

# York University Markham Campus

THE FUTURE OF RESEARCH  
EXCELLENCE

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YORK 





## Proposal Development

*York University Markham Campus: The Future of Research Excellence located in the heart of the most diverse community and one of the fastest growing technology hubs in Canada.*

### **Process**

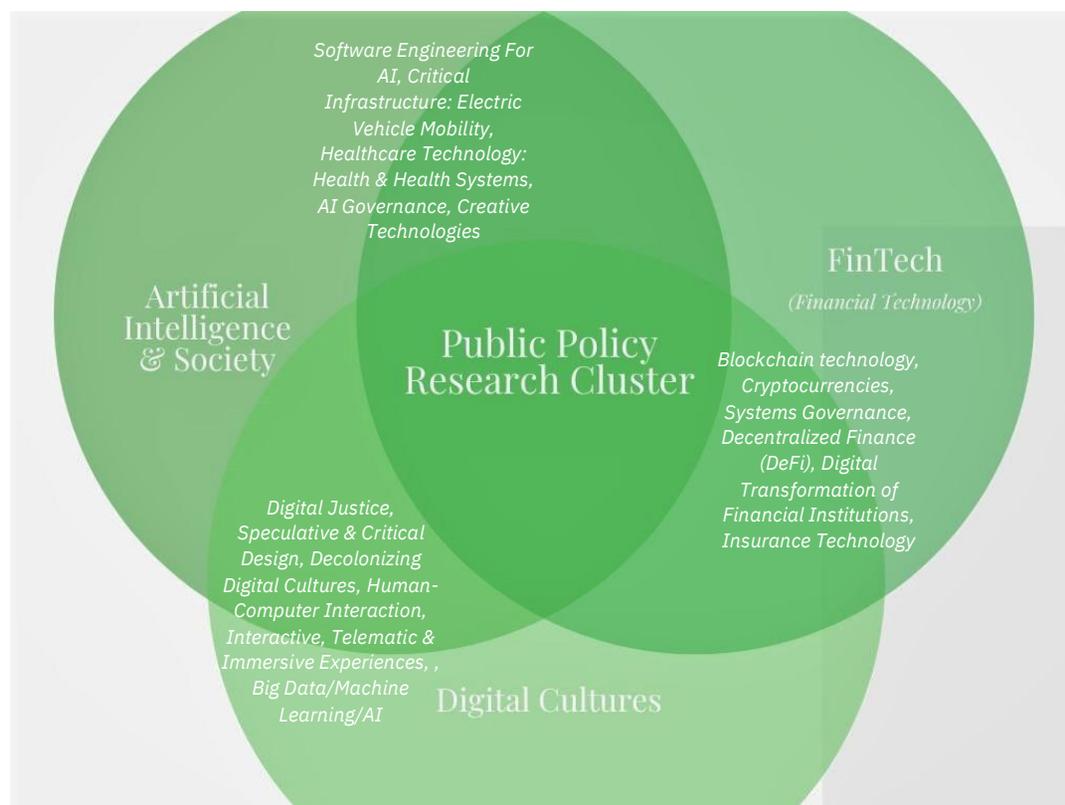
A two-stage planning process was followed in helping to shape the research vision for the Markham Campus. Led by VPRI, planning was initiated in early fall 2020 to develop a research and innovation vision for the Markham Campus.

*First stage:* focused on identifying broad research themes for the Markham Campus that was distinct from and complimentary to established research at York, with particular attention to those that aligned with the Region's major economic clusters, had the potential for innovation and entrepreneurship and community engaged research, and built on existing major funded research initiatives at York [see Appendix A]. A variety of input was solicited from senior leadership groups including the Markham Steering Committee, Deans and ADRs as well as the broader community at the York University Markham Townhall.

*Second stage:* developing further details of a research vision. A network of committees was formed to undertake further planning, led by the Markham Research, Innovation and Research Partnerships Committee (RIRP) and two associated research working groups. With the guidance of these groups, that included representatives from the across the university, an eventual short-list of

three multidisciplinary research & innovation themes, showcasing our strength in social sciences and humanities, arts and design, and natural sciences and engineering were identified- AI & Society, FinTech, and Digital Cultures. A fourth cluster in public policy was also defined, which focuses on leading critical policy research that addresses broader issues of ethics, governance, and public policy in an era of technological disruption and rapid innovation. This area will support 3 to 4 Chairs in public policy related to the three multidisciplinary cluster areas.

## Markham Research Clusters



*Artificial Intelligence & Society Research Cluster: Facilitating innovation in artificial intelligence technology and engineering to serve human needs in a socially responsible manner.*

*Financial technology Research Cluster: Help create the future of the financial world by developing, evaluating, and implementing next-gen Financial Technologies to address complex real-world financial problems in a socially responsible manner.*

*Digital Culture Research Cluster: Facilitating how arts, humanities, science, and digital technologies collaboratively construct a more responsible and sustainable digital future.*

*Public Policy Research Cluster: Addressing broader issues of ethics, governance, and Public Policy in an era of technological disruption and rapid innovation.*

*Figure 1: Four strategic research clusters with strong synergies to the Markham region will develop a world class research presence at York's Markham Campus in strong partnership with the Keele and Glendon Campuses.*

With a multifaceted approach, these clusters have been developed and defined with clear research synergies and linkages to both Keele and Glendon campuses, supporting work-integrated learning, research partnerships and innovation, and translating research into action. Clusters are also further aligned to a variety of the initial academic programs being established at the Markham Campus.

Following the identification of the short-listed clusters, additional consultations with select Faculty Deans and Associate Deans Research were held to identify proponents within each Faculty to assist with further cluster planning. VPRI formed a group of

## Markham Research Clusters

aligned faculty champions, based on Faculty recommendations, to assist with development of the cluster proposals. Accordingly, the cluster groups met in early May to late August 2021 to complete the development of cluster proposals. The following proposals have been developed by active and dedicated pan-university groups that engaged in open and thoughtful discussion and developed critical narrative that will help to set the course of research at the Markham Campus, develop new strategic research and innovation collaborations aligned with major economic clusters, and contribute to educational opportunities in high demand areas.

AI & Society Cluster Proponent Group	Digital Cultures Cluster Proponent Group	FinTech Cluster Proponent Group
- Marcus Brubaker, Lassonde	- Melanie Baljko, Lassonde	- Joann Jasiak, LA&PS
- Pina D'Agostino, Osgoode	- Rebecca Caines, AMPD	- Tsvetanka Karagyozeva, LA&PS
- Patricio Davila, AMPD	- Ian P. Garrett, AMPD	- Henry Kim, Schulich
- James Elder, Lassonde, Health	- Shital Desai, AMPD	- Murat Kristal, Schulich
- Marin Litoiu, LA&PS, Lassonde	- Ganaele Langlois, LA&PS	- Sotirios Liaskos, LA&PS
- Pirathayini Srikantha, Lassonde	- Rich Shivener, LA&PS	- Andrea Podhorsky, LA&PS
- Hongmei Zhu, Science	- Jane Tingley, AMPD	- Ingrid Spletstoeser, LA&PS
- Barbara Edwards, VPRI	- Barbara Edwards, VPRI	- Zijiang Cynthia Yang, LA&PS
- Amir Asif, VPRI	- Amir Asif, VPRI	- Barbara Edwards, VPRI
		- Amir Asif, VPRI

*Table 1: Pan-university groups of faculty members who participated in developing the research vision of the Markham Campus clusters.*

### Resources Recommended for the four research clusters

Achieving the ambitions articulated in this cluster plan depend on an engaged research environment across the University and on resources that are strategically invested to support research growth and development. Cluster members have met with the York University Development Corporation, and recommended the following resources to be considered for the long-term success of the research clusters. It is recognized that in the short-term faculty may need to utilize other applicable space and resources as needed within the current campus building plan. However, as the Campus develops its full operations and reaches targeted student enrolment, it is recommended that plans for the space on the 9<sup>th</sup> and 10<sup>th</sup> floors of the Markham Campus building include a more tailored approach with purpose-built space for research activities and interests, with consideration of the resources listed below.

**Common to all Clusters**

- Research space that is shared among all faculty involved in the three research clusters.
- Office space for faculty members and visiting scholars
- Research showcase/ public gallery space on the ground floor- Ideal to have a display space with dynamic displays of technology from our researchers (suggested a shared space with the libraries).
- Conference type breakout space
  - Space for confidential meetings to take place with clients over their commercialization/ intellectual property matters
  - Meeting rooms of various sizes, to accommodate between 3 – 20 people.
  - Seminar room accommodating up to 65 people
- Both academic and conference-type meeting spaces to include:
  - Teleconferencing equipment/capability
  - Wall surface with projection equipment
  - Whiteboarding capability
- Common support space: shared kitchen on each floor, a fun room to have coffee, talk, collaborate, access to filtered water.
- Shared office space for grad students, research assistants, academic meetings
- Shared space for grad students and others to include:
  - Enough power outlets (also on shared desks) to plug in portable equipment such as laptops
  - Shared computers (and/or docking stations) with large screens or dual screens
  - Shared printer/copier
- Storage space that is accessible and lockable - safe storage space- lockers for laptop and phone charging capability

**Additional shared suggestions**

- Roof top gardening/ community garden/ greenhouse (possibly partner with Markham)  
<https://www.markham.ca/wps/portal/home/about/sustainability/community-sustainability-projects/homegrown-community-allotment-gardens> )
- incorporate urban bee keeping (<https://www.alveole.buzz/>) – could also partner with BEEc at York and others from EUC (suggested Professor Jennifer Foster for urban sustainability)
- Citizen scientists group in TO for water considerations- and other faculty from York  
[http://www.citizenscientists.ca/Citizen\\_Scientists.html](http://www.citizenscientists.ca/Citizen_Scientists.html)

### **Research Chair(s) and Funding**

Research intensive faculty members contributing to the four clusters that also support academic programming at MC. Funding for bringing in research stars appointments is available through the research enhanced faculty appointment initiated by the University, which can be used for this purpose.

### **Specific to FinTech Cluster**

- Natural lighting options as much as possible
- High-capacity shared server space – similar to what is available at the Keele campus currently- economics compute server (delta.laps.yorku.ca) is a virtual machine running in our VMware cluster. There is dedicated 40-vCPU (Intel Xeon Gold 6140, multi threaded CPU so it's 20 real cores given to this VM), 192GB ECC RAM, and 1TB enterprise grade SAS drive disk space with RAID-6, and dual power supply. For more info, you may contact Don Kim at donkim@yorku.ca
- Storage space to store large databases associated with financial institutions
- A separate local area network where security and privacy issues related to FinTech will be tested

### **Specific to AI & Society Cluster**

- Specialized equipment and space:
  - GPU clusters
  - Configurable open area with 3D visual sensing for social robot research
  - Configurable space for clinical research (e.g. sensor-equipped hospital bed)
  - Data visualization room allowing collaborative panoramic visualization
- Labs configured as a demonstration space for industry and other external partners, international visitors, etc.
- 3D printers working with materials other than plastic
- Machine shop: lathes, metal cutting machines, ventilation needs, tech staff- (potential for first year Engineering)
- High performance computing infrastructure and data centre, including GPU clusters
- 5G with fibre access (possibility of Rogers partnership to support research projects at MC), support for edge research/computing, advanced computing and networking capabilities

**Specific to Digital Cultures Cluster:** There is recognition among Digital Cultures Cluster group members that there will be some opportunities to utilize applicable space and resources that are being planned by both the Libraries as well as the AMPD Faculty in relation to the research being conducted by Digital Cultures researchers at the Markham Campus. However, some additional facilities will be needed to augment the existing planned resources.

## Markham Research Clusters

- High-capacity shared server space - for conducting large scale data gathering of text, images, videos, audio etc., and to use software (including machine learning) to do data analytics. This would be used for both research and teaching.
- High performance computing infrastructure
- Community-based research spaces. It would be especially important to have a dedicated safe and accessible meeting spaces, including work stations, that could be used by marginalized and at-risk communities (e.g. Black youth, 2SLGBTQ+, Indigenous) and where researchers and community members could collaborate on research projects of various durations, all spaces must follow universal access principles for users with physical and sensory differences and have accessible (and pref. multilingual) signage, and user control of all lighting and forced air systems. Spaces for smudging will need to be established)
- Workshop / lab space for co-creation and codesign sessions (planned AMPD Trans Media Labs could also be used)
- User testing and observation suites – including one-way mirrors
- Large specialized audio design lab, with mulitchannel sound system, sound proofing and recording suites (planned AMPD sound studios, production studios and post-production A/V suites could also be used until custom spaces are set up)
- Dirty rooms for prototyping, which also include soldering station, work benches, and hand tools
- Black box – staging area – powered grid, sprung dance floor, with octaphonic (or larger) sound system, projectors and computers
- Configurable theatre space

### Catalyzing Interdisciplinary Research Cluster (CIRC) Grant

Members of the three clusters have received annual funding of \$175,000 per cluster for up to 3 years for their research proposals from the Catalyzing Interdisciplinary Research Clusters Grant initiative launched by the University, which will provide seed funds for the development of research collaborations in these clusters.

Cluster	PI / co-PI	Project
AI & Society	Pina D’Agostino (Osgoode), James Elder (Lassonde, Health), Marin Litoiu (LA&PS, Lassonde)	AI Systems: Engineering, Governance & Society
Digital Cultures	Patricio Davila (AMPD), Ganaele Langlois (LA&PS)	Digital Justice
FinTech	Joann Jasiak (LA&PS), Henry Kim (Schulich)	Digital Currencies

## Markham Research Clusters

A second group of FinTech cluster members are investigating research opportunities around issues facing SMEs (small and medium-sized enterprises), with the goal of applying for Insight Development Grant Stage I and Insight SSHRC funding next year to provide further funds for research collaboration. Other cluster members are also being encouraged to apply for external research grants.

### **Next Steps**

Cluster proposals will be presented in the fall 2021 and winter 2022 to Faculty Councils and Deans representing Faculties offering academic programs at the Markham campus as well as other senior leadership groups at York including the Markham Research, Innovation and Research Partnerships Committee (RIRP) and its research working groups. Incorporating all three cluster proposals along with the Public Policy research cluster, this Markham Campus research vision document will be presented to the Markham Steering Committee for final endorsement.

Further planning and implementation of the vision for research at the Markham Campus will be enabled by the Markham Research, Innovation and Research Partnerships Committee (RIRP) and the accompanying working groups – the Markham Research Working Group and the Markham Innovation & Research Partnerships Working Group. The primary responsibility of the RIRP group is to develop and implement plans for research, innovation, and community relations for the Markham Campus. RIRP provides updates, advice and recommendations on matters related to research, innovation, and community relations to the larger Markham Steering Committee. York researchers listed in Table 1, who have participated in developing the research vision of the Markham campus, will continue to support VPRI in the implementation of the research vision and mentor incoming faculty members being hired for the Markham campus. [see Appendix B for Committee planning structure and Terms of Reference]

Proposed timeline will be finalized in consultation with the Markham Steering Committee.

# Markham Research Clusters

## Digital Cultures

Vision



Strengths



Differentiation



Potential Partners





## Vision

## Digital Cultures

*Facilitating how arts, humanities, science, and digital technologies collaboratively construct a more responsible and sustainable digital future.*

The Digital Culture Cluster (DCC) at the Markham Campus (MC) will draw together a community of interdisciplinary researchers working at the intersection of the arts, humanities, science, and digital technologies. The focus of the DCC will be a multidisciplinary approach, within a methodological framework that combines creative and critical approaches, in the creation of artworks and experiences that are community focused. This cluster will scaffold the strengths of academic research and creative intervention, with industry partners and other community stakeholders in the development of projects that address social and global health, sustainability, and climate change.

Through a deep engagement with community and industry partners, researchers will focus on understanding the impacts and application of digital technologies in relation to and informed by a social justice framework of decolonization, ethics and sustainability. Through this framework, researchers will contribute to the creation of new knowledge, and explore how digital practices are embedded, represented, and personified in the way we live. Importantly the framework will enable a reimagining of creative practice and theorization which considers inclusivity and ethical practices, global sustainability, and the inclusion of non-western modes of knowledge. Further, with an aim to be mindful of the cultural and historical context of digital technology inception and use, a focus on knowledge co-creation with surrounding communities will be central to learning and understanding, helping to connect cultural expression with advancing technologies.

Broadly the DCC research will approach ideas from a transdisciplinary, action-oriented perspective. The cluster will utilize methodological and critical approaches central to the creative fields and will leverage community interests and engagement through iterative design and co-creation with community partners and other stakeholders, leading to the development of socially engaged projects and experiences. The DCC will function as a critical sandbox for the application of community driven research. It will mobilize storytelling coupled with technological tools in the creation of projects and experiences that are designed to

## Markham Research Clusters

encourage critical engagement. Further, the DCC will leverage digital tools and processes to imagine and enact change in the real world.

Research creation activities will be accomplished by drawing upon strong expertise spanning a wide range of scholarship including: speculative design and critical design, human-computer interaction, interactive media, visualization (data science and computer graphics), critical approaches to big data/machine learning/ AI, digital humanities, art/science/technology studies, socially engaged research, and epistemologies of knowledge. The DCC would enable stronger and more dynamic collaborations between these research areas and facilitate alignment with some of the key curricular programs being developed at the Markham Campus including digital technologies, creative technologies, social media and public relations, and computer science. Cluster research and innovation at Markham will be enabled by the proximity to one of the most diverse communities and largest technology clusters in Canada. This will provide a unique opportunity to cultivate valuable relationships and strengthen engagement with surrounding communities, industry and stakeholders in the Region, maximizing the growth and impact of digital cultures research. The research cluster would facilitate submission of larger-scale, interdisciplinary research grant applications. At a suitable time, the research cluster aspires to evolve in an Organized Research Unit (ORU) as a centre for transdisciplinary practice.

Once established the Digital Cultures research cluster at the Markham Campus will contribute to:

- Increasing the productivity in Digital Cultures academic research and enhanced capacity to generate world-class research and innovation
- Providing training of innovative and entrepreneurially enabled graduates
- Enhancing experiential education opportunities for our students
- Facilitating meaningful social innovation, community engagement and research impact through knowledge mobilization
- Increasing research collaborations and initiating new partnerships with key public sector and industry stakeholders in the Region and beyond including a wider network of related Canadian and international research centres
- Attracting and retaining outstanding students, Digital Cultures faculty and senior researchers at the MC
- Enhancing external investment and grants in Digital Cultures research



## Strengths

## Digital Cultures

*The inventory of researchers and research centres/ labs included below is tentative and will be further refined after a closer inspection of their alignment with the Digital Cultures research cluster.*

As previously mentioned, the mission of the Digital Cultures Cluster is to create inclusive and interdisciplinary research opportunities at the intersection of arts, humanities, science, and digital technologies. York University has a rich history of offering undergraduate and graduate programs in digital cultures related areas, including the undergraduate (BA) and graduate programs (MA, MSc, and PhD) in Digital Media offered jointly by Lassonde School of Engineering and School of the Arts, Performance, Media & Design. More than 50 faculty members at York are currently engaged in digital cultures related research areas, including internet of things, social media, 3D simulations and animation; artistic theories and cultural impact; interactive art and immersive environments; the implementation of participatory design, maker methods, physical computing, digital fabrication, wearable computing, and creative coding for the creation of novel digital forms; the expansion of procedural poetics into emerging virtual reality, augmented reality, and mixed reality media; the application of expertise in audio-visual signal processing, vision science, machine learning, AI, and robotics toward new conceptions of responsive living environments; design and development of assistive technologies in healthcare and other project-based research that integrates scientific investigation and creative expression into new critically computational futures. The proposed research cluster would provide a platform for researchers spanning multiple disciplines to collaborate as a transdisciplinary team for research creation and address key societal and cultural challenges that transcend traditional boundaries. The following tables list existing York research expertise, research centers and labs, and faculty members perceived as potential contributors to the research cluster.

<b>Existing Research Expertise</b>	Interaction Design (experience design, human computer interaction)	Digital Gaming, App development
	Design Justice (Human Centred, participatory design, codesign and beyond)	Digital Data Analytics
	Systemic Design	Digital Design
	Futures Design (Speculative Futuring)	Digital Scenography
	Application of Digital Technologies (Cinespace, Sensorium, VISTA)	Digital Audio, Socially-Responsive Technologies, Community-Engaged and Participatory Sound Art

## Markham Research Clusters

	Informatics, Data Visualization, big data (former project – BRAIN (Big Data Research, Analytics, and Information Network))	Impact of Digital Technology on Indigenous Communities
	Digital Arts	Internet of Things
	AI & Machine Learning, Data Mining	3D simulations and animation
	Smart cities technology	Immersive environments, virtual reality, augmented reality and mixed reality media
	Digital ethics- Intellectual property, data governance, privacy, EDI (equity, diversity and inclusion)	Vision science
	Digital education	Machine learning, AI, and robotics
	Digital Storytelling and Authoring	Virtual Production and Telepresence
		Sustainable Technologies in Culture
<i>Research Centres/ Labs focusing on Digital Cultures</i>	VISTA - <a href="https://vista.info.yorku.ca/">https://vista.info.yorku.ca/</a>	and coproduction, Human Centred Design, Systemic Design and Futures Design (Speculative Futuring), ( <a href="#">Shital Desai</a> )
	Cognitive Neuroscience Lab led by Dr. <a href="#">Shayna Rosenbaum</a>	Alice Lab for Computational Worldmaking, Graham Wakefield, Canada Research Chair; Assistant Professor, Computational Arts/Visual Art & Art History
	BEST lab, <a href="#">Andrew Maxwell</a>	BEEc- Bee Ecology, Evolution & Conservation (BEEc), Amro Zayed, Director, York Research Chair in Genomics, Professor Biology Department, Science <a href="https://beecsi.ca/">https://beecsi.ca/</a>
	Centre for Vision Research	Digital Sculpture Lab- dedicated to the study and utilization of emerging 3D printing technology, investigating the collapsing borders between the digital universe and the reality of physical objects.
	Sensorium ORU in AMPD	Peripheral Visions Lab
	Cinespace “Campus” / partnership	Future Cinema Lab
	Public Visualization Lab ( <a href="http://p-v-l.ca/lab">http://p-v-l.ca/lab</a> )- researchers from York ( <a href="#">Patricio Davila</a> , AMPD), Ryerson, OCADU	Augmented Reality Lab -
	Infoscape Research lab, Ryerson/York (Co-Director: <a href="#">Ganaele Langlois</a> , York- Communication and Media Studies).	Mobile Media Lab
	Institute for Research into Digital Literacies - (Director: <a href="#">Natalie Coulter</a> , Communication and Media Studies)	N-D: Studio Lab
	Practices in Enabling Technologies (PiET) Research Lab: commons-based peer production, Participatory design, anti-ableism, making accessible, ( <a href="#">Melanie Baljko</a> )	
	Social and Technological Systems (SaTS) lab: Interaction Design, Participatory design, Inclusive design, codesign	

## Markham Research Clusters

<b>Research Initiatives / Projects</b>	ORE ISSUM: Intelligent Systems for Sustainable Urban Mobility ( <a href="#">James Elder</a> )	
	Resource: Digital Scholarship Centre	
	Adaptive assistive technologies for older adults (NSERC and CI JELF grant, Shital)	
	BetaSpace – Media Arts Lab led by <a href="#">Taien Ng-Chan</a> , AIF project	
	David Gelb and Michael’s AIF project to create eportfolio	
<b>Faculty members with research interests in the area of Digital Cultures</b>	Laura Allen, Assistant Professor, Writing Department, LA&PS	Learning (IRDL)
	<a href="#">Robert Allison</a> , Associate Professor, Electrical and Computer Science	<a href="#">Marc Couroux</a> , Associate Professor, Visual Art & Art History
	Kelly Bergstrom, Assistant Professor, Department of Communication and Media Studies (Markham)	<a href="#">Michael Darroch</a> , Associate Dean, Academic and Associate Professor of Cinema and Media Arts in the School of the Arts, Media, Performance and Design
	<a href="#">Sarah Bay-Cheng</a> , Dean of the School of Arts, Media, Performance and Design	<a href="#">Patricio Dávila</a> , Associate Professor, Cinema and Media Arts, School of the Arts, Media, Performance and Design
	<a href="#">Chloë Brushwood-Rose</a> , Associate Professor, Education	Desirée de Jesus, Assistant Professor, Communication and Media Studies, LA&PS
	<a href="#">Mary Bunch</a> , Assistant Professor, Cinema and Media Arts	<a href="#">Shital Desai</a> , Assistant Professor, Department of Design, School of the Arts, Media, Performance and Design
	<a href="#">Rebecca Caines</a> , Creative Technologies, School of the Arts, Media, Performance and Design	Brandee Easter, Assistant Professor, Writing Department, LA&PS
	<a href="#">Darcey Callison</a> , Associate Professor and Graduate Program Director, Dance	<a href="#">James Elder</a> , Professor, Electrical Engineering and Computer Science, and Psychology
	Beth Caravella, Assistant Professor, Writing Department, LA&PS	Petros Faloutsos, Professor, Department of Electrical Engineering & Computer Science, Lassonde
	<a href="#">David Cecchetto</a> , Associate Professor, Humanities	<a href="#">Caitlin Fisher</a> , Chair; Associate Professor, Cinema & Media Arts (Future Cinema Lab)
	Julie Crooks, Adjunct Faculty, Visual Art & Art History	<a href="#">Jennifer Fisher</a> , Professor, Visual Art & Art History
	Natalie Coulter, Associate Professor, Communication and Media Studies, LA&PS and Director of Institute for Research on Digital	

## Markham Research Clusters

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[Ian Garrett](#), Associate Professor Theatre

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[John Greyson](#), Associate Professor, Department of Cinema and Media Arts

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[Alison Harvey](#), Assistant Professor, School of Translation Studies, Glendon College

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[Sharon Hayashi](#), Associate Professor and Graduate Program Director, Cinema & Media Studies

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Rob Heynen, Associate Professor & Undergraduate Program Director, Communication and Media Studies, LA&PS

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[Shelley Hornstein](#), Professor, Visual Art & Art History

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Mark-David Hosale, Associate Professor; Chair, Computational Arts

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[Anna Hudson](#), Associate Professor, Visual Art & Art History

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[Edward Jones-Imhotep](#), Associate Professor, Natural Science/Science & Technology Studies

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[Ali Kazimi](#), Associate Professor, Department of Cinema and Media Arts

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[Leslie Korrick](#), Associate Professor, Visual Art & Art History

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Ganaele Langlois, Associate Professor & Dept. Chair, Communication and Media Studies, LA&PS

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[Yam Lau](#), Associate Professor, Graduate Program in Visual Arts, Department of Visual Art & Art History

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Laura Levin, Associate Dean Research, Associate Professor, Theatre

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Evan Light, Associate Professor, School of Translation, Glendon (Bilingual Communications)

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[Brenda Longfellow](#), Associate Professor, Cinema and Media Studies

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Michael Longford, Associate Professor; Graduate Program Director, Digital Media

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[William Mackwood](#), Assistant Professor, Dance

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[Janine Marchessault](#), Professor, Department of Cinema and Media Arts, (former Canada Research Chair in Art, Digital Media and Globalization)

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[James McKernan](#), Assistant Professor, Theatre

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Casey Mecija, Assistant Professor, Communication and Media Studies, LA&P

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[Natasha Myers](#), Associate Professor, Anthropology/Science & Technology Studies

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Taien Ng-Chan, Assistant Professor, Cinema & Media Arts

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Jonathan Obar, Associate Professor, Communication and Media Studies, LA&PS

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Joel Ong, Director Sensorium, Assistant Professor, Computational Arts

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[Eva Peisachovich](#), Associate Professor, School of Nursing

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Jennifer Pybus (Political Science) Canada Research Chair in Data, Democracy and AI

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Gabi Schaffzin, Assistant Professor, Department of Design

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[Melissa Shiff](#), Research Associate

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Rich Shivener, Assistant Professor, Writing Department, LA&PS

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[Don Sinclair](#), Associate Professor and Acting Graduate Program Director, Department of Computational Arts

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Rianka Singh, Assistant Professor, Department of Communication and Media Studies (Markham)

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Debashis Sinha, Department of Theatre

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Jane Tingley, Assistant Professor, Computational Arts

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Brandon Vickard, Associate Professor, Visual Art & Art History- (Principal researcher - Digital Sculpture Lab)

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[Laurie Wilcox](#), Professor, Psychology

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[Mike Zryd](#), Associate Professor, Cinema and Media Studies

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Potential Partners

Digital Cultures

Markham Campus is in the midst of the largest cluster of technology firms in the Province, thus offering Digital Cultures researchers unparalleled opportunities to partner with the Markham industry sector and work on both fundamental and applied real-world problems. The table below shows potential research partners in the region. These and other firms suggest the rich potential for research and workplace-based learning.

<i>Industry - Information &amp; Communications Technology</i>	York Region is home to global ICT firms such as:	Compugen
	IBM	Redline Communications
	AMD	VIQ Solutions
	Qualcomm	Longview
	Lenovo	Mircom
	SAP	Real Matters
	Oracle	Spectra7
	GE	N-Dimension
	Toshiba	Google Toronto
	Nokia	ESRI Canada
	Siemens	Wattpad
	CGI	Samson Technologies
	OpenText	Myant Inc.

## Markham Research Clusters

<i>Film</i>	HotDocs	
	CineSpace Studios (existing partnership)	
	TIFF (Toronto International Film Festival)	
	TFO, specifically with their work on the LUV stage	
<i>Immersive and other digital Technologies</i>	The Vector Institute	
	VRTO/FIVARS	
	5 <sup>th</sup> Wall Forum	
	No Proscenium	
	Disguise	
	Single Thread XR/Performance XR	
	Educators in VR	
	Contraverse VR	
	Mozilla (Hubs)	
	Cleanbox	
	Opera Hack	
	Microsoft (AltSpace)	
	Double Eye Productions	
	Toasterlab	
Inclusive Media and Design lab, Ryerson University		
Samson Technologies		
<i>Social and Global Health</i>	UHN-TRI	Dementia Ageing Technology and
	Baycrest	Memory and Company
	Jane and Finch community centre	TeslaSuit (UK based)
	Evergreen	Alzheimers society of York, Toronto
	Future cities Canada	IBM
	Engagement lab	Myant

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	Memory and Company Carefirst	Black Creek Financial Action Network (BCFAN) League
<i>Incubators/ Accelerators</i>	ventureLAB YSpace Incubators – jLabs Hyundai - 2020 ZERO1NE AcceleratorCentre for sustainable practice in the Arts	Honda Xcelerator: AI/Robotics, Connected Vehicles, HMI, Industrial Innovation, Energy Innovation
<i>Festivals</i>	VRTO/FIVARS (Festival of International Virtual and Augmented Reality Stories) ImagineNATIVE Film and Media Arts Festival Mutek Inside Out Toronto LGBT Film and Video Festival Design TO	Luminato Vector Festival Nuit Blanche SubtleTechnologies Festival Elektra Festival Maker Festival Toronto
<i>Other Arts and or maker Organizations/ initiatives</i>	FITC Toronto Electric Runway (fashion/technology) STEPS Public Art Summerworks Markham's Public Art Program  InterAccess	Toronto Media Arts Centre Aboriginally determined research-creation network Initiative for Indigenous Futures (grant) Hacklab Toronto
<i>Environmental Organizations</i>	Rare Charitable Reserve University of Guelph Institute for Environmental Research Citizen Science Toronto	Ontario Nature conservation Avéole Land Art Generator
<i>Games Organizations</i>	Dames Making Games International Game Developers Association (Shivener & Caravella completing a Partnership Engage Grant project with association) Epic Games/Unreal Engine	

## Markham Research Clusters

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Hand Eye Society

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Touchdesigner/Derivative

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Ubisoft

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21 Toys

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The Markham Campus External Advisory Committee (MCCEAC) connects researchers at the Markham Campus with York Region community, fostering opportunities for collaborative research and development. The following affiliations are of increased potential to the Digital Cultures Cluster:

- United Way of Greater Toronto
- York Region District School Board
- York Catholic District School Board
- YMCA of Greater Toronto
- WSP
- Royal Bank of Canada
- Workforce Planning Board of York Regio

# Markham Research Clusters

## AI & Society

Vision



Strengths



Differentiation



Potential  
Partners





## Vision

## AI & Society Cluster

*Facilitating innovation in artificial intelligence technology and engineering to serve human needs in a socially responsible manner.*

Artificial Intelligence (AI) is “the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.”<sup>1</sup>. Increasingly AI systems are transforming many dimensions of Canadian society, and York University’s Strategic Research Plan has identified the integration of AI into Society as a key area of opportunity for amplifying research at the University.

The AI & Society research cluster at the Markham Campus (MC) will unite an interdisciplinary team of AI researchers who will collectively contribute to core theory and technological applications, as well as providing a broader human perspective including the ethical implications of AI on humanity and society. Our aspiration, through this comprehensive approach, is to explore the whole spectrum of possibilities for research, development and innovation in artificial intelligence, data governance and associated disruptive technologies as well as the impact of such technologies on society.

This holistic research approach will contribute to the creation of new knowledge, informing public policy and governance, training highly qualified students, enabling diverse industry partnerships, and fostering innovation and development of core technology in AI. This will be accomplished by drawing upon strong expertise across a range of research areas including software engineering for AI, critical infrastructure, healthcare technology, engineering & public policy, data governance, creative technologies, intellectual property law, and by engaging stakeholder communities in this research.

The proposed AI & Society cluster aligns with the initial academic programs being established at the Markham Campus in digital technologies, computer science, financial technologies, and media arts programs, and will contribute to the training of innovative and entrepreneurially-enabled graduates. Cluster research and innovation will be enabled by the proximity to one of the largest technology clusters in Canada. This will provide a unique opportunity to cultivate valuable relationships and strengthen existing partnerships with surrounding communities, industry and stakeholders in the Region, maximizing the growth and impact of AI research. The research cluster will also facilitate submission of larger-scale, interdisciplinary research grant applications. Further

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<sup>1</sup> Definition of “artificial intelligence” from the *Oxford Reference*, <https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095426960>.

## Markham Research Cluster

development and incubation of research will be facilitated through YSpace, York's incubator in Markham, providing researchers direct access to York's entrepreneurial and innovation ecosystem.

The AI & Society research cluster will conduct leading-edge research and innovation and enable collaborative contributions towards the development and implementation of AI technology, integrated with research on public policy and governance innovations that will maximize benefit and minimize risk to society. We expect the cluster will be integrated with a larger chartered AI & Society Organized Research Unit (ORU) also involving researchers at Keele campus.

### **Specific Research focus areas in AI & Society for Markham:**

- Software Engineering for AI:

There are profound systems/software engineering challenges to ensuring trustworthy AI systems that perform consistently in dynamic real-world conditions. To address these issues, the proposed research cluster will focus on the development of engineering processes for systematically evaluating the quality of data and models, patterns and anti-patterns for designing, implementing, testing and maintaining AI pipelines and feedback loops that allow AI systems to adapt to diverse user needs and handle failures. There is great opportunity to engage with Markham industry within this research domain, including Qualcomm, AMD, Samsung and IBM.

- Critical Infrastructure: Electric Vehicle Mobility

Electric vehicles offer great promise in contributing to climate change goals while also allowing providing support for the operation of the electric grid. This area is aligned with the recent call from the Government of Canada for Zero Emission Transit Fund in support of the electrification of the transportation sector (commitment of \$2.75 billion over 5 years). Collaborations with local industrial counterparts that include General Electric and Alectra will enable the translation of ideas from theory to practise. Important open research problems that will capitalize on AI constructs in this area include placement and sizing of charging infrastructure, incentive mechanisms to encourage electrification of the transportation sector, peer-to-peer efficient communication to coordinate electric vehicle charging/discharging activities and planning of grid infrastructure to accommodate these. These research areas have important security and privacy implications that will be addressed via inter-disciplinary efforts facilitated by the Markham Campus.

- Healthcare Technology: human health and health systems

## Markham Research Cluster

Healthcare is one of the biggest application areas for AI systems. The Markham AI & Society cluster will focus on health applications including bioinformatics, drug discovery, medical imaging, clinical robotics, diagnosis and treatment of age-related cognitive decline and neurodegenerative disorders. This research will contribute directly to the proposed Vaughan Health Precinct.

- **Governance & Public Policy:**

Includes Data Governance, data ownership, privacy implications, ethics, equity, diversity, and inclusion, and commercialization within AI. Exploring issues around public policy and technology: how can policy be developed in consultation with industry, promoting innovations to serve social needs in a responsible way. Engaging the local community, local/provincial/federal governments in developing policy around technology. This research area could be supported by the existing expertise within LA&PS, Osgoode, IP Osgoode and the IP Innovation Clinic and its partners. This research area could be further supported by an Ontario Chair in Public Policy at York. Chairs will support the development of leading research areas at the MC focused on critical policy research that addresses rapid changes in and impacts of Technology and/or Entrepreneurship. Funding will be used to attract outstanding external scholars to join MC. Chair proposals addressing broader issues of ethics, governance, and public policy in an era of technological disruption and rapid innovation are encouraged.

- **Creative Technologies**

Creative and community-led use of AI technologies is an important part of how AI's role in society is understood by non-specialist and end-users. Creative technologists and artists working with AI bring qualitative, experiential, and aesthetic research to AI that yield ways of revealing AI processes, creating novel applications of AI technologies, and experimenting with performance and art making. Research-creation at York U (e.g. AMPD) also offers valuable methodologies for collaborating with communities, especially those marginalized through structural discrimination, and to working with AI technologies to address social issues. Similarly, community-based citizen science applications that distribute accessible modes of measurement, detection, and analysis of environmental and health issues will be investigated through this cluster.

Expected results – Once established the AI & Society research cluster at the MC will contribute to:

- Enhancing York's international research profile in AI research and training;
- Strengthening York's thought leadership on the economic, ethical, policy and legal implications of advances in AI
- Increasing research collaborations and initiating new partnerships with key industry and public sector stakeholders in the Region and beyond including Canadian and international research centres

## Markham Research Cluster

- Enhancing external investment in AI research leading to home-grown start-ups
- Student recruitment and retention of top students into graduate programs at York
- Attracting and retaining outstanding AI faculty and senior researcher trainees (e.g., postdoctoral fellows) at the MC



## Strengths

## AI & Society Cluster

*The inventory of researchers and research centres/ labs included below is tentative and will be further refined after a closer inspection of their alignment with the AI & Society research cluster.*

York University currently offers more than 80 AI-related courses across six different Faculties, as well as three AI master’s programs supported by the Vector Institute for Artificial Intelligence and two AI certificate programs. More than 90 faculty members at York are currently engaged in AI-related research, contributing to a variety of technological applications while also providing broader perspectives, including the impacts of AI on humanity and society (Report from the Task Force on Artificial Intelligence & Society, to be released September 2021). This is exemplified by initiatives such as the Centre for Vision Research (CVR) and the Vision: Science to Applications (VISTA) program where York is providing global leadership in research that focuses on the intersection of computational and biological vision. Other researchers are exploring AI within digital media contexts (Computing & Arts), legal frameworks through IP Osgoode, and the Osgoode Hall Law School’s Intellectual Property Law and Technology program and the IP Innovation Clinic (Law & Engineering), and the intersection of the media arts, performance, and digital culture through research centres like Sensorium, which explores networked connections between people, sentient environments, and ecologies of place. Other researchers are working at the cutting edge of autonomous robotics, AI for remote sensing and localization, intelligent information systems and cognitive analytics. On the human side, scholars from across the humanities, social sciences, health, engineering and law are studying the moral, ethical and legal implications of AI as well as effects on governments, labour markets, the legal system, personal and national security, human health and health systems and challenges to our sense of individual identity and collective humanity.

A sampling of York’s existing AI & Society strengths are listed below:

<b>Research Centres</b>	Centre for Digital Arts and Technology
	Centre for Vision Research
	Vision: Science to Applications (CFREF)
	Sensorium
	IP Osgoode
	Centre for Innovation in Computing @ Lassonde

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Centre for Research in Earth and Space Science  
 Institute for Research on Digital Literacies

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*Research Areas*

Technical Foundations AI theory Machine learning Deep learning Data mining	Arts, Media & Design Visualization Art & gaming Computational creativity Social media studies
Computational Cognition Computer vision Speech processing Natural language processing	Philosophy Computational theory of mind Ethics & fairness of AI Cyborg identity and agency
Engineering Smart cities Software & systems engineering for AI-intensive systems Intelligent transportation systems Water resource engineering Disaster management Mobile robots Cyber-security in the smart grid	Law Governance, ethics & fairness of AI Data policy & intellectual property (IP) Surveillance, privacy & AI AI tools for IP law EDI & human rights issues of AI
Health & Science Cognitive science Computational neuroscience Epidemiology Structural chemistry	Other AI and Narrative Human/Machine Co-Creation Critical Data Studies Moral and societal challenges arising from AI deployment AI & Early Childhood Education

## Markham Research Cluster

<i>Faculty members with research interests in the area of AI &amp; Society</i>	Aijun An, Professor, Department of Electrical Engineering & Computer Science, Lassonde	Christo El Morr, Associate Professor, School of Health Policy & Management, Health
	Kristin Andrews, Professor, Department of Philosophy, LA&PS	Petros Faloutsos, Professor, Department of Electrical Engineering & Computer Science, Lassonde
	Muhammad Ali Khalidi, Professor, Department of Philosophy, LA&PS	<a href="#">Caitlin Fisher</a> , Chair; Associate Professor, Cinema & Media Arts (Future Cinema Lab), School of the Arts, Media, Performance and Design
	Kean Birch, Associate Professor, Environmental and Urban Change	Xin Gao, Professor, Department of Mathematics & Statistics, Science
	Michael S. Brown, Professor, Department of Electrical Engineering & Computer Science, Lassonde	Verena Gottschling, Associate Professor, Department of Philosophy, LA&PS
	Marcus Brubaker, Assistant Professor, Department of Electrical Engineering & Computer Science, Lassonde	Mark-David Hosale, Chair & Associate Professor, Department of Computational Arts, School of the Arts, Media, Performance & Design
	Amir Asif, Vice-President Research & Innovation	Michael Jenkin, Professor, Department of Electrical Engineering & Computer Science, Lassonde
	Michael Chen, Associate Professor, Department of Mathematics & Statistics, Science	Hui Jiang, Professor, Department of Electrical Engineering & Computer Science, Lassonde
	Stephen Chen, Associate Professor, School of Information Technology, LA&PS	Usman Khan, Assistant Professor and Graduate Program Director, Civil Engineering Program, Lassonde
	Gene Cheung, Associate Professor, Department of Electrical Engineering & Computer Science, Lassonde	Hamzeh Khazaei, Assistant Professor, Department of Electrical Engineering & Computer Science, Lassonde
	Giuseppina D'Agostino, Associate Professor, Osgoode Hall Law School, Founder and Director Intellectual Property Law & Technology	Murat Kristal, Associate Professor and Graduate Program Director, Business Analysis, Director Master of Business Analytics & Artificial Intelligence
	Patricio Davila, Associate Professor, Department of Cinema & Media Arts, School of the Arts, Media, Performance & Design	Matthew Kyan, Associate Professor, Department of Electrical Engineering & Computer Science, Lassonde
	Konstantinos Derpanis, Department of Electrical Engineering & Computer Science, Lassonde	Ganaele Langlois, Associate Professor & department Chair, Communication and Media Studies, LA&PS
	<a href="#">James Elder</a> , Professor, Electrical Engineering and Computer Science, Lassonde, and Psychology, Health	

## Markham Research Cluster

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Yves Lesperance, Associate Professor and Graduate Program Director, Department of Electrical Engineering & Computer Science, Lassonde

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Marin Litoiu, Associate Professor and Graduate Program Director, School of Information Technology, LA&PS

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Zhen Ming (Jack) Jiang, Associate Professor, Department of Electrical Engineering & Computer Science, Lassonde

---

Manar Jammal, Assistant Professor, School of Information Technology, LA&PS

---

Maleknaz Nayebi, Assistant Professor, Department of Electrical Engineering & Computer Science, Lassonde

---

Jonathan Obar, Associate Professor, Communication and Media Studies, LA&PS

---

Manos Papagelis, Assistant Professor, Department of Electrical Engineering & Computer Science, Lassonde

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Rebecca Pillai Riddell, Professor, Department of Psychology, Health, Associate Vice-President Research & Innovation

---

Enamul Prince, Assistant Professor, School of Information Technology, LA&PS

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Jennifer Pybus (Political Science) Canada Research Chair in Data, Democracy and AI, LA&PS

---

Regina Rini, Assistant Professor, Canada Research Chair in Philosophy of Moral and Social Cognition, Department of Philosophy, LA&PS

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Shayna Rosenbaum, Professor, Department of Psychology, Health

---

Sarah Rotz, Assistant Professor, Department of Social Science, LA&PS, and Faculty of Environmental and Urban Change

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Terry Sachlos, Assistant Professor, Department of Mechanical Engineering, Lassonde

---

Ali Sadeghi, Assistant Professor, Department of Electrical Engineering & Computer Science, Lassonde

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Lauren Sergio, Professor School of Kinesiology & Health Science, Health

---

Yan Shvartzshnaider, Assistant Professor, Department of Electrical Engineering & Computer Science, Lassonde

---

Ikjyot Singh Kohli, Adjunct-Status Professor, Department of Mathematics and Statistics, Science

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Gunho Sohn, Associate Professor of Geomatics Engineering, Department of Earth & Space Science & Engineering, Lassonde

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Pirathayini Srikantha, Assistant Professor, Department of Electrical Engineering & Computer Science, Lassonde

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Ian Stedman, Assistant Professor School of Public Policy and Administration, LA&PS

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Hina Tabassum, Assistant Professor, Department of Electrical Engineering & Computer Science, Lassonde

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John Tsotsos, Distinguished Research Professor, Department of Electrical Engineering & Computer Science, Lassonde

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Hjalmar Turesson, Deloitte Data Scientist, MBAN & MMAI Programs, Management Science Specialization, Schulich

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Natasha Tusikov, Program Coordinator, Assistant Professor, Department of Social Science, LA&PS

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Vassilios Tzerpos, Assistant Professor, Department of Electrical Engineering & Computer Science, Lassonde

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## Markham Research Cluster

Ruth Urner, Assistant Professor, Department of Electrical Engineering & Computer Science, Lassonde	Richard Wildes, Associate Professor, Department of Electrical Engineering & Computer Science, Lassonde
Doug Van Nort, Associate Professor, Department of Computational Arts, School of the Arts, Media, Performance & Design	Jianhong Wu, Professor, Canada Research Chair, Distinguished Research Professor, Department of Mathematics & Statistics, Science
Natalija Vlajic, Associate Professor, Department of Electrical Engineering & Computer Science, Lassonde	Dan Zhang, Professor, Department of Mechanical Engineering, Lassonde
Graham Wakefield, Associate Professor, Department of Computational Arts, School of the Arts, Media, Performance & Design	Hongmei Zhu, Associate Professor, Department of Mathematics & Statistics, Science
Steven Wang, Professor, Department of Mathematics & Statistics, Science	Huaiping Zhu, Professor, Department of Mathematics & Statistics, Science
	Joel Zylberberg, Assistant Professor, Department of Physics & Astronomy, Science

### **Projects**

- NCRN (2018-2023). A \$5.5 million NSERC Strategic Partnership Grant is funding the NSERC Canadian Robotics Network (NCRN). The Interactive Autonomy theme of the network is led by Professor Michael Jenkin (EECS, Lassonde)
- BRAIN (2016-2021). A \$4 million Ontario Research Fund – Research Excellence grant established the Big Data Research, Analytics and Information Network (BRAIN) Alliance, led by Professor Aijun An (EECS, Lassonde).
- ISSUM (2017-2022). A \$4 million Ontario Research Fund – Research Excellence grant established the Intelligent Systems for Sustainable Urban Mobility (ISSUM) project, led by Professor James Elder (EECS, Lassonde; Psychology, Health).
- SentryNet (2019-2023). A \$2.33 million contract through the Innovation for Defence Intelligence and Security (IDEaS) program, led by Professor Michael Jenkin (EECS, Lassonde).
- DITA (2019-2025). A \$1.65 million NSERC grant established the NSERC CREATE Training Program in Dependable Internet of Things Applications (DITA), led by Professor Marin Litoiu (EECS, Lassonde; School of Information Technology, LA&PS).
- CREATE DAV (2015-2021): A \$1.65 million NSERC grant established the NSERC CREATE Training Program in Data Analytics & Visualization (DAV), led by Professor James Elder (EECS, Lassonde; Psychology, Health).



Potential Partners

AI & Society Cluster

AI research at York is highly collaborative, currently involving more than 30 partnerships with Canadian companies and public agencies, and more than 120 international organizations and institutions. The establishment of a strong program of AI research and curriculum at the new Markham Campus will serve to support intensified engagement with AI-focused companies in the Markham technology hub, one of the largest technology clusters in Canada.

Some potential partners for the AI & Society research cluster at MC:

<i>Information &amp; Communications Technology</i>	Qualcomm
	-There are current collaborations with L. Wilcox (Psychology), R. Allison (EECS) and S. Magierowski (EECS)
	-Ongoing discussions with J. Elder
	-James Goel, Director Engineering at Qualcomm is a strong supporter of York and very focused on collaborating on AI projects
	Samsung
	IBM
	-Collaborations with Marin Litoiu, Aijun An (EECS)
	AMP
	Epson
	Huawei
-J. Elder (EECS) collaborating currently but project ends in Aug 2021.	
-R. Wildes (EECS) may still be collaborating Sunil Bisnath collaboration	

	Toshiba
	Oracle
	OpenText
	Mircom
	Siemens
	Redline Communications
	Genesys
	CrossWing
	Teledyne-Optech
	Esri Canada
	Learning Jungle
<i>Automotive</i>	GM- Canadian Technical Centre Markham Campus—Canada’s largest software R&D and innovation hub for autonomous and connected vehicles, with 700 engineers and software developers.
	-previous Lassonde engagement

## Markham Research Cluster

	Uptake on research collaboration projects was limited but I believe Sunil Bisnath has a GPS project with them.		GE Healthcare in Markham
	Auto sector Information Technology (IT) companies include CleNET, Lync, Applanix, Dealer-FX		Abbott
<i>Life Sciences &amp; Healthcare Technologies</i>	Mackenzie Health- affiliated innovation and accelerator programs include Mackenzie Innovation Institute (Mi2)	<i>Critical Infrastructure</i>	Cardinal
	Cortellucci Vaughan Hospital	<i>Government</i>	Johnson & Johnson
	Markham Stouffville Hospital		Philips Healthcare
	Southlake Regional Health Centre		Toshiba Medical
			General Electric
			Alectra Inc. and its GRE&T Centre
			City of Markham
			City of Vaughan
			York Region
			Ontario Centres of Excellence

Those affiliations from Board members of the MC External Advisory Committee:

- United Way of Greater Toronto
- York Region District School Board
- York Catholic District School Board
- YMCA of Greater Toronto
- WSP
- Royal Bank of Canada
- Workforce Planning Board of York Region

# Markham Research Clusters

## FinTech

Vision



Strengths



Differentiation



Potential Partners





## Vision

## FinTech Cluster

*Help create the future of the financial world by developing, evaluating, and implementing next-gen Financial Technologies to address complex real-world financial problems in a socially responsible manner.*

The financial services industry is facing radical transformation and restructuring and is evolving towards a customer-centric platform-based model supported by global digital technology infrastructures. In view of these game-changing trends, the establishment of the FinTech cluster at the MC (Markham Campus) will unite academic disciplines at York University and their research partners from academia and the private and public sectors to advance the understanding, development, and implementation of financial technologies. Members of the research cluster will apply their expertise to create and disseminate new knowledge, inform public policy, train highly qualified researchers and practitioners, and foster innovation in Financial Technologies (FinTech).

This Cluster will operate as a point of connection between York University and external private, public and non-profit entities of all sizes to undertake fundamental and industry based FinTech research, and capacity building (consulting, policy formulation, and novel curriculum development). Aligned with key programs being developed at the MC in financial technologies, digital technologies, computer science and others, this cluster will contribute to the engagement of scholars, students and the community in experiential learning opportunities. Our approach will encourage responsible organizational and societal adaptation to FinTech, innovation and entrepreneurship in the area, and leverage the opportunities that accessibility to financial technologies bring.

This cluster will draw upon the considerable research expertise at York University in the areas of blockchain technology, cryptocurrencies, central bank digital currencies (CBDCs), public policy and compliance, information systems governance, decentralized finance (DeFi) and the digital transformation of financial institutions, insurance technology (InsurTech), the development of IT platforms for financial information, and financial data analytics. The Fintech cluster will enable stronger collaboration among and within these research areas to develop new FinTech solutions that transcend traditional boundaries. The research cluster will facilitate the submission of larger-scale, interdisciplinary research grant applications and aspires to evolve into an Organized Research Unit (ORU).

By leveraging York University's vast strengths and complementarities, and working in conjunction with its innovation hub, YSpace, this cluster will formulate leading-edge solutions to serve Fintech companies and the organizations that use them. Based at the MC,

## Markham Research Cluster

its research and innovation will be enabled by its proximity to one of the largest technology sectors in Canada. This will provide a unique opportunity to cultivate valuable relationships and strengthen existing partnerships with the surrounding communities, industry, and stakeholders in the region, maximizing the growth and impact of FinTech research. By supporting the Markham region and beyond, we will contribute to Canada's competitiveness in the broader emerging digital economy.

Once established, the FinTech research cluster at the MC will contribute to:

- Increasing the productivity in Financial Technology academic research and enhancing capacity to generate world-class research and innovation
- Growing research collaborations and initiating new partnerships with key industry and public sector stakeholders in the Region and beyond including a wider network of Canadian and international FinTech research centres
- Enhancing external investment and grants in Financial Technology research
- Attracting and retaining outstanding students, FinTech faculty and senior researchers at the MC
- Incorporating more research outcomes within curricular programming to enhance student learning
- Increasing experiential education opportunities for our students



# Strengths

## FinTech Cluster

*The inventory of researchers and research centres/ labs included below is tentative and will be further refined after a closer inspection of their alignment with the FinTech research cluster.*

FinTech research is highly collaborative and is underpinned by expertise in diverse fields, including economics, commerce, mathematics, data science, computer science, IT, public policy, environmental science, law and many other related areas. York faculty members are currently engaged in FinTech-related research, contributing to a variety of technological applications while also providing broader perspectives, including understanding the impacts of the future of financial technologies from an economic, legal, ethical and societal-technical view. This is exemplified by those involved in the interdisciplinary exploration of digital currencies where York researchers take a holistic approach exploring the technical aspects of governance, architectures, financial inclusion of underprivileged communities, and policy on regulatory frameworks for financial systems including data and privacy regulations.

York faculty have demonstrated their agility and responsiveness by joining two new cluster research groups, one focussed around digital currencies and a second addressing the needs of small and medium-sized FinTech organizations. These new cluster members are: Antoine Djogbenou, Sepideh Ebrahimi, Mark Hayward, Irene Henriques, Marcela Porporato, Poonam Puri, Perry Sadorsky, Andreas Strebinger, Razvan Sufana, and Divinus Oppong-Tawiah.

The proposed FinTech Cluster will permeate various research centres, research areas, funded projects, and involve a diversity of faculty members leading to greater University-wide collaboration in this area. A sampling of York’s existing FinTech strengths is listed below:

<i>Research Centres</i>	Centre for Innovation in Computing @ Lassonde	
	Institute for Research on Digital Literacies	
	Risk and Insurance Studies Centre	
	Centre of Excellence in Digital Finance and FinTech (Schulich)	
	Blockchain Lab (Professor Henry Kim)	
	Schulich and Science offer a Graduate diploma in <a href="#">Financial Engineering</a> , hosted by Schulich.	
<i>Research Areas</i>	Economics (LA&PS)	Computer Science (Lassonde)
	Financial Econometrics	Machine learning

<p>Computational Finance          Developmental Economics          Economics of Insurance          Public Economics          Environmental Economics          International Trade          International Finance (also Schulich)          Digital Currencies/Cryptocurrencies          Central Bank Digital Currency (also Osgoode)</p>	<p>Data Security (also Osgoode, Schulich)          Information Technology Adoption (also LA&amp;PS and Schulich)          Human Computer Interaction          Information systems          Big Data Analytics (also Schulich)          Blockchain (also Schulich)          Data Science</p>
<p>Mathematics &amp; Statistics (Science)          Financial performance measures          Nonparametric analysis          Financial Mathematics</p>	<p>Law (Osgoode)          Governance &amp; Ethics (also Schulich, LA&amp;PS)          Data Policy &amp; Intellectual Property (IP) (also LA&amp;PS)          Security &amp; Privacy (also Schulich, LA&amp;PS)          Securities Regulations/          Regulatory Frameworks for Financial Systems (also Schulich, LA&amp;PS)</p>
<p>Business (Schulich, LA&amp;PS)          Financial Markets          Banking Research          Financial Engineering (Math)          Corporate Governance and Accountability (also Osgoode)          Business Ethics (also Osgoode)          Information Technology Assurance and Compliance          Big Data Analytics (also Lassonde)          Artificial Intelligence (also Lassonde)          Security, Privacy, Ethics (Osgoode)</p>	

*Faculty members with research interests in the area of FinTech*

**Liberal Arts & Professional Studies**

**Economics:** financial econometrics and big data inference methods:

- [Antoine Djogbenou, daa@yorku.ca](mailto:daa@yorku.ca)
- [Joann Jasiak, jasiakj@yorku.ca](mailto:jasiakj@yorku.ca)
- [Tsvetanka Karagyozeva, tkarag@yorku.ca](mailto:tkarag@yorku.ca)
- [Andrea S. Podhorsky, andrea@yorku.ca](mailto:andrea@yorku.ca)

- [Paul Rilstone, pril@yorku.ca](mailto:pril@yorku.ca)
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**School of Administrative Studies:**

- [Ali Asgary, asgary@yorku.ca](mailto:asgary@yorku.ca)
- [Pilar F Carbonell, pilarc@yorku.ca](mailto:pilarc@yorku.ca)

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**Schulich School of Business**

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**Lassonde School of Engineering:**

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## Potential Partners

## FinTech Cluster

York's Markham campus will be a nexus for partnerships with the Markham industry sector and the Region broadly. The Markham campus is situated in the York region, which is recognized as one of the largest and well-rounded technology clusters in Canada. This technology hub continues to garner attention from its track record as a growth centre for technology start-ups supported by impressive incubators and accelerators, like YSpace and ventureLAB, and research and talent foundation being supplied by universities like York. In fact, a 2020 CBRE report on tech talent found that the Toronto region was the top Canadian tech talent market and cited it as among the highest value by tech workers in North America.

The desire for top talent and the opportunities for current York students and future graduates in FinTech and other technology driven sectors is considerable. Ontario's share of Canadian FinTechs is over 60% in 2020, most of those residing in the York Region/Toronto and the Kitchener-Waterloo corridor, with many well-positioned for substantial growth given current market trends (Canada Fintech Report 2021, Accenture). Our technology focused campus will be able to capitalize on this already formidable presence by not only augmenting research partnerships but also being able to provide work-integration and experiential learning to prepare career-ready graduates. Indeed, the new Markham campus is both well situated geographically and programmatically aligned to feed into this growing ecosystem. Undoubtedly the establishment of this research cluster would serve to support strengthened engagement by building on York's current partnership foundation in related disciplinary areas, and further growing and fostering industry-based FinTech research relationships and capacity building in the Region. Some potential partners for the FinTech research cluster at MC include:

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### *Academic Research Labs/ Institutes:*

[Blockchain Research Institute](#)

[Financial Innovation Lab](#) (Rotman)

[Digital Finance Institute](#) (Ellis Odyne, Executive Director and Chief AI Officer)

[Singularity University](#) and SU Canada ([Anne Connelly](#), entrepreneur and faculty)

[UQAR \(Universite de Quebec a Rimouski\)](#)

[The Linux Foundation](#) (Hilary Carter, Vice-President of Research)

[Stanford Center for Blockchain research](#)

[Stanford Advanced Financial Technologies Laboratory](#)

[Cornell's Initiative for CryptoCurrencies and Contracts \(IC3\)](#)

[University of Basel Center for Innovative Finance](#)

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	<a href="#">MIT Digital Currency Initiative</a>
	<a href="#">Imperial College London</a>
	<a href="#">MIT Cryptoeconomics Lab</a>
<b><i>Not for Profit</i></b>	<a href="#">CryptoChicks.ca</a> (Elena Sinelnikova, CEO and co-founder)
<b><i>Financial Institution</i></b>	<a href="#">Wealthsimple</a> (Hanna Zaidi, Director of Regulatory R&D)
<b><i>Associations</i></b>	<a href="#">Chartered Professional Accountants (Ontario &amp; Canada)</a>
	<a href="#">ISACA (Information Systems Audit and Control Association)</a>
	<a href="#">Payments Canada</a>
	Casualty Actuarial Society
	<a href="#">Society of Actuaries</a>
	CABE (Canadian Association for Business Economics)
	Canadian Economics Association
	<a href="#">CFA Institute</a> (Chartered Financial Analyst)
	<a href="#">RIMS</a> (Risk and Insurance Management Society)
	Canadian Bankers Association
	Internal Auditors Association
<b><i>Finance, Insurance and Accounting Services in York Region</i></b>	Corporate and/or back-office location for:
	State Farm
	Scotiabank
	Allstate Insurance
	RBC KPI
	TD Waterhouse
	TD Insurance
	MNP
	KPMG
	Johnson Insurance
	Aviva Insurance
	Bank of China
	Grant Thornton
	HSBC
	E&I

## Markham Research Cluster

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	Deloitte
	CIBC
	Leading Canadian FinTech hub with over 50 companies including:
	XE.com
	Real Matters
	Everlink Payment Services
	Ceridian Canada
	Giesecke & Devrient
	Paymentus
<i>Government Offices</i>	York Region Economic Development
	<a href="#">City of Markham Economic Development</a>
	<a href="#">City of Vaughan Economic Development</a>
	<a href="#">Richmond Hill</a>
	<a href="#">Town of Newmarket</a>
	<a href="#">Aurora</a>
	<a href="#">King Township</a>
	<a href="#">Bank of Canada</a>
	<a href="#">Bank of International Settlements</a>
	<a href="#">Statistics Canada</a>

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Those affiliations from Board members of the MC External Advisory Committee:

- United Way of Greater Toronto
- York Region District School Board
- York Catholic District School Board
- YMCA of Greater Toronto
- WSP (management & consultancy services to the built and natural environment)
- Royal Bank of Canada
- Workforce Planning Board of York Region



# Appendix

## Appendix A.

### Major Economic Clusters

### York University – Markham Centre Campus

Information & Communications

60,000 employees in over 4,300 businesses (IBM, AMD, Huawei, CGI, Qualcomm, Lenovo, SAP, Oracle, GE, Toshiba, Nokia, and Siemens)



Financial, Business & Accounting

40,000 jobs and 2,900 industry related businesses (Allstate, Aviva, CIBC, Deloitte, HSBC, KPMG, MNP, TD, RBC KPI, State Farm, Scotiabank)



Consulting Engineering, Building, Construction

10,000 trades, developers, real estate & consulting firms (AECOM, AE, ARCADIS, B & M, GHD, Morrison Hershfield, MMM, Stantec, URS, WS)



Automotive Technologies, Parts & Components

120 auto related companies, 16,000 local jobs (BMW, Honda, Hyundai, Mazda, Volvo, Magna International, Ex-Cell, VanRob, Autoliv Elect.)



Advanced Manufacturing

2,600 manufacturers, 88,000 employees (GE, Magna, Microart, Martinrea, Jeld-wen, RuggedCom, Siemens, Showa, Teva, Apotex, Amico)



## Existing Major Funded Research Initiatives

SUPERCLUSTERS (CANADA)	CFREF (ONTARIO)
Digital Technology Supercluster	Metal Earth (Laurentian)
Protein Industries Supercluster	Astroparticle Physics (Queens)
Next Generation Manufacturing Supercluster	Agricultural Systems for a Healthy Planet (Guelph)
Scale AI Supercluster	Transformative Quantum Technologies (Waterloo)
Ocean Supercluster	Brain Health for Life (Queens)
	Vision: Science to Applications (VISTA) (York)
	Medicine by Design (Toronto)

MCC: Focus on being distinct with potential to develop a world-renowned reputation

# Potential Research Areas (SSHRC)

York University –  
**Markham Centre  
Campus**

<b>Digital Cultures</b>	Digital Performance, Gaming and Game Technologies, Digital Technologies, Advanced Virtual/Augmented Reality, Intellectual Property
<b>Public Engagement</b>	Social Work, Human Resource Management, Public Policy and Administration – Municipal program, Global Labour/labour relations
<b>Urbanization, Cultures</b>	Urban Planning, Urban Leadership, Urban Governance, Black Canadian Studies, Indigenous Studies, Canadian Studies, East Asian Studies, Jewish Studies
<b>Energy, Environmental Management</b>	“Living Labs”, Sustainability Energy Initiative, fuel cells, Renewable Energy, Smart Grids
<b>Disaster Risk Governance</b>	Risk Management (RISC), Disaster & Emergency Management
<b>Business Management &amp; Accounting</b>	Financial Accountability, Corporate Social Responsibility/ Responsible Business, Governance, Diversity in Corporate Development, Supply Chain Management

# Potential Research Areas (NSERC/CIHR)

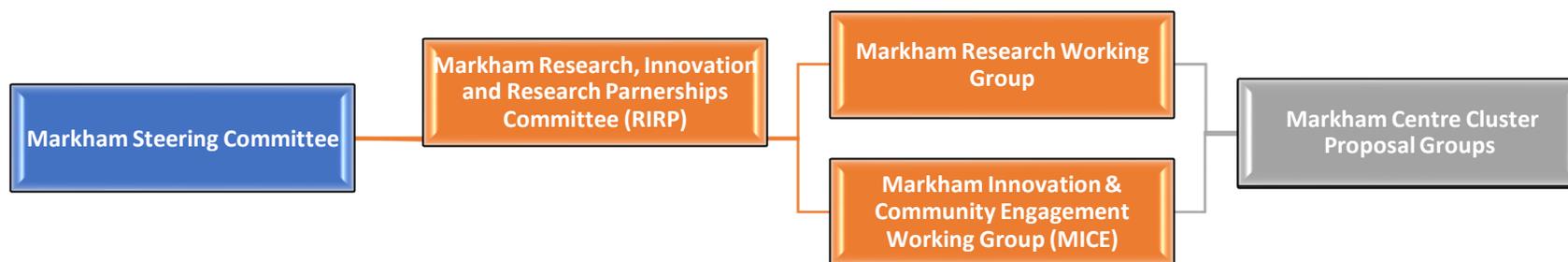
## York University – Markham Centre Campus

Information & Communications	Beyond 5G, Internet of Things, Cybersecurity and Blockchain technologies, Robotics/Drones, Advanced Virtual/Augmented Reality
Financial Technologies, Big Data	Fin Tech, AI/Machine learning/Data Analytics, Data Visualization, Actuarial Science <a href="#">(Artificial Intelligence and Society)</a>
Consulting Engineering, Building, Construction	Real Estate Management & Engineering, Smart Cities and Communities, Urban Planning, Net Zero Energy Buildings, Infrastructure Development
Life Sciences and Healthcare Technologies	Medical Innovations, Preventive Health/Healthy Living, Bio Engineering, Medicinal Chemistry, Biophysics
Automotive Technologies, Parts & Components	Autonomous Vehicles, Traffic Engineering, Battery Technologies and Modeling
Advanced Manufacturing	3D Printing, Industry 4.0, Renewable Energy, CyberPhysical Systems, Microelectronics
Agriculture and Food Processing	Supply Chain Management, Food Storage/Processing



## Appendix B.

### Research Planning Committee Structure:





**Markham Research, Innovation  
and Research Partnerships Committee (RIRP)  
Terms of Reference**

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**Membership:**

Amir Asif, Vice-President Research & Innovation (Chair)  
Alice Pitt, Senior Advisor, Markham Academic Strategic Planning  
Christine Brooks-Cappadocia, Director, Continuing Professional Education  
Ijade Maxwell Rodrigues, Chief of Government and Community Relations, Office of the President  
Lucy Fromowitz, Vice-Provost, Students  
Sandra McLean, Senior Media Relations Officer, Media Relations & External Communications  
Sarah Howe, Assistant Vice-President, Innovation & Research Partnerships  
Shawna Teper, Community and Government Relations Officer, Office of the President  
Thomas Loebel, Dean and Associate Vice President, Faculty of Graduate Studies  
William Gage, Associate Vice-President, Teaching and Learning

**Mandate:**

Chaired by Vice President, Research and Innovation, this Committee has the primary responsibility of developing and implementing plans for research, innovation, and community relations for the Markham Center Campus (MCC). RIRP provides updates, advice and recommendations on matters related to research, innovation, and research partnerships to the Markham Steering Committee and co-ordinates implementation of the Steering Committee's decisions on these matters. RIRP will leverage collegial expertise, solicit advice on the requirements of the community, as well as advise and provide relevant information to other MCC committees on matters related to research, innovation, and research partnerships.

**The RIRP Committee will:**

- Provide a forum for discussion of research, innovation, and community relations related decisions for the MCC.
- Lead the articulation and development of a vision on research, innovation, and research partnerships for the MCC in collaboration with relevant Faculties/Schools at the Keele and Glendon campuses.
- Implement decisions made by the Markham Steering Committee on research, innovation, and research partnerships at MCC.
- Create additional working groups, as required, and dissolve these working groups at the completion of the assigned tasks.

**RICR Working Group: Markham Research Working Group**

Reporting to RIRP, the Markham Research Working Group is the first support group established by RICR to provide support to RICR on developing a research plan for MCC. The composition of the Markham Research Working Group is Vice-President Research and Innovation

## Markham Research Cluster

(Chair); Up to two representatives from each of the five participating Faculties (AMPD, Graduate Studies, LA&PS, Lassonde, and Science); Senior Advisor, Markham Academic Strategic Planning, and; Senior Policy Advisor, Research.

### **Membership:**

Amir Asif, Vice-President Research & Innovation (Chair)  
Alice Pitt, Senior Advisor, Markham Academic Strategic Planning  
Barbara Edwards, Senior Policy Advisor, Research – VPRI  
Jennifer Steeves, Professor Psychology, Health  
John Justin McMurtry, Dean – LA&PS  
John Moores, Associate Dean Research – Lassonde  
Mark Bayfield, Associate Professor Biology – Science  
Michael Brown, EECS Professor – Lassonde)  
Michael Darroch Associate Dean, Academic – AMPD  
Ravi De Costa, Associate Dean Research and Graduate Studies – LA&PS  
Thomas Loebel, Dean and Associate Vice President, Faculty of Graduate Studies

### **RIRP Working Group: Markham Innovation & Research Partnerships Working Group**

#### **Purpose:**

The purpose of Markham Innovation & Research Partnerships Working Group is to determine how innovation and research partnerships will be embedded in the new Markham Campus (MC). The Markham Innovation & Research Partnerships Working Group will bring together representatives from across the University, but with specific emphasis on those Faculties who will be launching programs at the MCC. The following are the key goals:

- Create a common understanding of the type of activities that fall within innovation and research partnerships and the activities that already exist within Markham.
- Conduct a needs analysis, to determine the innovation and research partnerships gaps for the MCC. Identify ways in which existing initiatives can support these activities and identify new opportunities for collaboration between VPRI and Faculties.
- Develop an innovation and research partnerships plan for the MCC.
- Coordinate with the Markham Engagement and Communications Committee to ensure that stakeholder outreach is coordinated, and that duplication does not occur.

#### **Roles:**

## Markham Research Cluster

**Working Group Chair:** The Chair will ensure that meetings are scheduled and ensure timely completion of meeting minutes. The Chair will work with working group members to develop the innovation and research partnerships plan for the MCC and will liaise with the RIRP and the Markham Steering Committee to champion said plan.

**Working Members:** Members of the working group are responsible for attending meetings, actively participating and carrying out the work to identify key strategic initiatives and to support the development of the innovation and research partnerships plan.

### **Membership**

Reporting to RIRP, the Markham Innovation & Research Partnerships Working Group is the second support group established by RIRP to provide support to RIRP on developing an innovation and research partnerships plan for MCC. The composition of the working group is as follows:

Sarah Howe, Assistant Vice-President, Innovation & Research Partnerships (Chair)

Lucas Anderson, Government Relations Officer, Office of the President

Sarah Bay Cheung, Dean, School of Arts, Media, Performance & Design

Chris Carder, Special Advisor, Entrepreneurship, Office of the President

Natalie Coulter, Director, Institute for Research on Digital Learning (FGS representative)

Will Gage, Associate Vice-President, Teaching & Learning

Andrea Kosavic, Digital Engagement and Strategy, Office of the Dean of Libraries

Jack Leong, Associate Dean, Research and Open Scholarship, Office of the Dean of Libraries

Andrew Maxwell, Bergeron Chair in Tech. Entrepreneurship, Lassonde School of Engineering

Terry Sachlos, Assistant Professor, Lassonde School of Engineering

Gary Sweeney, Professor, Dept. of Biology, Faculty of Science

Sean Kheraj, Associate Dean, Programs, Faculty of Liberal Arts & Professional Studies

Hongmei Zhu, Associate Professor, Dept. of Mathematics & Statistics, Faculty of Science