

# Five-Year Academic Strategic Plan 2016-2021 - DRAFT

## ENVIRONMENT

### Opportunities

- Shifting focus of government funding for industrial research
- Declining research group in companies and government
- Large-scale funding initiatives in Canada and internationally (Genome Canada, IC-IMPACTS, Gates)
- Dean's Strategic Fund
- Non-traditional funding sources: industrial contributions, philanthropy
- Sustainability of planet (climate change, pollution, social unrest, water distribution and scarcity)
- Students adapt to changing workplace
- Large urban metropolitan environment
- Scale of U of T
- Centre for Innovation and Engineering Entrepr.
- Leveraging international reputation for collaborations
- Leveraging int'l reputation for student recr.
- Online learning tools and resources
- E-textbooks/Cloud/open access for R&D data
- Changing accreditation approach

### Threats

- Government Funding model (bums in seats)
- Government deficit
- Declining/flat government funding (resrch + edu)
- Increasing availability /competition from 'free' online education
- U of T Funding model (passed down)
- Differentiation with emerging nation programs (Asia, Southeast Asia)
- Shifting focus of government funding for industrial research
- Stricter immigration policies
- Declining international student funding
- Project-based focus for industrial collaborations
- Lack of established industrial areas for collaborative funding in Canada
- Cyclical and short term nature of funding in different areas
- Current IP Policy - companies want the IP
- Sustainability of planet (climate change, pollution, social unrest, water distribution and scarcity)
- Large urban metropolitan environment (cost of living, traffic, commute, recruitment & retention)
- Funding from Science without Borders disappearing at the undergraduate level

## VISION/VALUES/BELIEFS

*“Through leading edge research and education, we integrate chemistry, biology and engineering to drive solutions to global challenges in energy, the environment and health”*

### Values

- Ethics, values and integrity of students
- Education, student future well-being in vocation
- Collegiality, collaboration & community
- Benefit to society, sustainability, meaningful problems, global impact
- Adaptive to rapidly changing world / global issues
- Creativity, imagination, open-mindedness
- Technical excellence & international reputation

### Beliefs

- World is on unsustainable track
- We will be among the top chem eng depts, and will be recognized as such
- Type of offering will attract corresponding type of students
- Rate of change in world is accelerating
- Strong link between “big” global issues and sustainability in chemical engineering discipline

## ORGANIZATION

### Structure

- 1 Chair
- 3 Associate Chair – UG/Grad/Research
- 17 Admin Staff – optimize with transformation
- Leadership Team
- 13 Committees & 7 Task Forces
- Staff have very defined roles
- 8 Research Clusters for collaboration
- 5 Institutes: (3 with Exec Dir – Business Dev)
- BioZone, OCCAM, SOCAAR, IWI, P&PC

### Style

- Faculty champions drive key initiatives
- Flexible, adaptable community
- Collegial with low team integration
- Low authority / high autonomy for prof
- Self-organizing system with tenure security

### Systems

- Effective undergraduate teaching systems
- Grad needs to be upgraded
- E-learning technology very limited

### Size (Capacity)

- First year intake ~90 domestic, 40 int'l
- Second year intake ~150
- Graduate students 240, ~8 students/FTE
- Focus on TTC improvements in grad

### Staffing

- 34 Professors
- 19 Adjunct Professors
- Not anticipating sign change in Faculty size (+10%?)

### External Relations With Industry

- Mediated through institutes & centres
- \$1.8M industrial funding
- 46 invention disclosures; 7 licenses
- ~70 Company relationships
- 20 Companies Formed since 1970=1/2yr

### Transformational Resources (New)

- Support for faculty champions
- Educational Design Advisor (EDA)
- Faculty of Education Masters/PhD Students
- Board of Advisors focus on business development
- Develop Exec. Dir. role to drive business growth with industry
- Teaching technology & big data resources

## STRATEGY

### Product Market Focus

- **BASc** 100 Domestic 50 Foreign
- Eng & Business Minor / Cert
- 7 Minor options
- PEY support for 70 Students
- **MEng** 120 up dramatically; 1.1 TTC
- **MASc** 70-80 in 7 years – declining; 2.2 TTC
- **PhD** 70-80 in 7 years – growing demand; TTC is 4.9-5.9 yrs. (High)
- **Research** – Per Prof network
- 170 Publications 5.7 / FTE per yr.
- 46 invention disclosures & 7 licenses over 5 yrs.
- **Tech transfer** / start-ups (0.5 / yr.)
- Future trend 40:60 MASc: PhD

### Differentiation / Uniqueness

- Interconnection of undergrad learning and research strength
- Research intense environment
- Strong in fundamentals
- Large urban campus in GTA
- Interdisciplinary cross connection with the rest of U of T
- Specializations / relevance
- Vision & societal impact
- Low tuition cost domestically
- International tuition also attractive

### Transformational Targets

#### By 2020 we will:

1. Add 3 new multi-researcher / multi-disciplined programs to drive solutions to global challenges.
2. Reduce in-classroom instructional time significantly (~30%), complementing with problem-based and experiential learning in ways that improve learning outcomes
3. Elevate teaching excellence such that the total learning environment is the distinguishing trait of the program in the eyes of students.
4. Increase research funding by 70% to \$30M through deeper integration and synergy with our total external network.
5. Reorganize and streamline administration and support systems efficiency to drive overall space and organizational effectiveness.

## RESOURCES

### Human

- 34 Professors (5 new in last five years)
- 18 Full Professors
- 5 Associate Professors
- 5 Assistant Professors
- 3 Research Professors Limited Term
- 3 Teaching Stream Professors
- 19 Adjunct Professors
- 15 Professors Emeriti
- 17 Admin Staff

### Financial

- Annual operating budget \$12M
- Dean's Fund Project Funding \$4.5M over past 5 years
- ~\$1M Undergrad Financial Assistance
- \$5M Graduate Funding
- \$15-20M in Research Funding \$680k/FTE
- \$30-40k Donations; \$6M Chair endowments; \$2.3M Grad end.; \$2.2M Undergrad end.

### Concerns

- Limited resources for transformation to “work on the work”
- Efficiency of teaching resource considering attendance
- Faculty workload – fragmented, too many different tasks
- Funding (MTCU) based on headcount with base costs covered by undergrads
- Foreign vs. domestic grad student funding basis
- Unstable & unpredictable research funding
- Wallberg Building and lack of space – 9,875 m<sup>2</sup> of space in 237 rooms (Inflexible space, not adaptable)
- Resistance to space reallocation
- Poor big data infrastructure

# Five-Year Academic Strategic Plan – Key Initiatives, 2016-2021 (DRAFT)

	Initiative	Rationale	Multi Year Targets	Tactics
1	<b>Initiate large multi-researcher / multi-disciplinary (MR/MD) collaborative programs around our vision</b>	<ol style="list-style-type: none"> <li>Previous initiatives like BioZone have multiple positive effects</li> <li>Aligned with our new vision, we are targeting major societal impact on relevant problems</li> <li>These programs drive new fertile external relationships</li> <li>There are strong benefits to student learning and faculty</li> </ol>	<p><b>By 2020 - 3 new MR/MD programs are running</b></p> <ol style="list-style-type: none"> <li>2016 Identify potential target issues</li> <li>2017 Establish funding and approvals</li> <li>2018 First Multi Researcher / Multi Disc program is formally launched</li> <li>2019 Program 2</li> <li>2020 Program 3</li> </ol>	<ol style="list-style-type: none"> <li>Broad solicitation of problem identification candidates</li> <li>Kickstarter initiatives + Dean's Strategic Fund seed projects</li> <li>Start more seeds with risk that some will fail</li> <li>Engage industrial partners</li> <li>External advisory board</li> <li>Hire 3 new faculty aligned with the plan</li> <li>Identify key funding sources attached to big themes</li> </ol>
2	<b>Create a modern chemical engineering curriculum aligned with our vision</b>	<ol style="list-style-type: none"> <li>The curriculum must have key characteristics:                             <ul style="list-style-type: none"> <li>Student-centred mindset</li> <li>Career success outcome driven</li> <li>Experiential learning</li> <li>Global perspective</li> <li>Research immersion</li> <li>Embracing change / future focus</li> </ul> </li> <li>Learning technology and methodology is out of touch and not oriented toward problem based and experiential learning.</li> </ol>	<p><b>By 2020 reduce in-classroom instructional time significantly (~30%), complementing with problem-based and experiential learning in ways that improve learning outcomes</b></p> <ol style="list-style-type: none"> <li>2016 Foundation with grad students</li> <li>2016 Lab Task Force integrating Labs/curriculum</li> <li>2016 E-modules for Engineering Economics</li> <li>2017 Enhanced professional skills program &amp; international program</li> <li>2018 Graduate hatchery</li> <li>2019 – 30% reduction in classroom time</li> <li>2020 – 50% achieved</li> </ol>	<ol style="list-style-type: none"> <li>Benchmark (e.g., MIT &amp; Stanford &amp; others)</li> <li>Add Educational Design Advisor + Fac of Ed help</li> <li>Define roadmap to 50% in detail</li> <li>Unit operations renewal – Integrated Chemical Engineering</li> <li>Seed pilot designs in selected safe places in the existing curriculum</li> <li>New mandatory course for grads in Graduate Research Methods</li> <li>Develop MOOC pilot with Dean's Strategic Fund</li> <li>Hire the faculty who can deliver new program</li> </ol>
3	<b>Elevate teaching excellence, effectiveness and impact</b>	<ol style="list-style-type: none"> <li>Teaching and research cultural strength are our two legs</li> <li>Students not currently inspired to attend and participate</li> <li>A cultural shift is required to elevate teaching excellence</li> <li>We are not currently resourcing this as a focus of improvement – we are good but not great</li> </ol>	<p><b>By 2020 the student-centred, diverse-style learning environment is a distinguishing trait of the whole program</b></p> <ol style="list-style-type: none"> <li>2016 Teaching triads kick-off</li> <li>2017 Budget includes new resources</li> <li>2018 Measurable impact expected in student response</li> <li>2020 No doubt in transformation on feedback</li> </ol>	<ol style="list-style-type: none"> <li>Teaching stream appointment (s)</li> <li>Teaching effectiveness committee</li> <li>Initiate teaching triads for mutual support</li> <li>Coordinate with new curriculum above</li> <li>One faculty with strong teaching improvement focus</li> </ol>
4	<b>Catalyze the synergy of our external networks with our internal capability for societal and economic impact</b>	<ol style="list-style-type: none"> <li>Value, impact and relevance of the program is enhanced by more intensive industry and alumni linkages</li> <li>Resource, mining, chemical industry under intense pressure and decline</li> <li>By identifying pressing needs and issues and serving them we realize our vision</li> <li>Global view needed, not just Canada (e.g., Toilet 2.0)</li> <li>Stanford &amp; MIT are very different in this area and could serve as role models</li> </ol>	<p><b>By 2020 increase R&amp;D funding to \$30M</b></p> <ol style="list-style-type: none"> <li>2016 New interface engagement plan developed</li> <li>2016 Launch Graduway to engage alumni</li> <li>2017 Research theme alignment plan</li> <li>2020 – 1,000 engaged alumni &amp; 100 engaged industrial partners</li> </ol>	<ol style="list-style-type: none"> <li>Benchmark to ID best practice</li> <li>Strong design support from Board of Advisors</li> <li>Priority focus areas determined with initiative 1</li> <li>Catalogue and critique current situation – external links</li> <li>Institute Exec Dir help design effective approaches</li> <li>Identify climate change related big themes &amp; funding</li> <li>Enhance tracking and engagement with alumni and customers</li> </ol>
5	<b>Reorganize and streamline administration and support systems efficiency to drive overall space and organizational effectiveness</b>	<ol style="list-style-type: none"> <li>We don't have transformational resource to improve</li> <li>We don't allocate the time to transform b/c we are "busy"</li> <li>We need catalyzing change agents to activate initiatives</li> <li>Our administrative staff design needs to be optimized</li> <li>With a new approach we could access more funding</li> <li>Space allocation needs to be flexible to match needs</li> <li>Physical space approach is transformed by learning model</li> </ol>	<p><b>By 2020 we have realized the above bold plans because we purposefully allocated the resource to do it!</b></p> <ol style="list-style-type: none"> <li>2016 Organizational design and funding freed up</li> <li>2017 4-year facility plan reflecting above</li> <li>2017 Resources in place and actively working</li> <li>2017 New space concept is in place</li> <li>2018 TTC model saves resources</li> </ol>	<ol style="list-style-type: none"> <li>Streamline administrative work and allocate to new transformation resources</li> <li>Shared services model across the Dept/Faculty</li> <li>Space management committee/policy</li> <li>Re-conceptualize learning space design per above</li> <li>Lose the walls and see industry partners and the whole university as learning space</li> </ol>