cell Biology to Human Diseases, e.g., Autoimmunity, Infectious Diseases, Cancer, and Inflammation, Biotechnology, Food Science and Technology, Forensic DNA Analysis, Drug Analysis, Phytoanalytics, and Chemical Analysis. Established research initiatives, facilities and working groups include: HEAL (Herbal Evaluation and Analysis Laboratory), CREATE (Centre for Rehabilitation Engineering and Technology that Enables), Dr. Tong Louie Living Laboratory, Integrated Molecular Biology Lab, Rehabilitation Engineering Design Lab, a collaboration with SFU on Wearable Biomedical Technologies, and the Advanced Laboratory for Prototyping Health and Automation.

Technological innovations have begun to advance solutions to improve independent living and community access for people living with disabilities and the aging population. At the same time, rapid advances in electronics, communications, and materials have changed how the general population communicates, moves, and lives. BCIT's Rehabilitation Engineering Design Lab generates new solutions for disability-related problems regarding access, mobility, and assistive technology, and will advance BCIT's vision to remain integral to the province's prosperity by conducting research that makes a tangible contribution to our society. The School of Health Sciences, the School of Computing and Academic Studies, the Centre for Rehabilitation Engineering and Technology that Enables (CREATE), and the UBC/Vancouver Coastal Health's ICORD (International Collaboration On Repair Discoveries) research initiative are partners in this multidisciplinary research and development effort.

A CRC in Phytoanalytics focuses on validation of analytical methodology and application of metabolomics as a quality assurance tool for natural health products, advancing the state-of-practice in product development and informing policy development in the regulation of natural health products. Understanding medicinal plant chemistry provides insight into the variability that exists between commercial producers, elucidates the challenges and opportunities afforded by genetic selection in breeding agricultural crops, and the potential to develop new specialty crops for value-added food and natural health product sectors, thus playing a role in human health and nutrition. This approach directly mobilizes research results to improve agricultural management practices, advances product lab testing, supports development of novel therapeutics, and guides policy in the regulation of botanical-based natural health products. BCIT's role as a leader in linking research to social, cultural, scientific, educational, technological, and economic development is reinforced through this research program so Canadians can achieve the potential health and economic benefits afforded by medicinal plants and natural health products.

4. Natural Resources and the Environment

Research strengths in this area include: Sustainable Resource Management, Water and Wastewater Treatment, Contaminated Site Remediation, Protection and Restoration of Rivers and Streams. The Rivers Institute is an established research facility, a leader in science-based management and restoration of aquatic ecosystems in British Columbia, Canada and abroad, and the BCIT-SFU MSc program in Ecological Restoration enables students to engage with a wide range of organizations conducting ecological restoration of aquatic ecosystems.

5. Energy, Manufacturing and Transportation

Research strengths in this area include: Renewable Energy, Smart Microgrids, Energy and Environmental Testing, Energy Systems, Industrial Energy Applications, Engine Performance Using Alternative Fuels, Industrial Instrumentation, Marine Manufacturing, Alternative Fuels, Bio Diesel, Demand-Side Energy Processes, Industrial Waste Recycling, Pulp and Paper, and Mechanical Pulping.

Established research initiatives and facilities include: BCIT's Smart Microgrid, Centre for Energy Education and

Research (CEER), the Industrial Instrumentation Process Laboratory, Engine Performance Testing Laboratory, and Marine Vessel and Port Simulation Facilities.

6. Business, Economy, Human Capital, Culture and Education

Research strengths include: Business Intelligence, Sustainable Business Leadership, Transportation Economics, Millennial Students, Clinical and Education Practice, Mobile Devices for Clinical Teaching and Learning, eHealth, Technology Assessment and Utilization, Digital Learners in Higher Education, Crime and Intelligence Analysis for Public Safety and Security initiatives.

Institutional Planning and Approval Processes

BCIT's five main campuses (Burnaby, Downtown Vancouver, Marine, Aerospace Technology, and Annacis Island) are home to 1,800 full-time faculty and staff and 600 part-time faculty and staff. Student enrolment (full-time and part-time) exceeds 48,000 annually. With an annual operating budget of $370M, the institute's activities span six Schools: Business and Media; Computing and Academic Studies; Construction and the Environment; Health Sciences; Energy; and Transportation.

A Research Task Group (RTG) with representation from all areas at BCIT is in charge of developing and maintaining policies regarding research at the Institute. The RTG operates under the leadership of the VP Academic and the Dean of Applied Research. The RTG builds upon the existing work completed by previous BCIT committees and workgroups to stimulate research in alignment with the Institute's Strategic Plan, as well as assess progress towards meeting BCIT's research objectives.

In addition, BCIT has in place significant administrative and operational infrastructure to support its research activities. BCIT's Institute Research Committee (IRC) and School Research Committees (SRCs) have been created to operationalize and administer research policies, practices, and funding. These committees monitor the research performance of BCIT as a whole and for each of the Schools. They also review the progress of research activities in the priority areas and review and approve applications for internal and major external funding. The IRC is responsible for administering the selection process for BCIT's CRC candidates.

Research activities are supported by the Applied Research Liaison Office (ARLO), which assists with developing research proposals, sourcing and securing funding for research activities, technology transfer, intellectual property management, entrepreneurship and commercialization activities, and liaising with private industry and publicly funded clients/sponsors. Research activities are also supported by the expertise of the BCIT Centre for Applied Research and Innovation (CARI) in: design and development of prototype devices, systems and applications; analysis, testing, and evaluation of new technologies; and commercialization and licensing of new technologies and products. BCIT retains an independent Research Ethics Board (REB) with internal members and external members from other BC universities and related organizations. Research involving human subjects can only be carried out after review and approval by the REB.

Internal Funding and CRC Support

In addition to approximately $3.0M annual funding to support ARLO and CARI and internal research funding in BCIT's Schools, an internal Institute Research Fund exists to support applied research across the Institute by allowing new and existing researchers to explore new areas of interest and to expand existing research programs. Our CRC research programs are targeted to benefit multiple BCIT research areas to promote our multidisciplinary industry-focused approach to research. Funding for the development of CRC applications and establishing new CRCs at BCIT is also drawn from these internal funds.

Deployment of BCIT's Allocated Chairs

BCIT currently has four Tier 2 Chair positions to fill. A nomination for a Tier 2 CRC in Cybersecurity in Energy Trading was submitted in 2022 and a Tier 2 CRC in Internet of Things will be submitted in 2023.

For the proposed Tier 2 CRC in Internet of Things, BCIT will allocate up to $200,000 of its JELF allocation to the successful nominee.