AESIS

Dalhousie University | 19-21 June 2023

Welcome to the 11th international AESIS conference on

Impact of Science on Society

SSHRC CRSH

ELSEVIER

CIHR IRSC

DALHOUSIE UNIVERSITY

GenomeCanada

Work Wellness Institute
L'institut de bien-être au travail

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Michael Smith Health Research BC

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Words of Welcome

Conference chairs:

Barbara Hamilton-Hinch

Rohini Bannerjee

Plenary Opening

Ursula Gobel

David Budtz Pedersen

Chafic Mokbel

Ahsan Habib

Wednesday, June 21

Ursula Gobel

VP, Stakeholder Engagement & Advancement

of Society, Social Sciences & Humanities Research

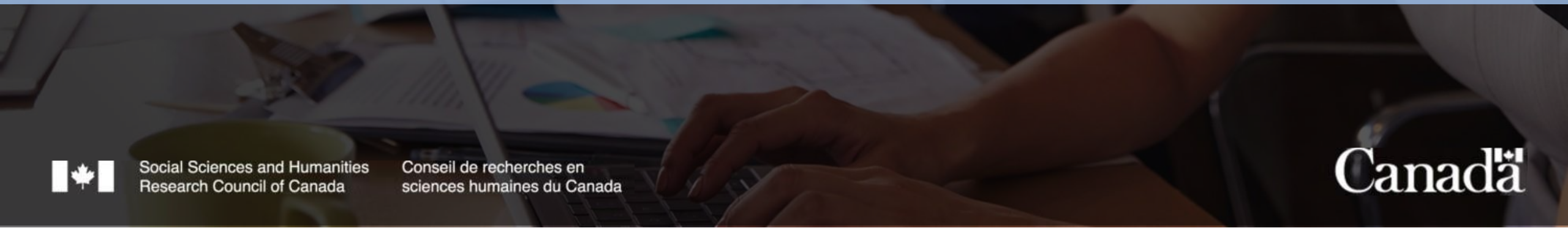
Council, Canada

SSHRC CRSH

Ursula Gobel, SSHRC - AESIS, June 21, 2023

FORGING CONNECTIONS IN RESEARCH AND RESEARCH TRAINING

Relationship-Building and Research Impact



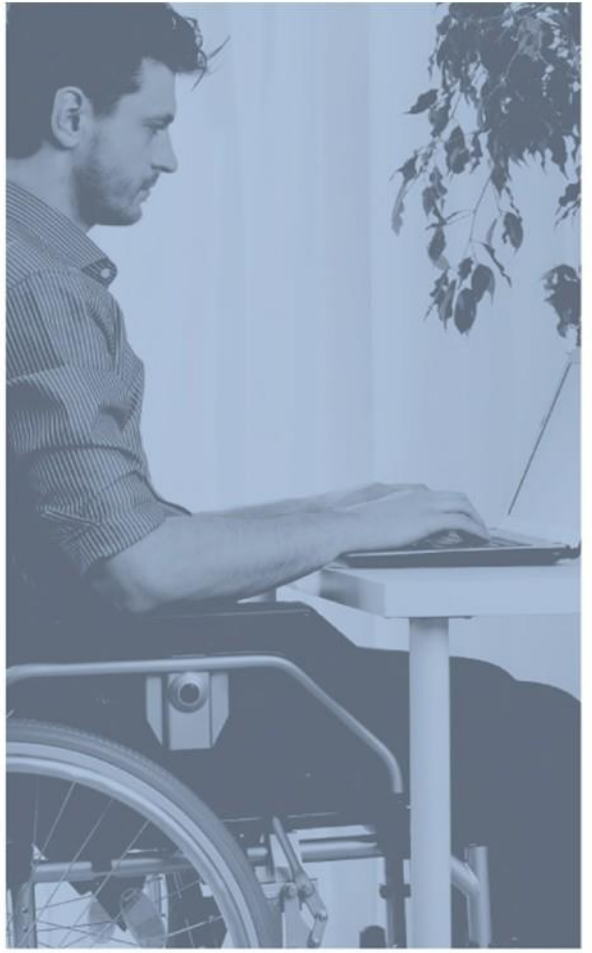
Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada
Canada

OUR ROLE

Federal agency mandated to promote and support research and training in the social sciences and humanities

Through grants, fellowships and scholarships, SSHRC:

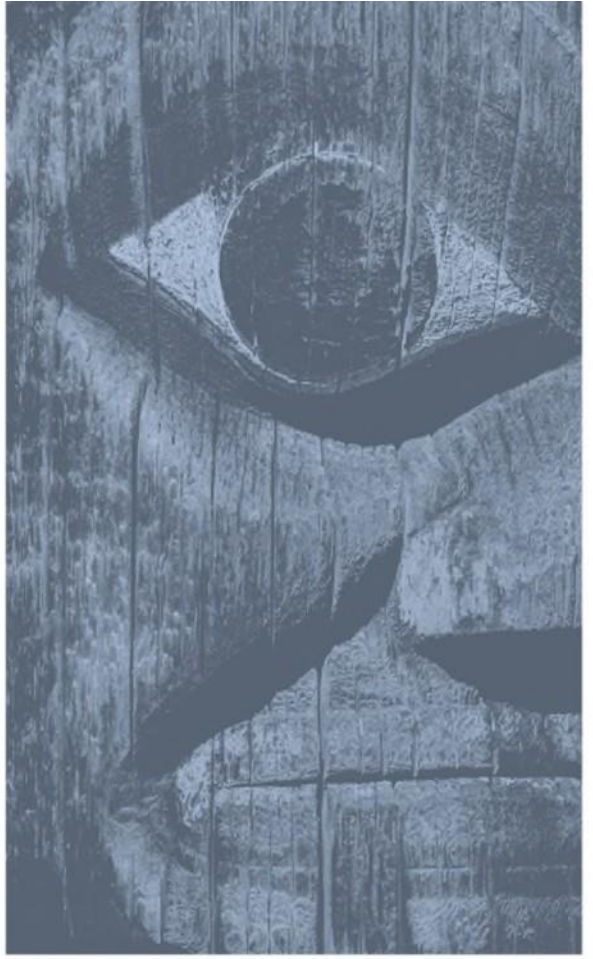
- **Trains** the next generation of talented, creative thinkers and doers
- **Builds** knowledge and understanding about people, cultures and societies
- **Drives** the innovations that address the challenges of today and tomorrow



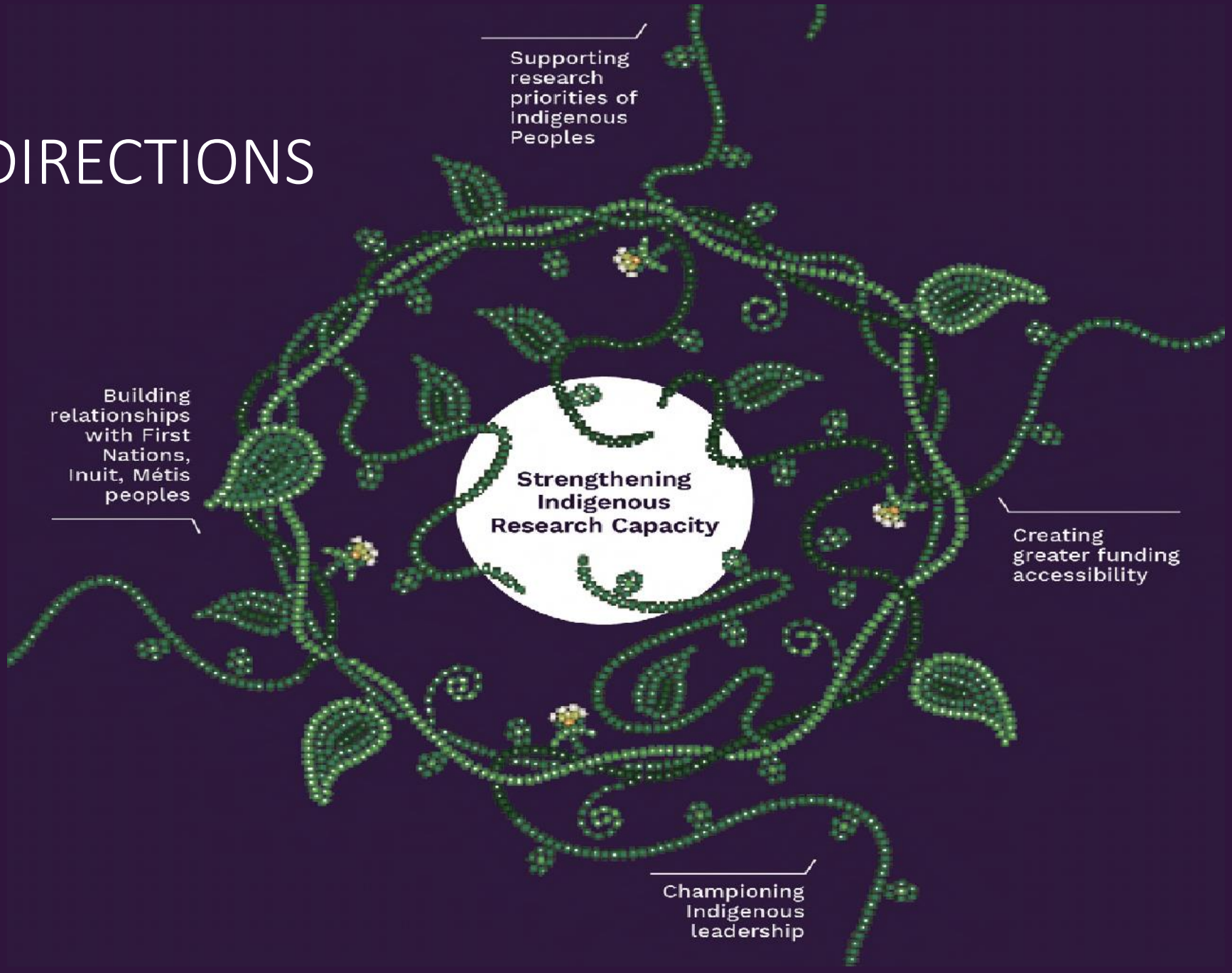
It's all about People, … People

INDIGENOUS RESEARCH

SSHRC is committed to supporting and promoting social sciences and humanities research by and with First Nations, Métis and Inuit Peoples.



STRATEGIC DIRECTIONS



Self-determination: fostering the right for First Nations, Inuit and Métis Peoples to set their own research priorities

Decolonization of research: respecting Indigenous ways of knowing and supporting community-led research

Accountability: strengthening accountability in respecting Indigenous ethics and protocols in research and identifying the benefits and impacts of research in Indigenous communities

Equitable access: facilitating and promoting equitable access and support for Indigenous students and researchers

Knowledge shapes policy

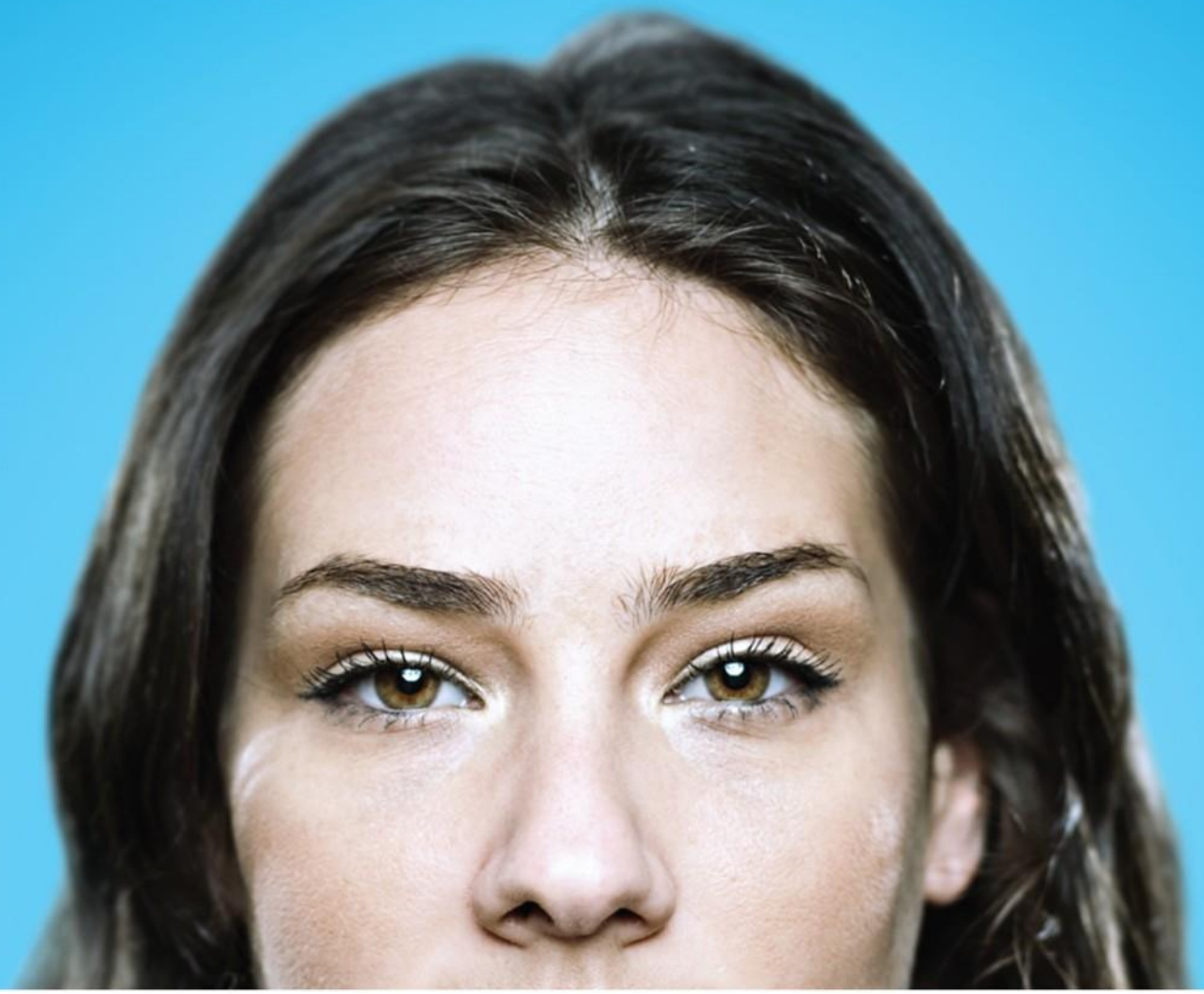
Read the evidence briefs linked to Knowledge Synthesis Grants on the themes of:

- Mobility and Public Transit
- Skills and Work in the Digital Economy
- Living Within the Earth's Carrying Capacity

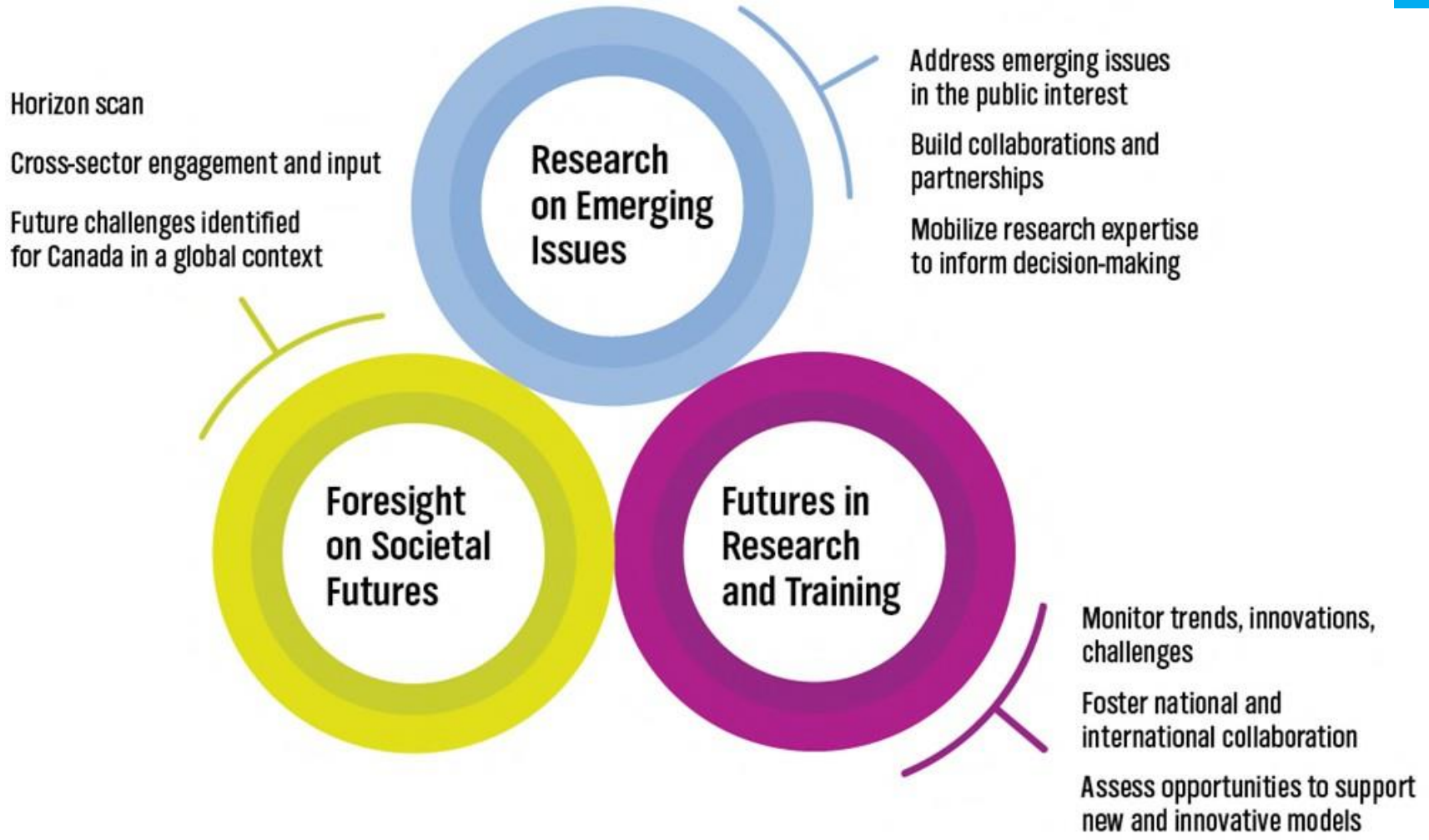
www.sshrc-crsh.gc.ca/evidencebriefs

SSHRC CRSH

IMAGINING CANADA'S FUTURE



IMAGINING CANADA'S FUTURE FRAMEWORK



Imagining Canada's Future – 16 Future Challenge Areas

Working in the Digital Economy

Global Health and Wellness for the 21st Century

The Emerging Asocial Society

Shifting Dynamic of Privilege and Marginalization

Building Better Lives Across the Gender Spectrum

Inhabiting Challenging Environments

Balancing Risks and Benefits in the Emerging Surveillance Society

Humanity+

The Evolving Bio-Age

Living Within Earth's Carrying Capacity

The Pervasive Contamination of the 'Natural'

Envisioning Governance Systems that Work

The Changing Nature of Security and Conflict

Truth Under Fire in a Post-Fact World

The Arts Transformed

Evolving Narratives of Histories and Cultures

Forging Connections with early career researchers: International Policy Ideas Challenge

SSHRC Storytellers Challenge

Forging Connections with Students:


Creating opportunities for Parliamentary Interns – future leaders


Real Insight.
Real Impact. Real Purpose.

Forging Connections with Parliamentarians

IN CONVERSATION WITH

Public talks with Canada's leading social sciences and humanities scholars

Canada

THE CONVERSATION

RACE GENDER AND DIVERSITY INITIATIVE

- The Race, Gender and Diversity Initiative was launched in 2021 to support community -based and community - led research partnerships, with postsecondary institutions, that are grounded in the lived experience of underrepresented or disadvantaged groups and that analyze the causes and persistence of systemic racism and discrimination.

- Value and duration: Up to $450,000 over three years.

- 171 eligible applications were submitted and 46 projects were funded, amounting to a total investment of $19.3M.

- Applications were adjudicated by a multidisciplinary and multisectoral selection committee with a diversity of research and lived experience e and representing academic, public, private and not-for-profit sectors.

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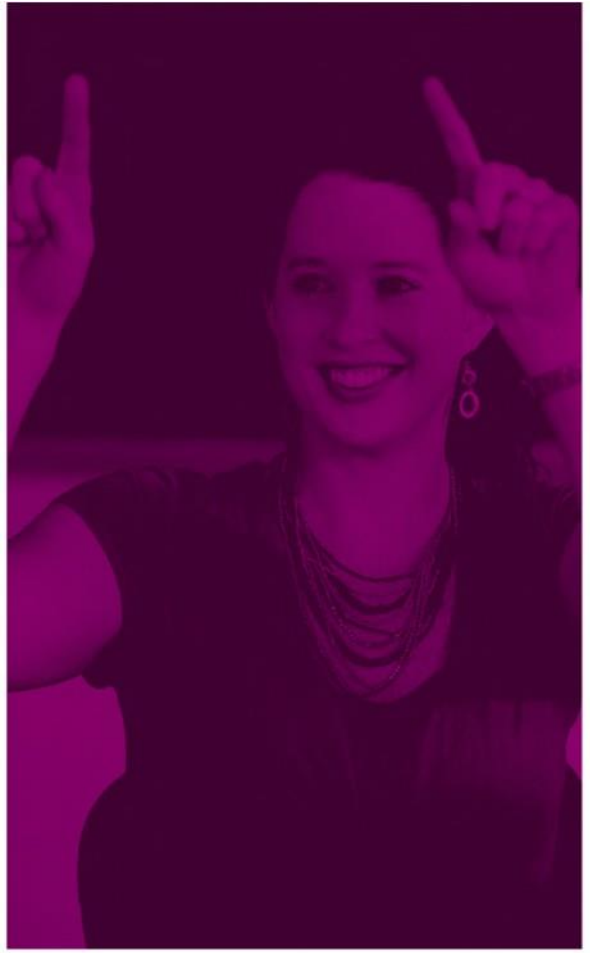

THANK YOU!

URSULA GOBEL

URSULA.GOBEL@SSHRC-CRSH.GC.CA

David Budtz Pedersen

Professor, Science Communication & Impact

Studies, Humanomics Research Centre,

Aalborg University, Denmark

Science Communication for Effective Impact

David Budtz Pedersen PhD

Professor of Science Communication
Aalborg University Copenhagen

21 June 2023
AESIS Social Impact of Science | Halifax

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VILLUM FONDEN VELUX FONDEN

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EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

European Commission

Ministry of Higher Education and Science – Denmark

International Network for Government Science Advice

David Budtz Pedersen
Professor of Science Communication
Aalborg University

Head of Humanomics Research Centre

Science Policy Adviser, Danish Government
Chair of EU COST Expert Group on Science Communication
Knowledge Broker for Algorithms, Data and Democracy (2021-2030)

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cost
EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY


European
Commission


DET FRIE
FORSKNINGSRÅD
DANISH COUNCIL
FOR INDEPENDENT
RESEARCH


CARLSBERG FOUNDATION


Innovation Fund Denmark
RESEARCH, TECHNOLOGY & GROWTH


NSF
National Science Foundation
WHERE DISCOVERIES BEGIN

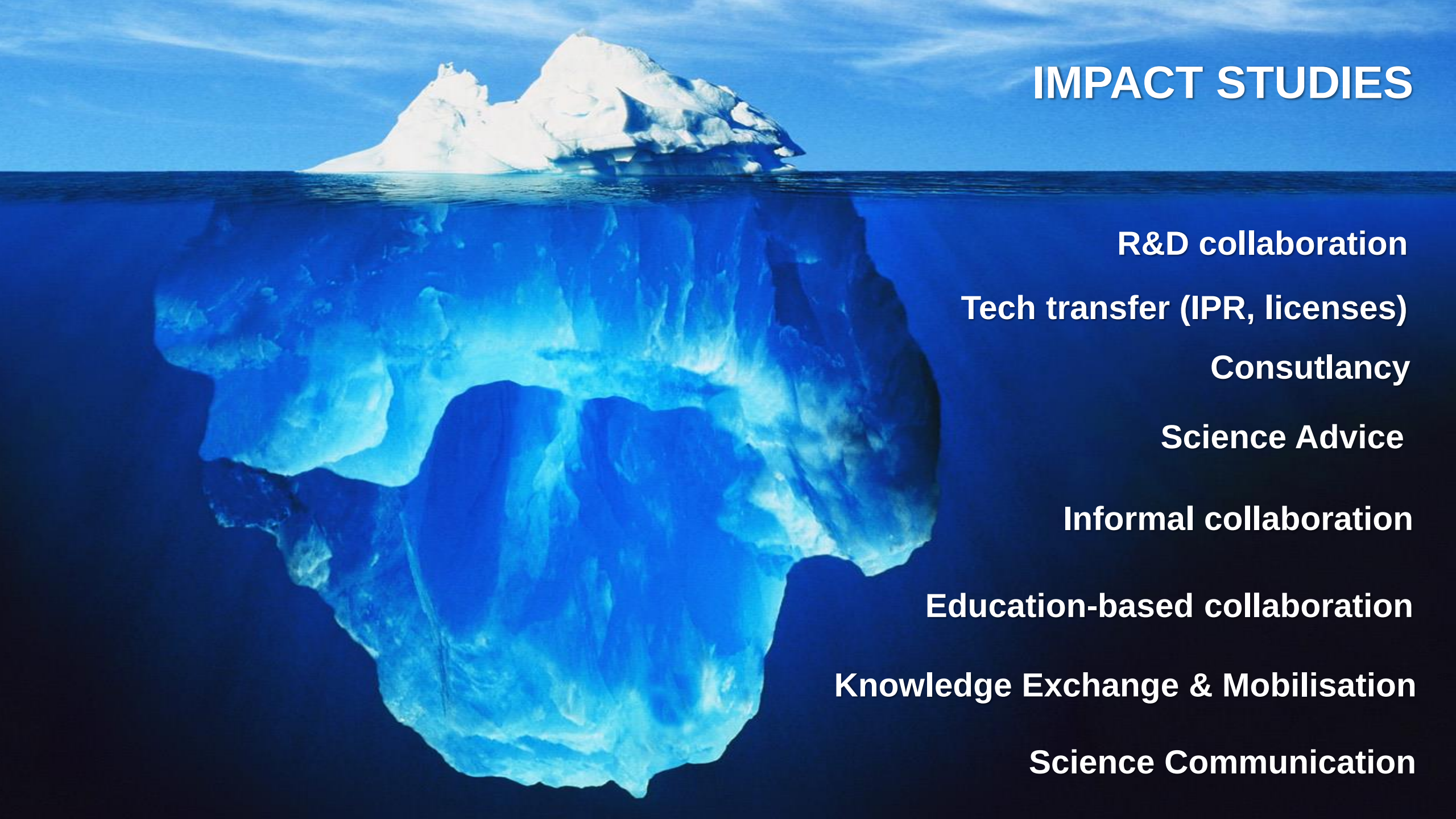

erc


Ministry of Higher Education
and Science – Denmark

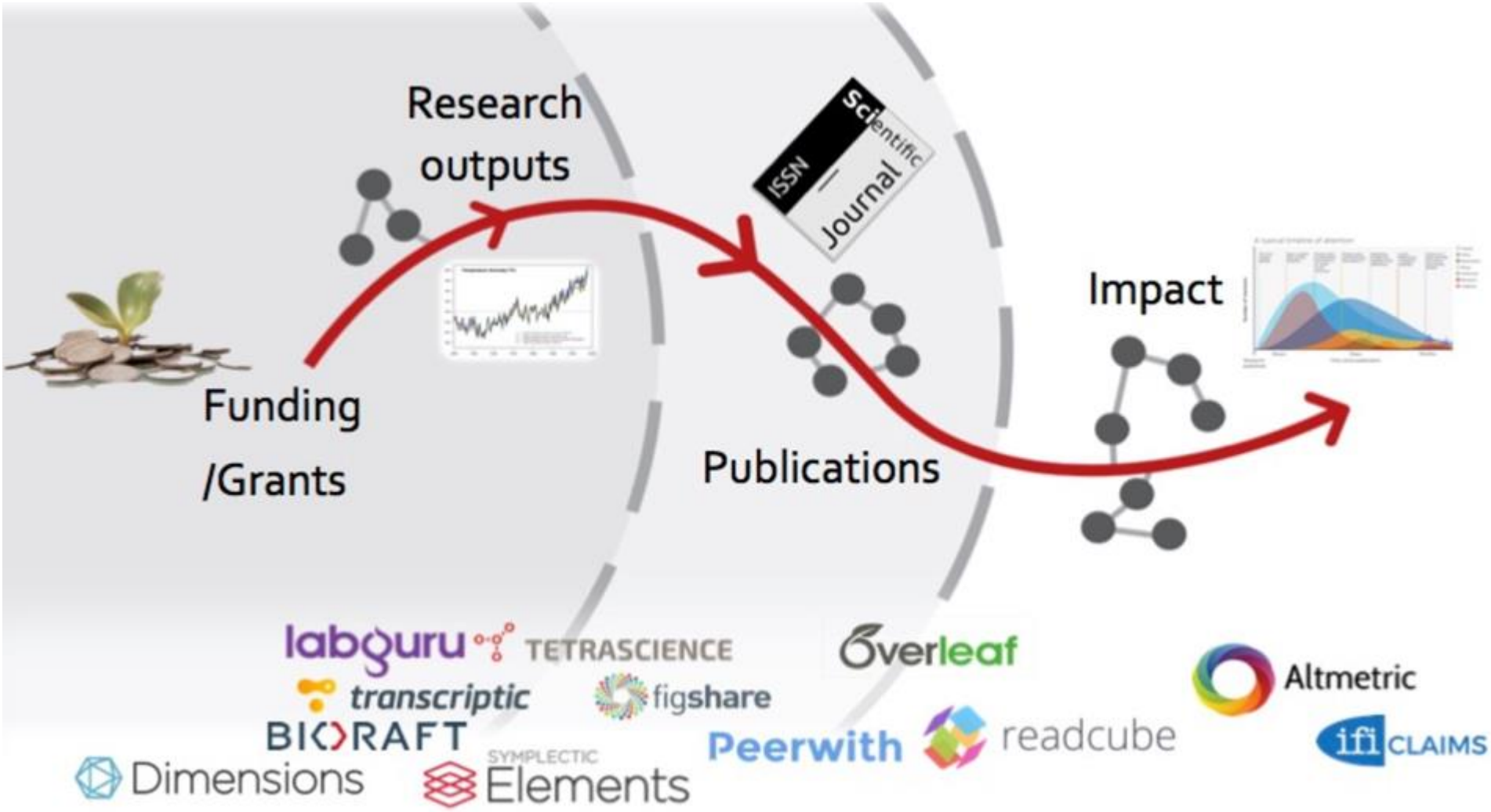

NORWEGIAN MINISTRY
OF EDUCATION AND RESEARCH


VETENSKAPSRÅDET
THE SWEDISH RESEARCH COUNCIL


AALBORG UNIVERSITY
DENMARK

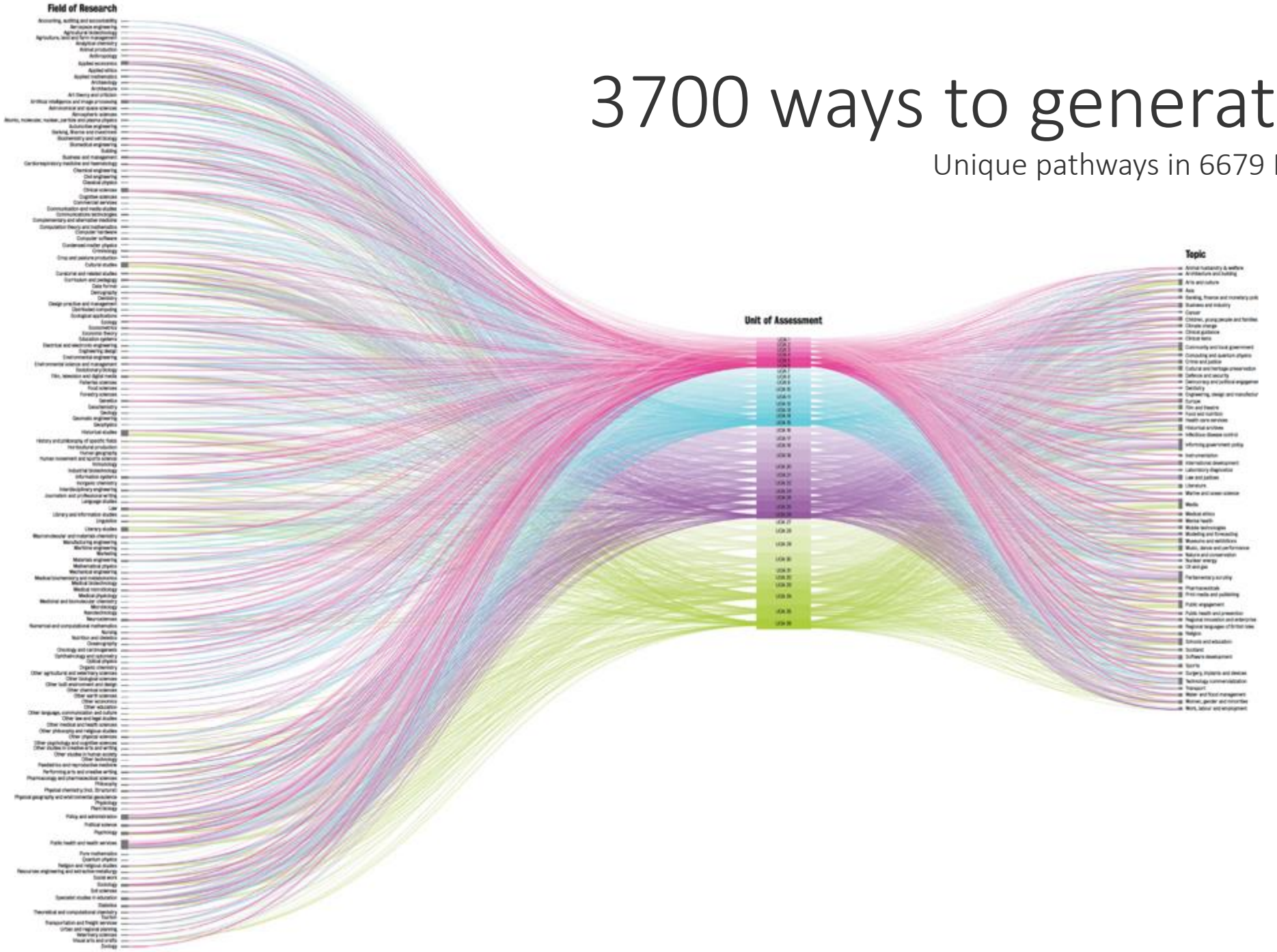

IMPACT STUDIES
R&D collaboration
Tech transfer (IPR, licenses)
Consutlancy
Science Advice
Informal collaboration
Education-based collaboration
Knowledge Exchange & Mobilisation
Science Communication

The linear fallacy



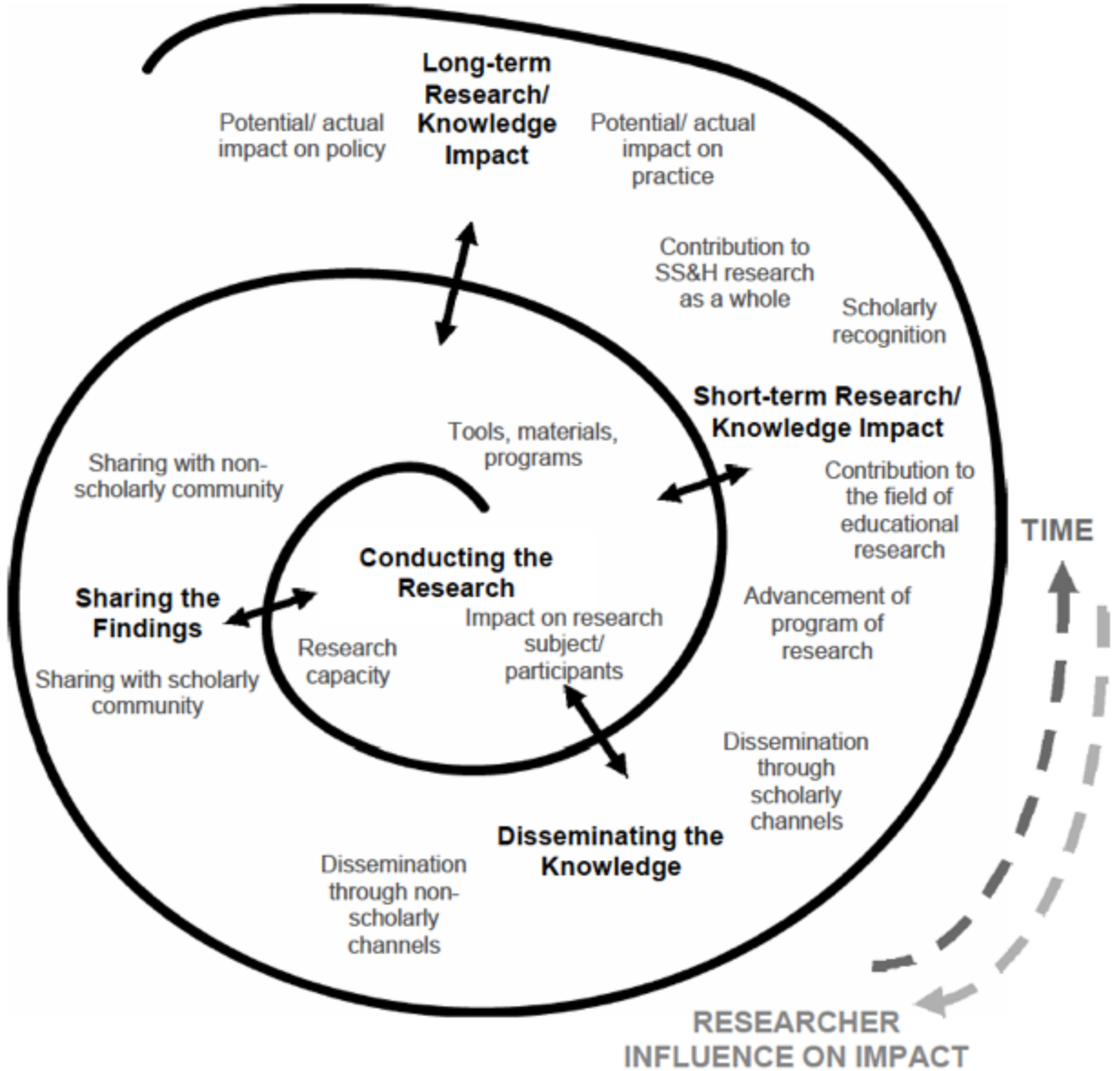
3700 ways to generate impacts

Unique pathways in 6679 REF impact case studies



Grant et al. 2016

Figure 1
Conceptual Framework of Research Impact in the Field of Education

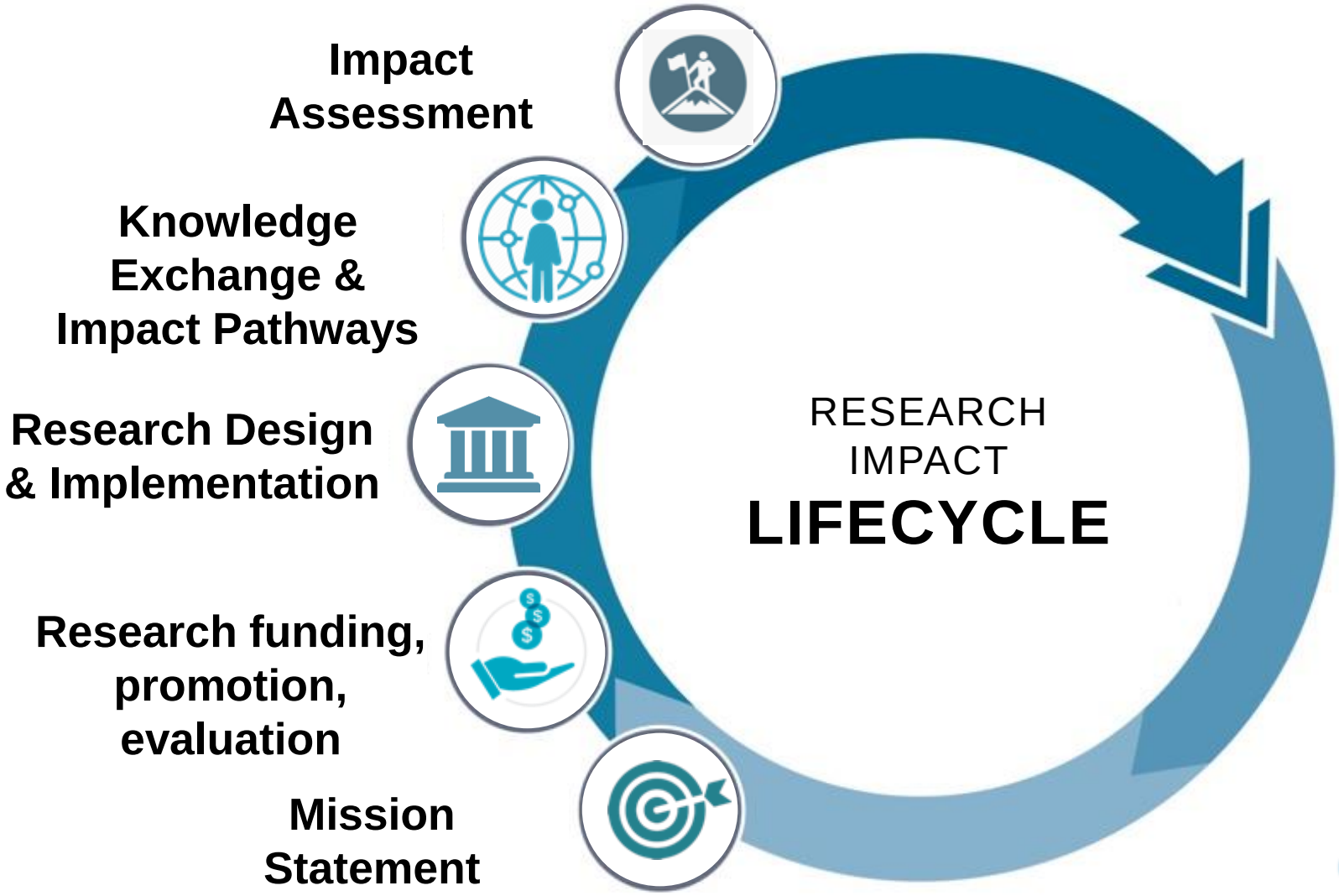


Amo, C. 2007. Conceptualizing research impact: the case of education research. The Canadian Journal of Program Evaluation 22(1):75-98

humanomics
mapping the dynamics of the humanities

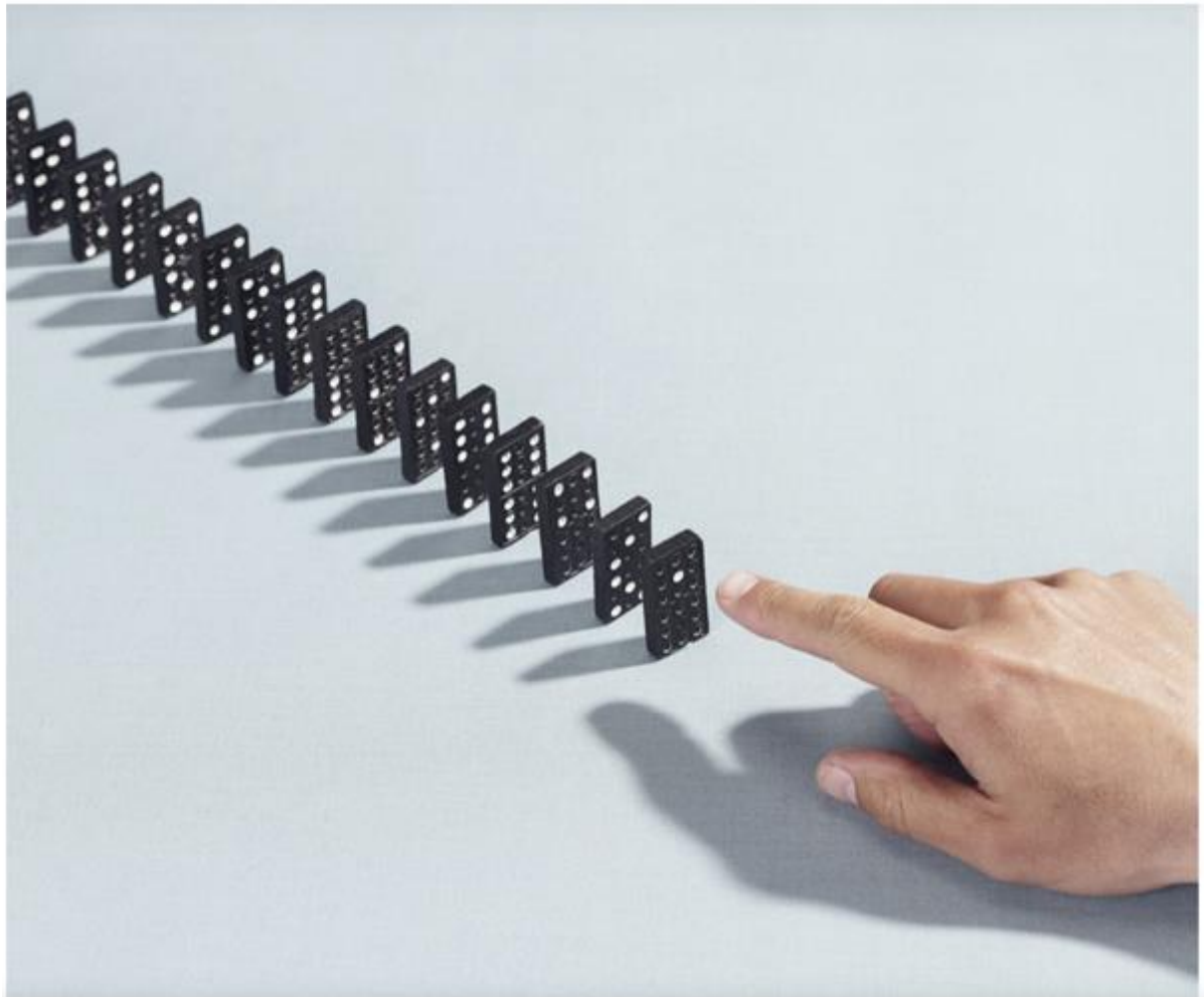
An integrated approach to impact planning and assessment

humanomics
mapping the dynamics of the humanities



humanomics
mapping the dynamics of the humanities

You Don’t Need a Breakthrough, You Need a Microshift



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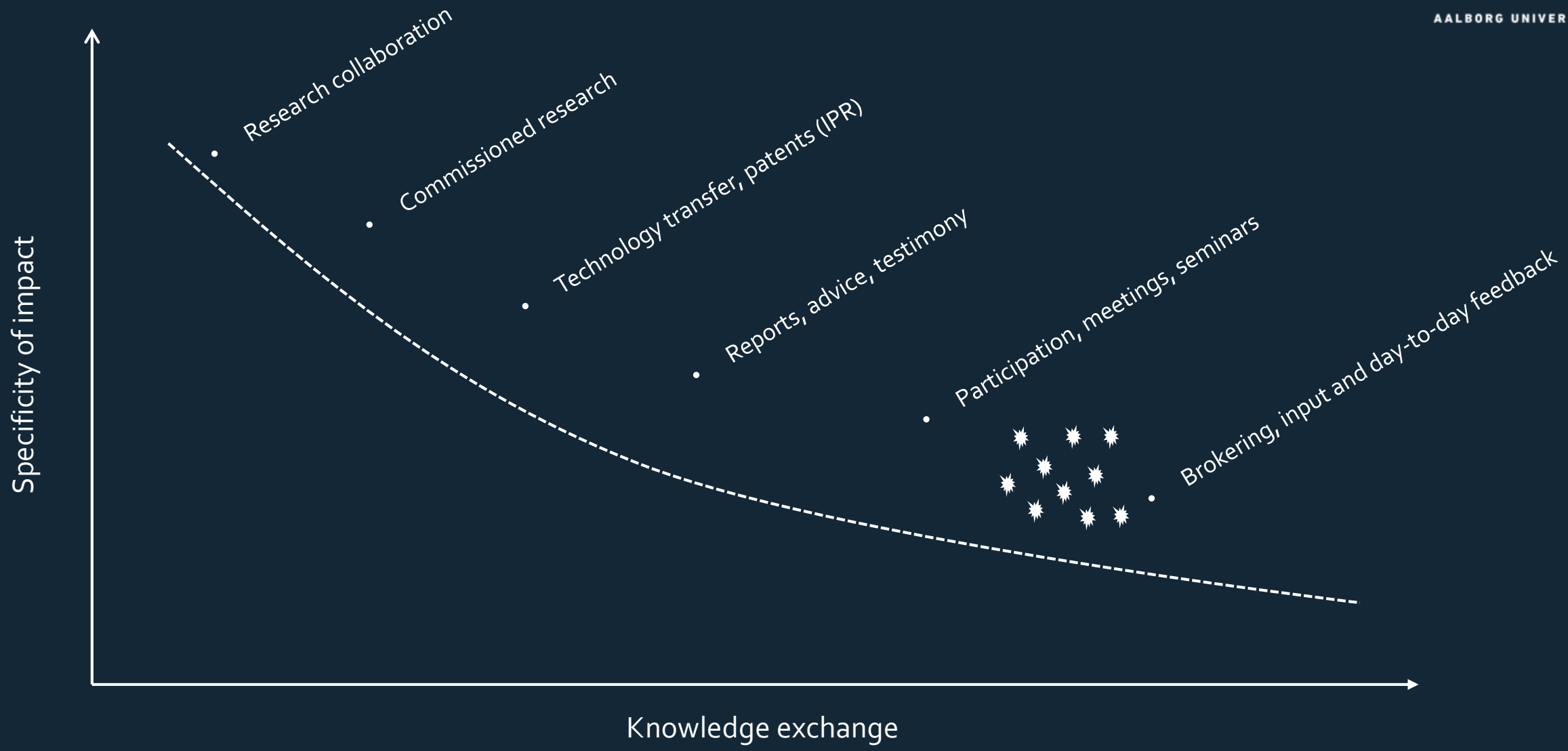


Budtz Pedersen et al. 2019
Impact Survey 1371 respondents

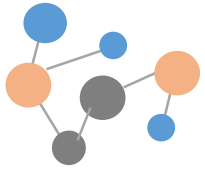
humanomics
mapping the dynamics of the humanities

Scattered

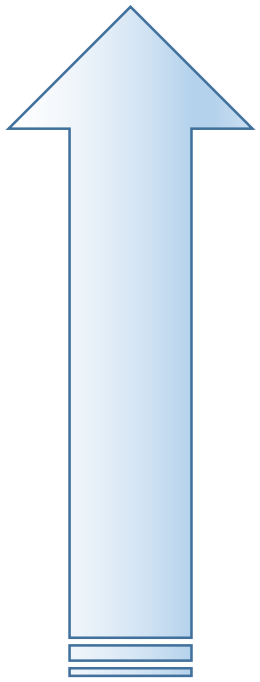
Focused

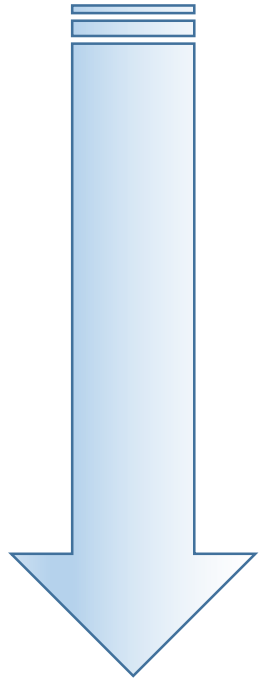
Concentrated

Structural



Case-based assessment

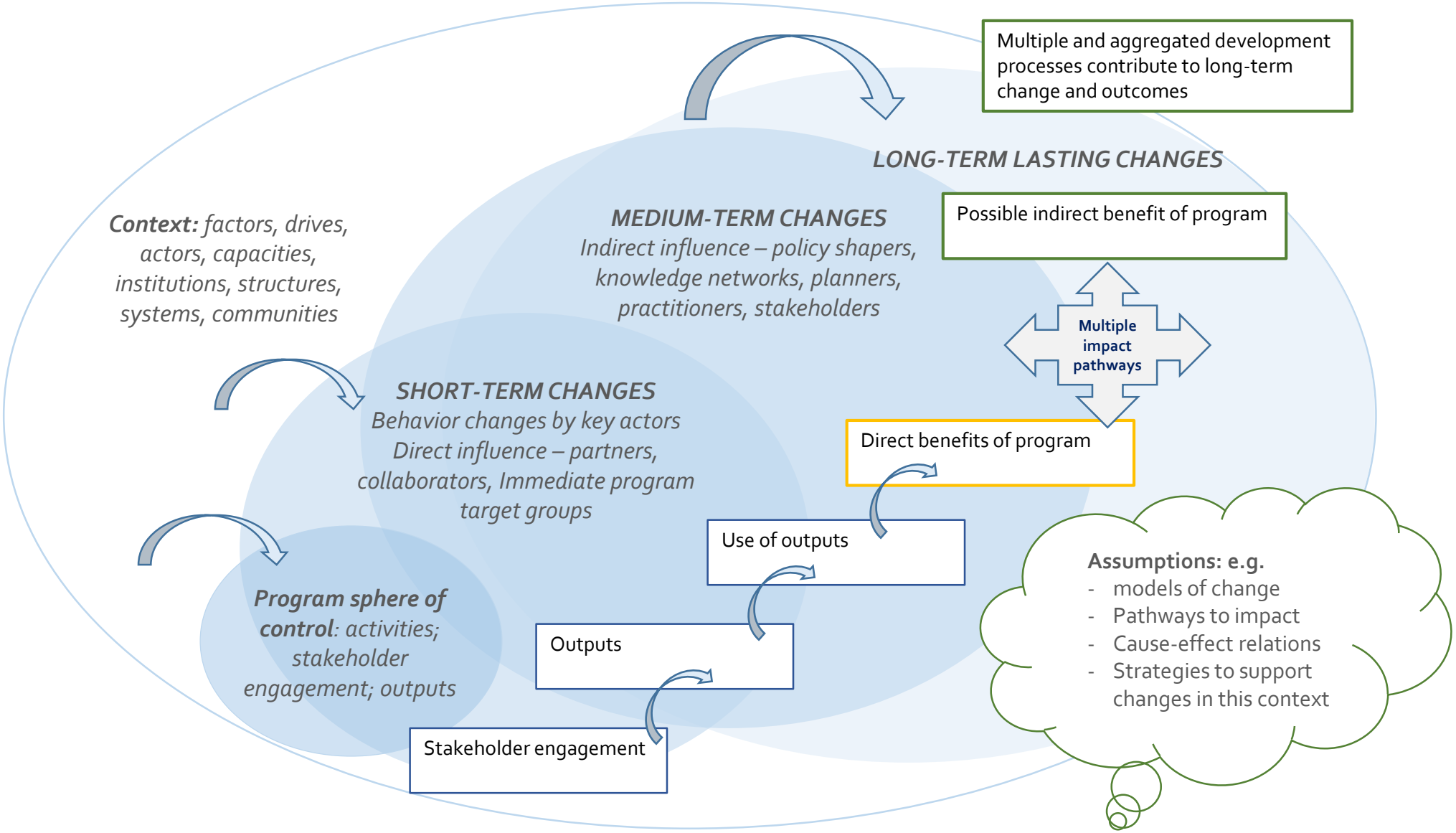




Indicator-based assessment

LEVEL OF IMPACT

THEORY OF CHANGE



Conclusions

- We need healthy, connected institutions
- Microimpacts (interactions, relations, activities) do not tell the full story about ‘change’ or ‘effect’ (attribution) but about ‘contributions’
- Research is part of a complex, multi-causal ecosystem of interacting parts
- Cultivate ecosystem, build institutional readiness, engage partners, and promote skills to interact!
- Use process indicators rather than performance indicators

humanomics
mapping the dynamics of the humanities

Thank you for the attention

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Research Evaluation, 2023, 00, 1–8
https://doi.org/10.1093/reseval/rvad011
Special Issue Paper

OXFORD

The missing links of research impact

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Abstract

In this article, we present a conceptual framework for studying research impact focusing on the foundations that need to be in place to accelerate an observable change of policy, practice or behaviour. The article investigates the relationship between micro-impacts and societal change, and how smaller impacts scale into larger cascades of end effects and value creation. We define micro-impacts as interactions and connections where information is exchanged between a researcher or research group and external audiences, stakeholders or co-producers. Micro-impacts are elements in highly complex causal relations between research activities and larger societal macroshifts. We argue that even though these causal relations are complex, micro-impacts are tangible and observable and should be integrated in research evaluations as constitutive elements of causal impact relations leading to larger macroshifts. We suggest a working model for studying micro-impacts and for reflecting on the causality of impacts by drawing on contributions from philosophy of causation. A proper understanding of causation is a prerequisite for eventually understanding and capturing research impact, which itself is a prerequisite for responsible research assessment and planning.

Keywords: impact assessment; impact pathways; causation; contribution analysis

1. Introduction

At a time when international research institutions and funding agencies are increasingly focusing on creating a positive effect on society, it is important to keep challenging what 'research impact' means and how it is recorded by different evaluation devices (Benneworth, Maxwell and Charles 2022; Benneworth and Olmos-Peñuela 2022; Hamann, Blome and Kosmützky 2023). In numerous university and policy statements, decision-makers call for greater efforts to 'prioritize, fund and support' research impact and 'to marry science and practice to understand the problems around us and solve them' (Stanford Impact Lab 2023). This shift of attention from internal academic impact to the wider societal impact of research presents great methodological challenges. Impact, connectivity and links between research and society have been defined and assessed by numerous methods and frameworks (Pedersen, Grønvad and Hvidtfeldt 2020). Whereas some frameworks focus on impact as an observable 'effect or change to the economy, society, culture or policy… beyond academia' (REF 2011: 31), others focus on the interactions that need to be in place for such effects to arise (Benneworth 2015; Olmos-Peñuela, Benneworth and Castro-Martínez 2015a,b; Benneworth, Gulbrandsen and Hazelkorn 2016). In this article, we explore this tensions in the contemporary literature and evaluation practice by emphasizing the importance of tracing impacts through larger webs of interactions. By doing so, we follow the recommendation of Muhonen, Benneworth and Olmos-Peñuela (2020) to develop a 'typology that captures the diversity of the mechanisms by which research leads to societal impact' (34). As the authors state:

> We conclude by arguing that this typology is useful for thinking more critically about practical mechanisms and instruments for creating more nuanced tools for impact evaluation (Muhonen, Benneworth and Olmos-Peñuela 2020: 35).

This attempt to develop a broader empirical typology of 'impact pathways' has proved to be highly useful and inspirational for empirical experiments. In the following sections, we examine further what we believe are the necessary components of a viable working model for assessing pathways to research impact. Based on reflections on the impact pathway framework and revisiting and updating the concept of 'productive interactions' (Spaapen and van Drooge 2011; Molas-Gallart and Tang 2011; van den Akker, Spaapen and Maes 2017), we propose a reorientation of research impact assessment to focus on micro-impacts and their cascading effects on society, policy and business. The conceptual model presented here is predominantly philosophical. However, it is based on and inspired by a comprehensive review of the literature (Pedersen, Grønvad and Hvidtfeldt 2020) combined with empirical research, most significantly the Responsible Impact project (ReACT) which was carried out at Aalborg University (DK) from 2016 to 2021 (Pedersen and Israelsson 2021; Lykke et al. 2022). In various ways, the framework offered in this article is inspired by and widens the scope of work by Benneworth, Gulbrandsen and Hazelkorn (2016), Benneworth and Olmos-Peñuela (2018) and Muhonen, Benneworth and Olmos-Peñuela (2020) and their attempts to develop methodologies for capturing the contexts and pathways in which various interactions lead to societal impact.

The theory of impact pathways has inspired us to look in more detail at the individual steps that constitute a pathway. Studying the emergence of impact at this level of analysis reveals a multitude of causal contributions, which adds nuance to the theory of generalized pathways. What we take from Muhonen, Benneworth and Olmos-Peñuela (2020) are important suggestions for how to identify and map micro-

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Transitions and Gaps: The Role of Local Policy Plans

Societal Impact of Science
AESIS Conference, Halifax, June 2023

Chafic Mokbel
Erasmus+ HERE Lebanon, University of Balamand

Case of Five Year Policy Plan for the Lebanese Higher Education

Acknowledgment: The 5YP for the LHE proposal was developed by E. Hazelkorn and T. Boland within a UNESCO project based on demand of the Ministry of Education and Higher Education

Local Policy in Context

- The 5YP plan for the Lebanese HE came in a very particular context:
  - Locally
    - Economic and socio-political crises
    - Ineffective regulations and struggling reforms
    - Emigration of talents
    - Fragmented sector
    - Poor alignment with socio-economic needs
    - Weak funding model
    - Under-developed research system
    - Insufficient infrastructure
    - Large refugee communitee
  - Globally
    - Transitions and transformations

➢Questioning the societal impact of higher education/research?

Local Policy in Context

- Building on existing strengths
  - Locally
    - Tradition of Higher Education
    - Competitive environment
    - Strong international dimension
    - Accredited institutions and programs
    - Significant infrastructure
    - Resilience
  - External
    - Important connections

A Plan to Bring Responses

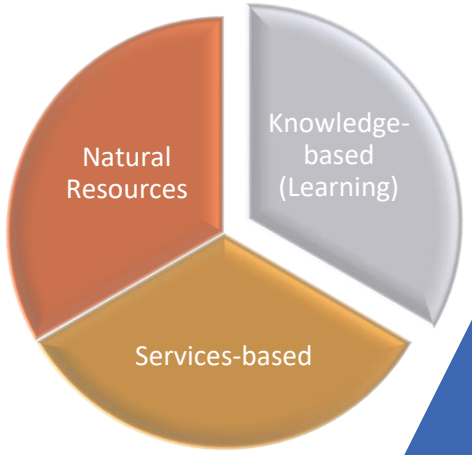
- To specific questions:
  - International experience
  - Gaps in the system
  - Recommendations, actions and priorities

Bringing Responses in a Structured Way

- A comprehensive background analysis of capacity and capabilities of HE and RDI systems
  - Need for a vision
  - Regulatory framework and governance
  - Quality
  - Financing
  - HEMIS
  - Relevance of programmes
  - RDI
  - Internationalisation
  - Equity, Diversity and Inclusion

Setting a Vision

Lebanon's higher education system will meet the needs of Lebanon by providing knowledge and learning of lasting social, economic and cultural significance, which is sustainable and internationally competitive.



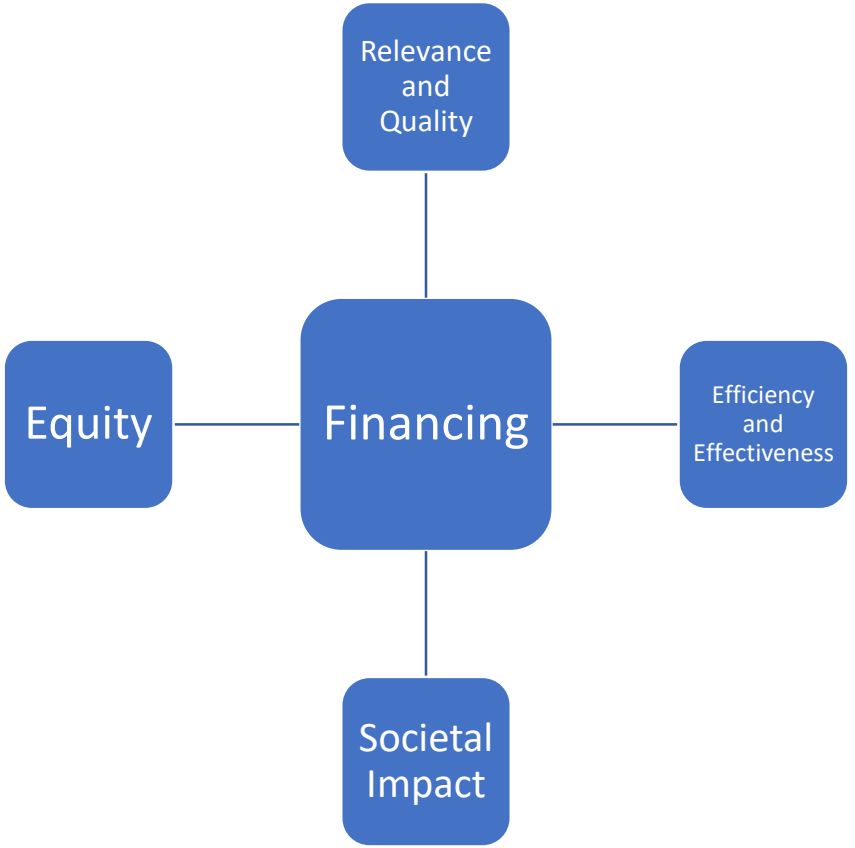
Economic

Ecological

Societal

Financing

- Should be
  - Performance based
  - Innovation oriented
  - Strategic



HEMIS

- Essential to:
  - Monitor
  - Assess and Evaluate:
    - relevance and quality
    - societal impact
    - Equity and inclusion
  - Plan
  - Allocate resources

Relevance of Programmes

- Relevance to:
  - National vision and objectives
  - Preparation of needed human resources
    - Balance in domains, levels and types
  - Societal needs
    - Building capacity
    - Innovation ecosystem

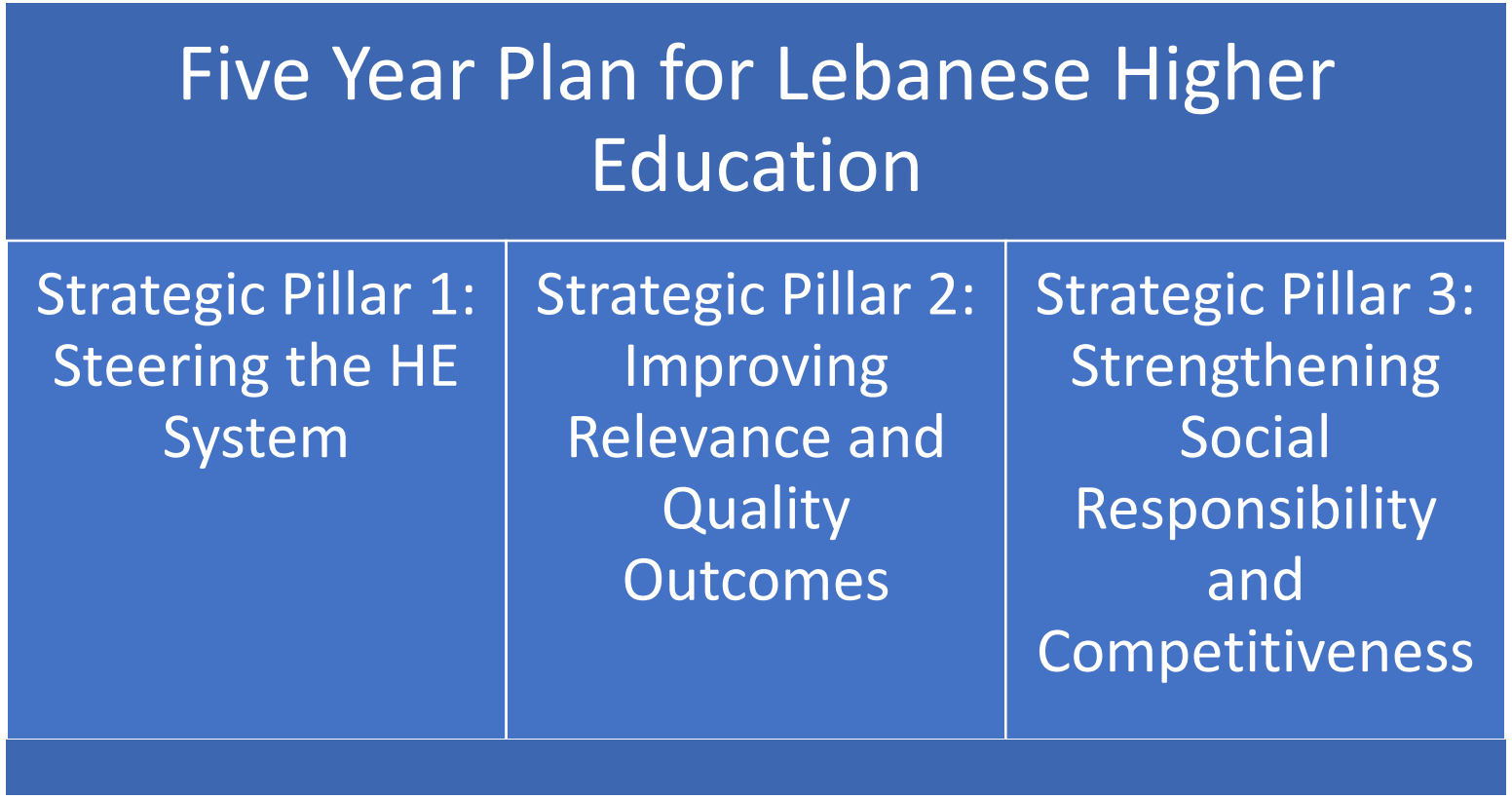
Research Development Innovation

- Amount and type of research
- Type of outcomes
  - Publications
  - Policies
  - Products
  - Services
- Impact and benefits
  - To the society
  - To the economy
- Respect of sustainable development
- Partner with external stakeholders
  - Local
  - External

Equity Diversity Inclusion

- Service-to-society and civic engagement
  - Many projects could be imagined in Lebanon today
  - Civic engagement projects can be of crucial importance in many cases
    - Refugees communities
    - Human rights
- Focusing on transferable skills
- Inclusiveness

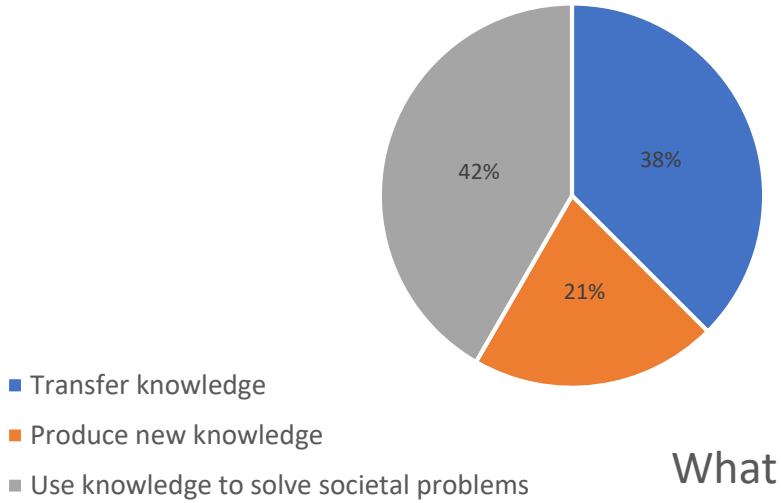
- Responsible impact investments are needed


Five Year Plan for Lebanese Higher Education
Strategic Pillar 1: Steering the HE System
Strategic Pillar 2: Improving Relevance and Quality Outcomes
Strategic Pillar 3: Strengthening Social Responsibility and Competitiveness

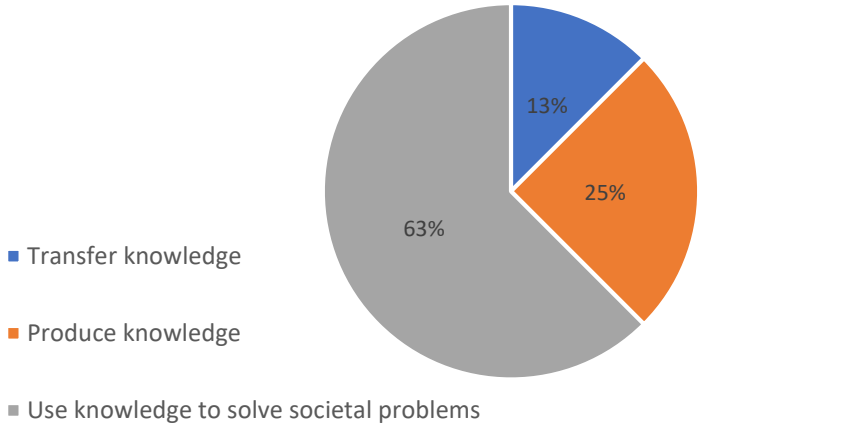
Implementation

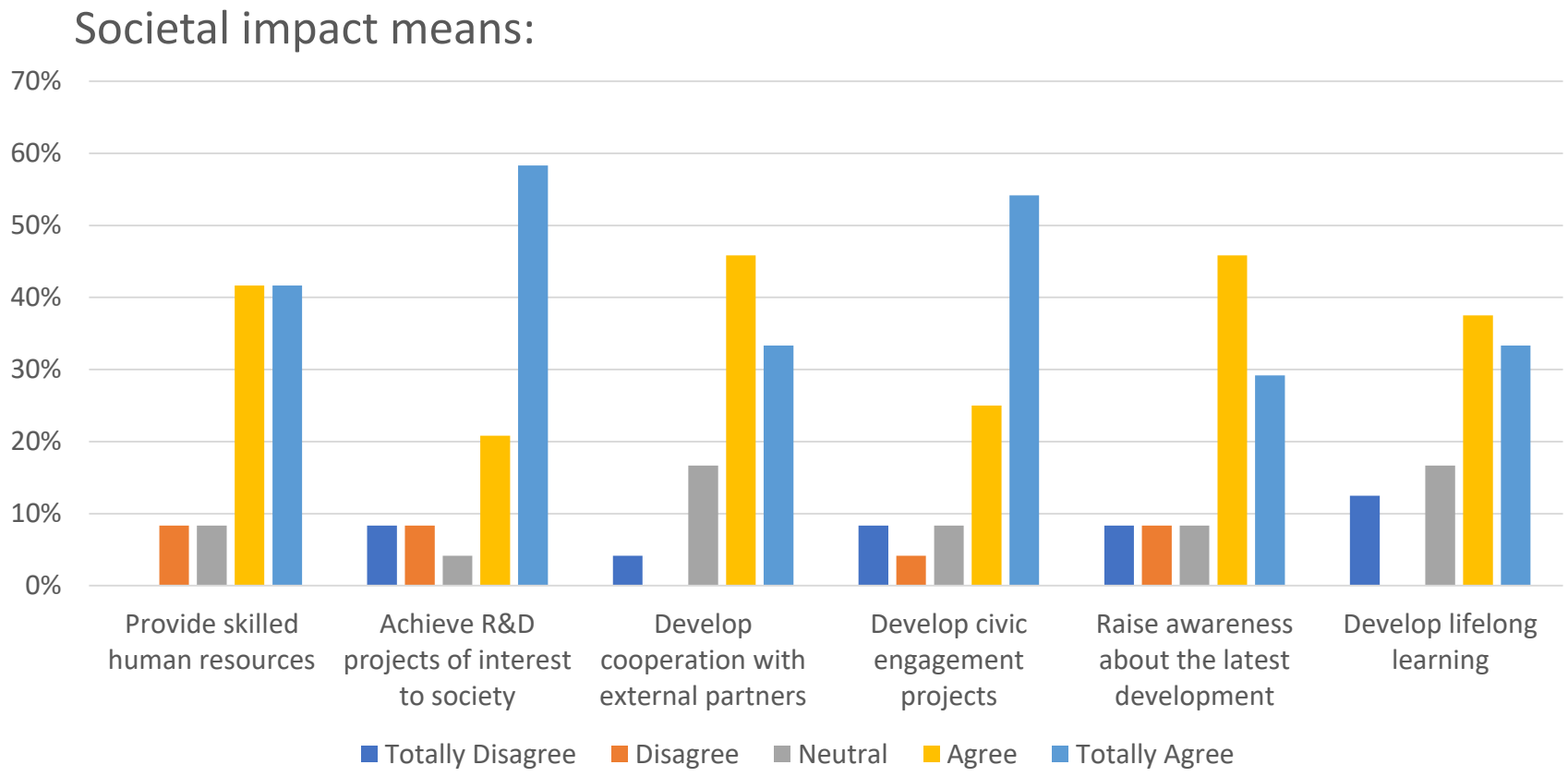
- The 5YP shall be of high benefits for the sector
- For higher local benefits: Monitor and maximise social impact
- Local community is receptive for this message as shown in a recent limited survey

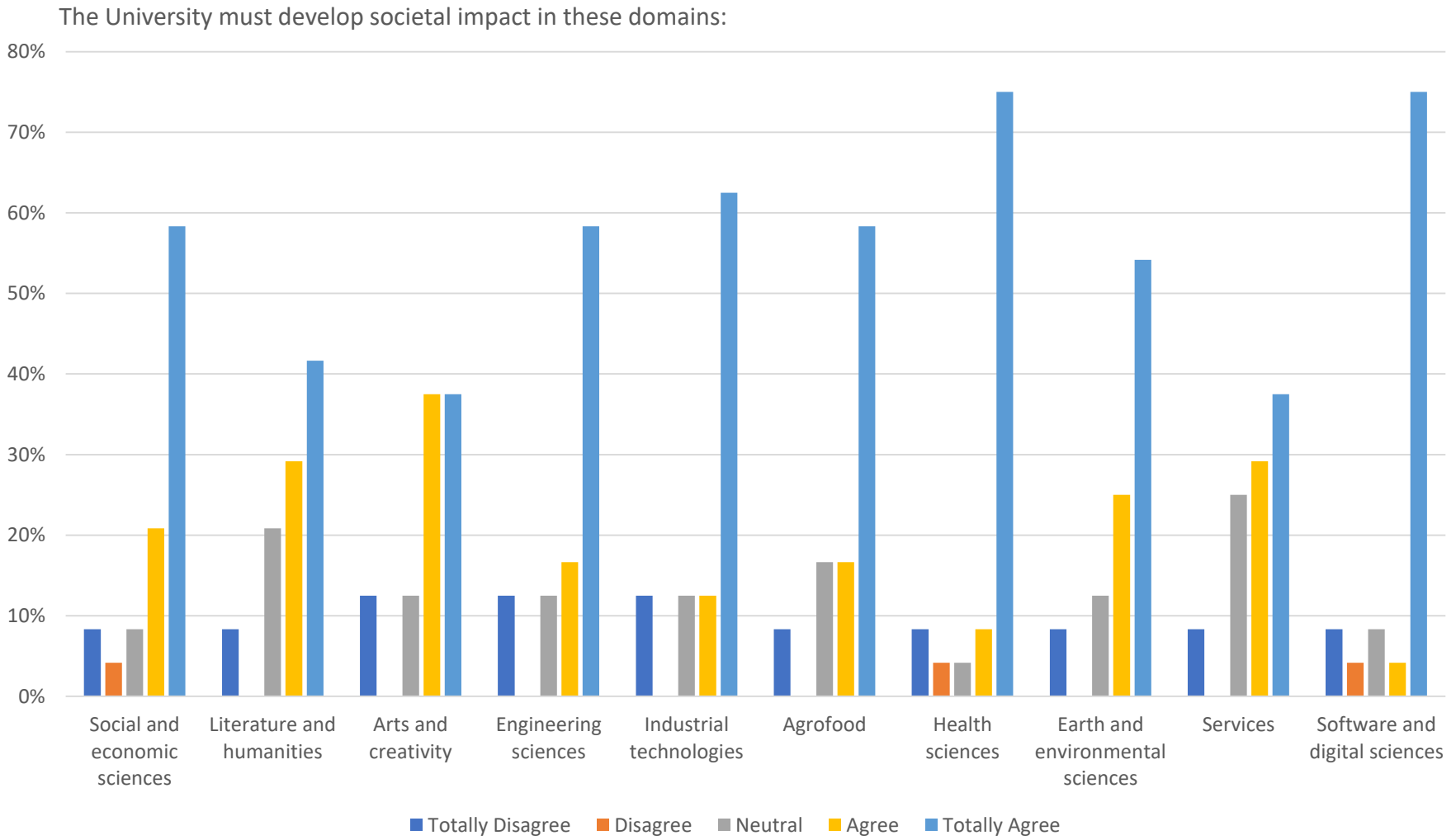
What is the most important role of Lebanese universities in societal impact?

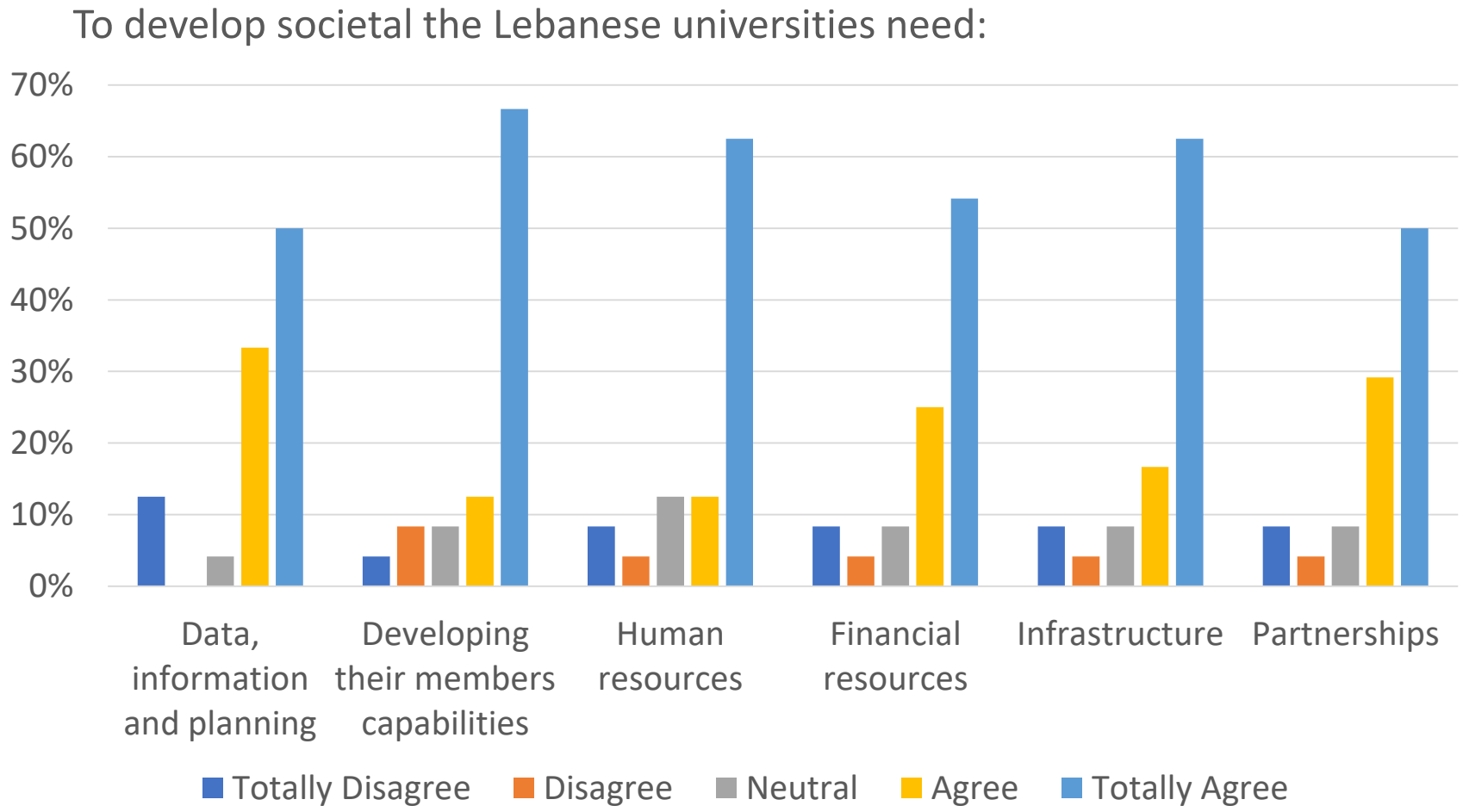


What shall be the most important role of Lebanese Universities for a better societal impact?




Societal impact means:
70%
60%
50%
40%
30%
20%
10%
0%
Provide skilled human resources
Achieve R&D projects of interest to society
Develop cooperation with external partners
Develop civic engagement projects
Raise awareness about the latest development
Develop lifelong learning
Totally Disagree
Disagree
Neutral
Agree
Totally Agree


The University must develop societal impact in these domains:
80%
70%
60%
50%
40%
30%
20%
10%
0%
Social and economic sciences
Literature and humanities
Arts and creativity
Engineering sciences
Industrial technologies
Agrofood
Health sciences
Earth and environmental sciences
Services
Software and digital sciences
Totally Disagree
Disagree
Neutral
Agree
Totally Agree


To develop societal the Lebanese universities need:
70%
60%
50%
40%
30%
20%
10%
0%
Data, information and planning
Developing their members capabilities
Human resources
Financial resources
Infrastructure
Partnerships
Totally Disagree
Disagree
Neutral
Agree
Totally Agree

Conclusions

- A policy plan is always needed especially in a period of local crises and global transitions
  - Because Higher Education and Research are pillars of societal development and well-being
  - To maintain the gaps with international developments in a margin
- The two phases preceding and following the plan definition are crucial
  - For preparing the ground
  - For having an implementation of significant impact
    - This does not necessary mean a full implementation but an implementation that preserves the core idea
- The adopted plan has at its core positive societal impact and sustainable development
- Implementation is a key to achieve the goals
  - It is also the responsibility of the external stakeholders

Thank you

Wednesday, June 21

Ahsan Habib

Professor, Transportation Engineering &

Planning, Dalhousie University, Canada

DALTRAC
DALHOUSIE TRANSPORTATION COLLABORATORY

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Climate Change and Natural Disasters: Lessons Learned from Mass Evacuation Modelling

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Background

- Climate change is increasing the frequency and severity of natural disasters like wildfires across Canada
  - Shelburne Wildfire (Glass, 2023)
  - Tantallon Wildfire (Bauman, 2023)
  - 2017 British Columbia Wildfires (Duran, 2017)
  - 2016 Fort McMurray Wildfire (Pruden, 2016)

- Wildfires are occurring in locations where they were previously not common

- Wildfires pose unique challenges to government evacuation strategies and modelling

Smoke from the Tantallon wildfire

Collapsed bridge from Shelburne wildfire

Background

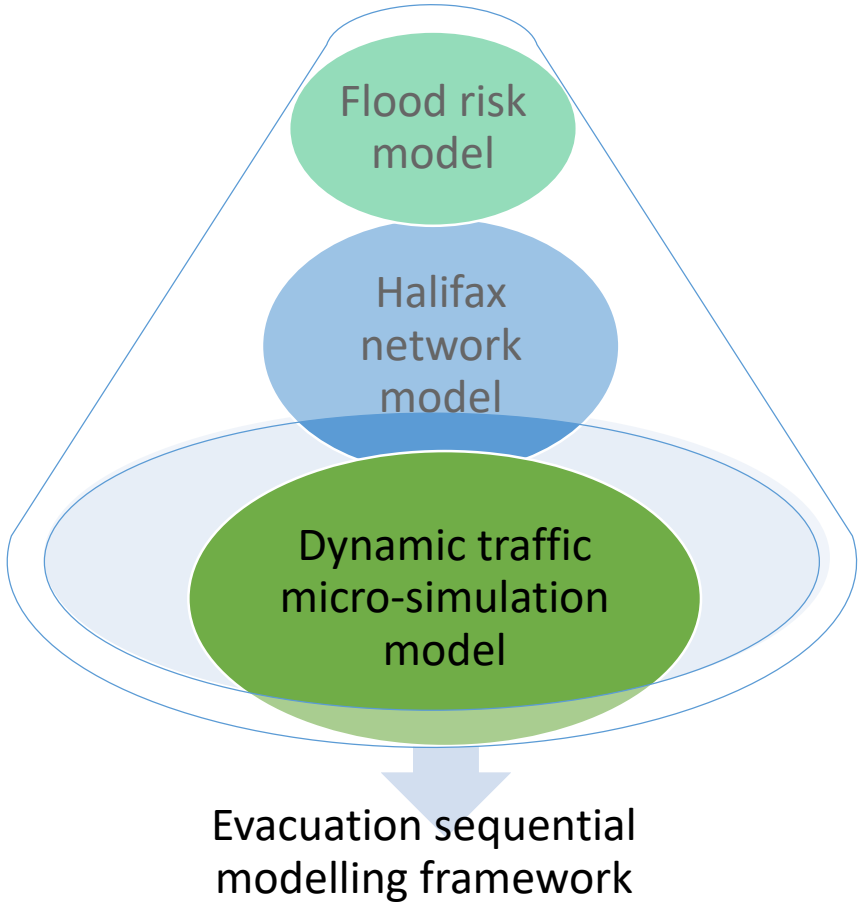
- Cities face enormous risks from natural disasters
  - Hurricane Irma, 2017 (Mclaughlin, 2017)
  - Hurricane Harvey, 2017 (Emanuel, 2017)
  - Tohoku Earthquake Tsunami, 2011 (California Coastal Commission, 2011)
  - Hurricane Katrina, 2005 (Litman, 2006)
  - Hurricane Rita, 2005 (Litman, 2006)
- Cities have little experience with evacuation events as disasters rarely occur, which can result in severe consequences
- A tactical decision tool can improve evacuation response and performance
- Therefore, development of a **comprehensive modelling framework of an evacuation decision support tool** is very important

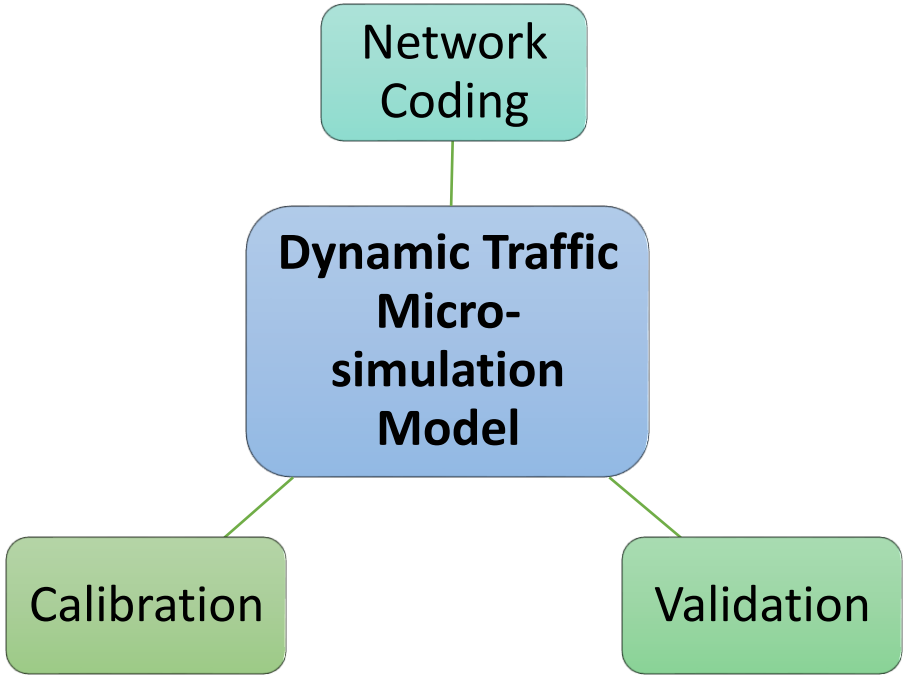
Hurricane Florence, Oceanana Pier in Atlantic Beach, NC

Hurricane Irma flooding

Mass Evacuation Modelling

Sequential Modelling Framework





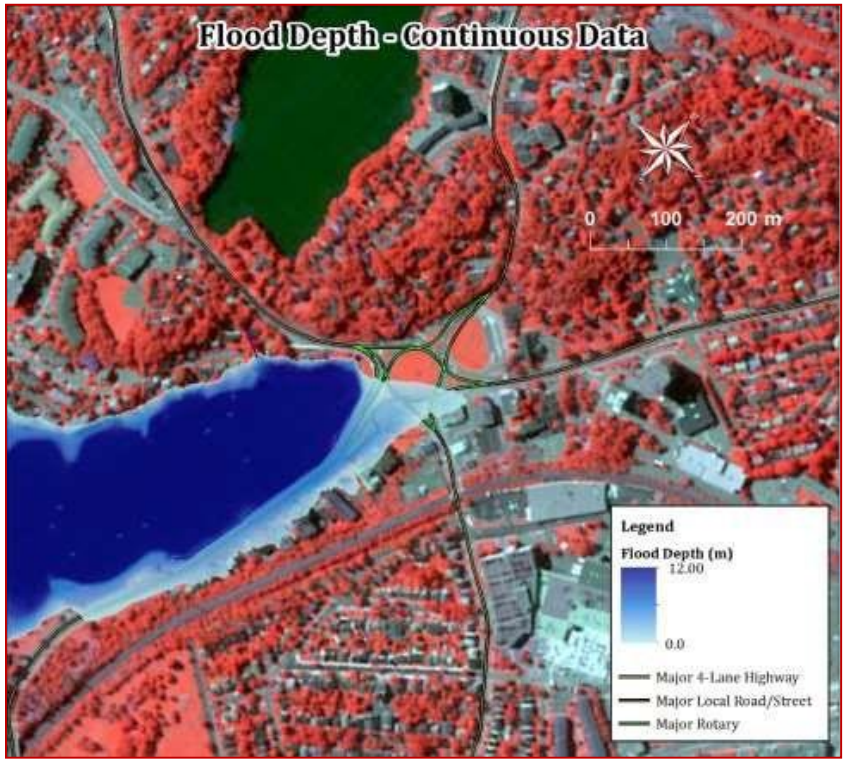
Flood Risk Model

Flood Extent: 2.9m, 3.9m, 7.9m and 30m CGVD28

Flood Risk Model

Flood Risk Model Output

Name of roads	Flooding scenario water level (m CGVD28)	Length of roads flooded (m)	Original length of roads (m)	% of roads impacted by flooding
Armadale Rotary	2.9	234.6	1324.3	17.7
	3.9	576.1		43.5
	7.9	1175.1		88.7
Barrington Street	2.9	0.0	7782.2	0.0
	3.9	162.4		2.1
	7.9	660.5		8.5
Bedford Highway	2.9	0.0	3974.6	0.0
	3.9	0.0		0.0
	7.9	1898.9		47.8
Chebucto Road	2.9	0.0	2201.2	0.0
	3.9	0.0		0.0
	7.9	79.0		3.6
Joseph Howe Drive	2.9	0.0	2873.3	0.0
	3.9	0.0		0.0
	7.9	149.2		5.2
Kearney Lake Road	2.9	0.0	269.4	0.0
	3.9	0.0		0.0
	7.9	110.2		40.9
Quinpool Road	2.9	245.4	2420.7	10.1
	3.9	398.4		16.5
	7.9	464.3		19.2

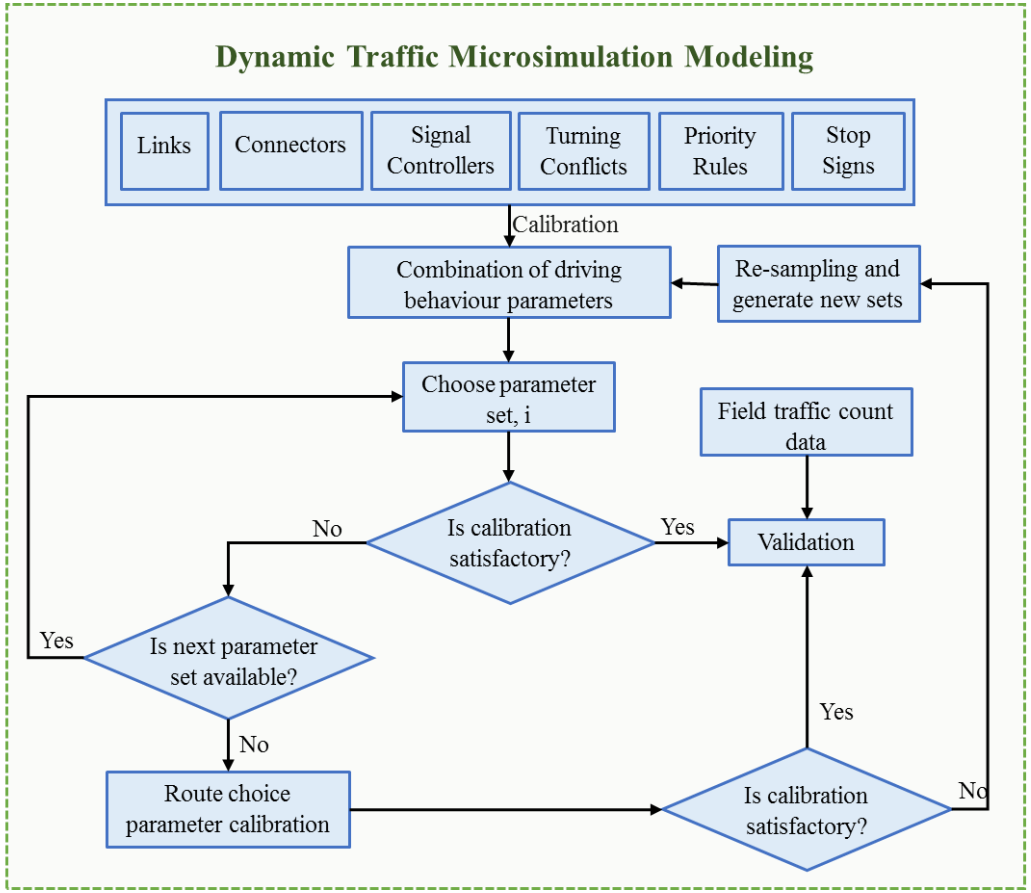


Armdale Rotary is the most susceptible roadway to flooding.

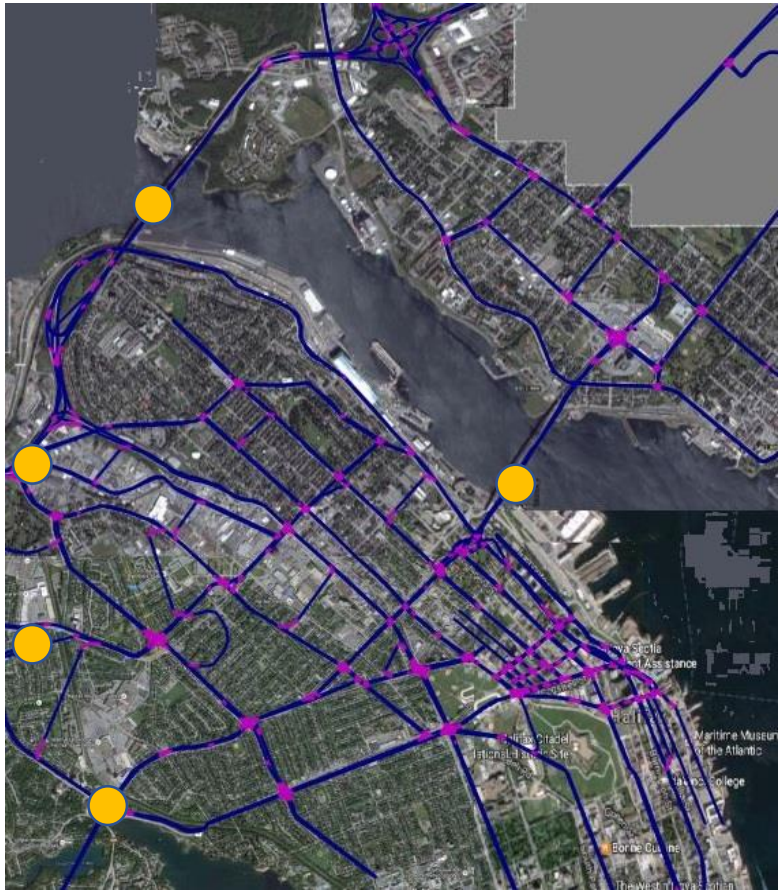
A portion of the rotary floods in every scenario.

Traffic Microsimulation

Traffic Microsimulation Model



The Halifax Peninsula transport network with five exit points coded in VISSIM



Five exit points: (i) Macdonald Bridge, (ii) Mackay Bridge, (iii) Armdale Rotary, (iv) 102 Highway, and (v) Bedford Highway

Traffic Microsimulation

Evacuation Scenarios

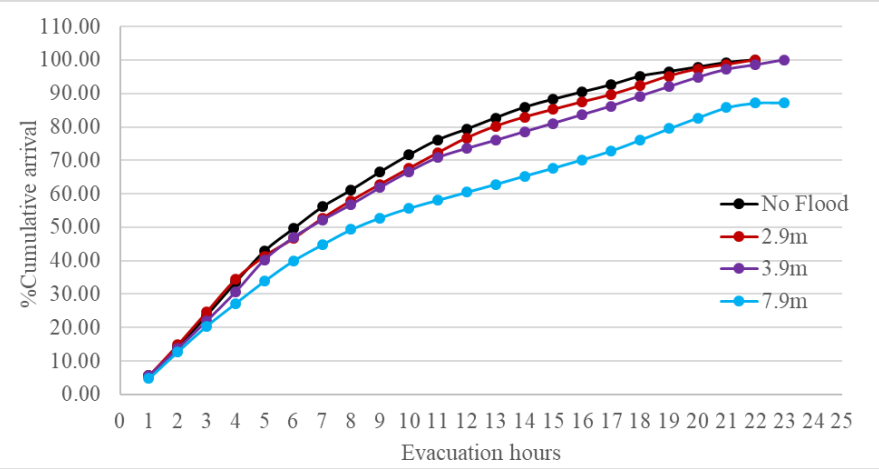
Scenarios	Loss of Connectivity, %
Scenario 1: Base case	0.0
Scenario 2: 2.9 m	23.3
Scenario 3: 3.9 m	23.7
Scenario 4: 7.9 m	31.2

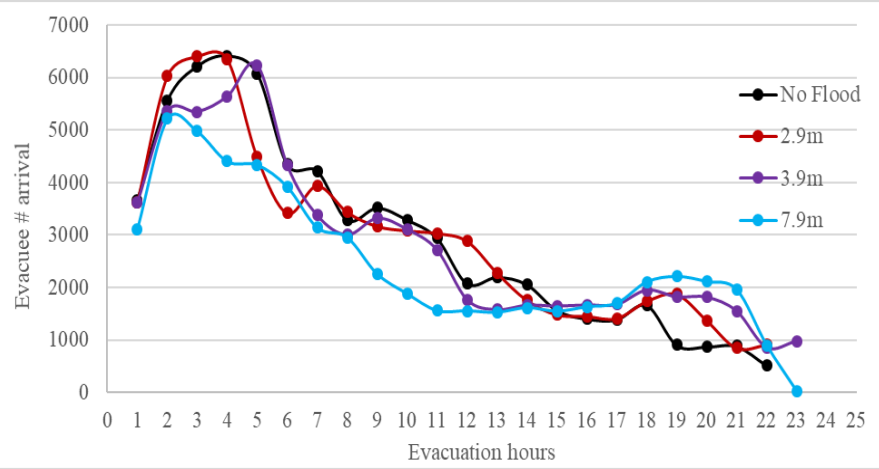
- Scenario 1 (Base case): No links are affected
- Scenario 2 (2.9 m): 0.11% link length of modelled network is affected
- Scenario 3 (3.9 m): 0.27% link length of modelled network is affected
- Scenario 4 (7.9 m): 1.1% link length of modelled network is affected

Results: Traffic Simulation

Overall Evacuation Performance

Scenarios	Case 1: No links flooded	Case 2: 2.9 m	Case 3: 3.9 m	Case 4: 7.9 m
Loss of Connectivity, %	0.0	23.3	23.7	31.2
Total Departure, %	100	100	100	100
Completed Evacuation, %	100	100	100	87
Evacuation Time, hr.	22	22	23	23
Increment in evacuation time w.r.t case 1, hr.	-	0	1	1

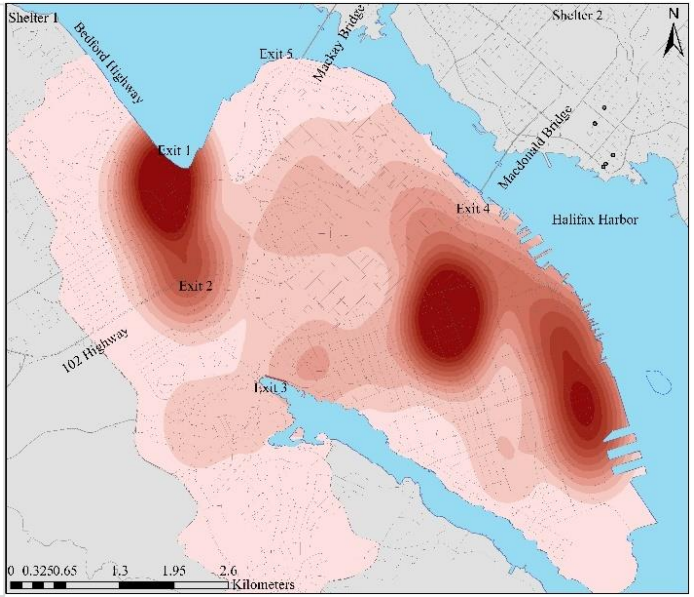




Results: Network Disruption Scenarios

- Uncertain network disruptions to evacuation traffic flows
- Collision risk consideration for managing emergency traffic operation is subject to uncertainties
- Collision Prediction: Bayes theory and Monte Carlo simulation

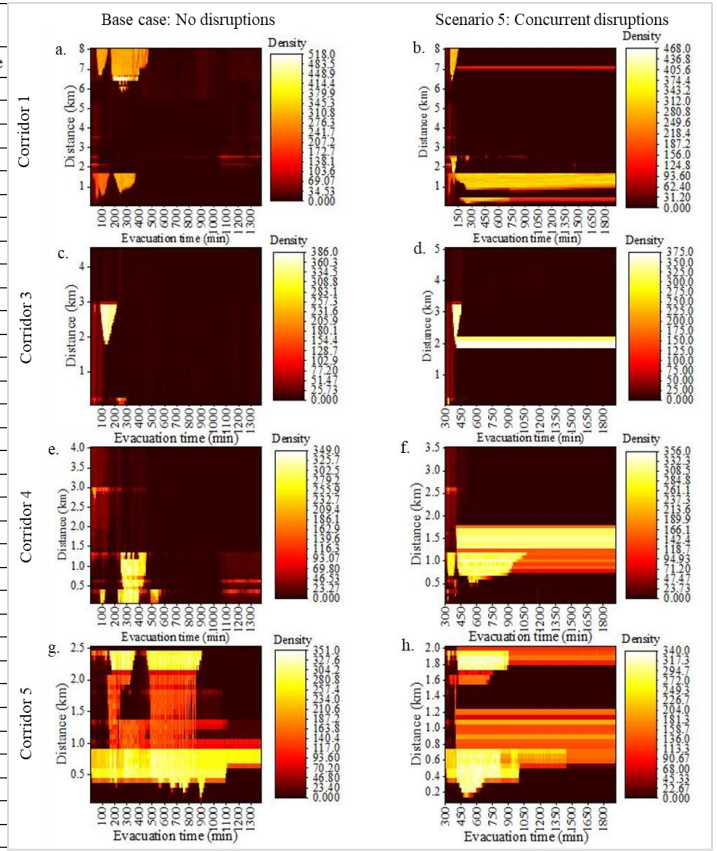
Evacuation hours	Scenario 1: P ≥ 2%		Scenario 2: P ≥ 3%		Scenario 3: P ≥ 4%		Scenario 4: P ≥ 5%	
	Incident locations# from Monte Carlo Simulation	Collision location considered	Incident locations# from Monte Carlo Simulation	Collision location considered	Incident locations# from Monte Carlo Simulation	Collision location considered	Incident locations# from Monte Carlo Simulation	Collision location considered
1000-1100	1	No	1	No	1	No	1	No
1100-1200	1	No	1	No	1	No	1	Loc 7
1200-1300	2	Loc 7 & Loc 1	1	No	1	Loc 3	1	Loc 5
1300-1400	2	Loc 10	1	No	1	No	1	No
1400-1500	1	Loc 3	1	No	1	Loc 10	1	Loc 10
1500-1600	1	No	1	No	1	No	1	No
1600-1700	2	No	1	Loc 7	1	No	1	Loc 3
1700-1800	1	Loc 7	1	No	1	Loc 1	1	Loc 1
1800-1900	2	Loc 5	1	Loc 5	1	Loc 7	1	No
1900-2000	1	No	1	Loc 10	1	No	1	No
2000-2100	1	No	1	Loc 3	1	Loc 5	1	No



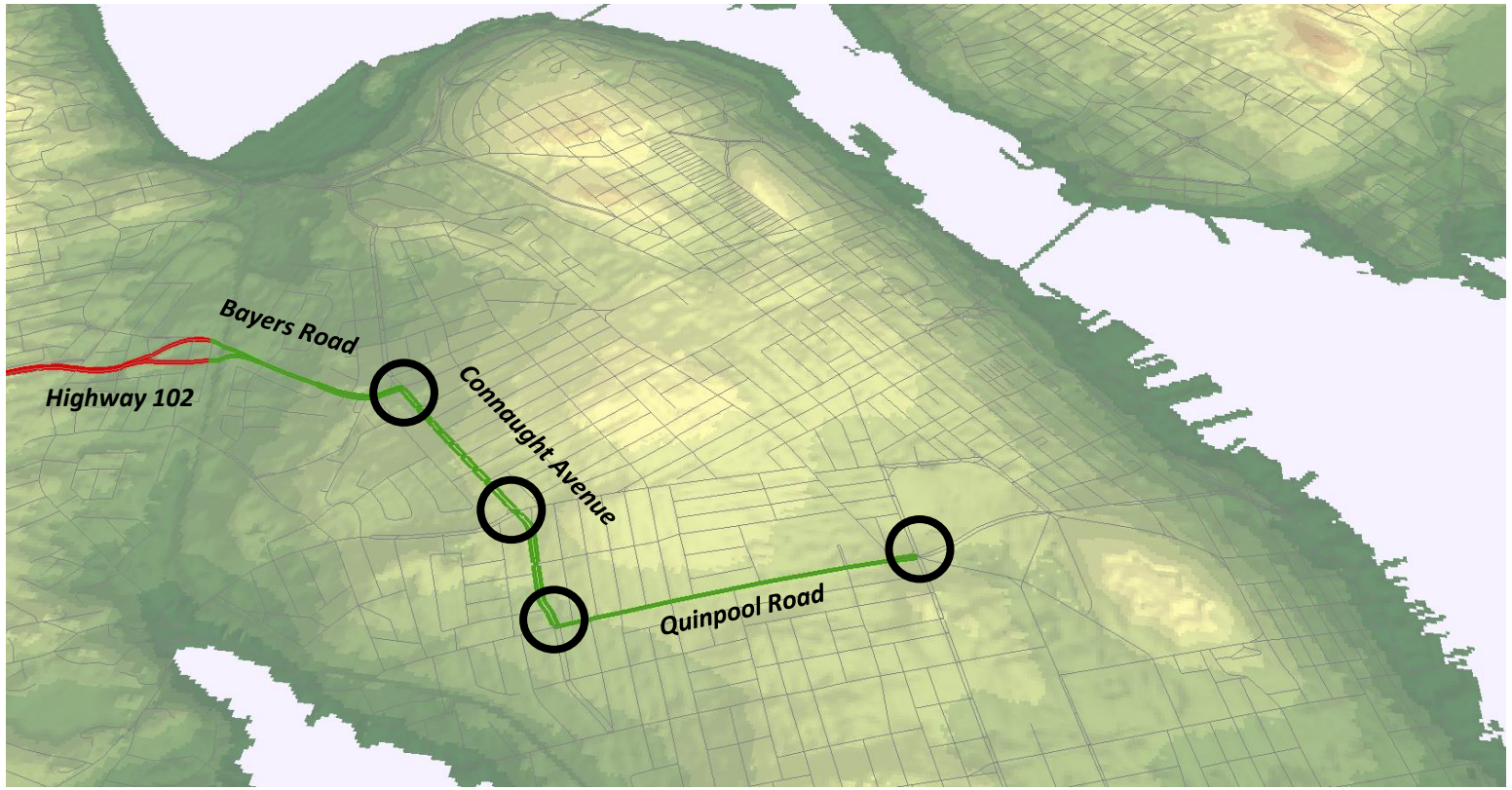
Results: Network Disruption Scenarios

Congestion during Evacuation

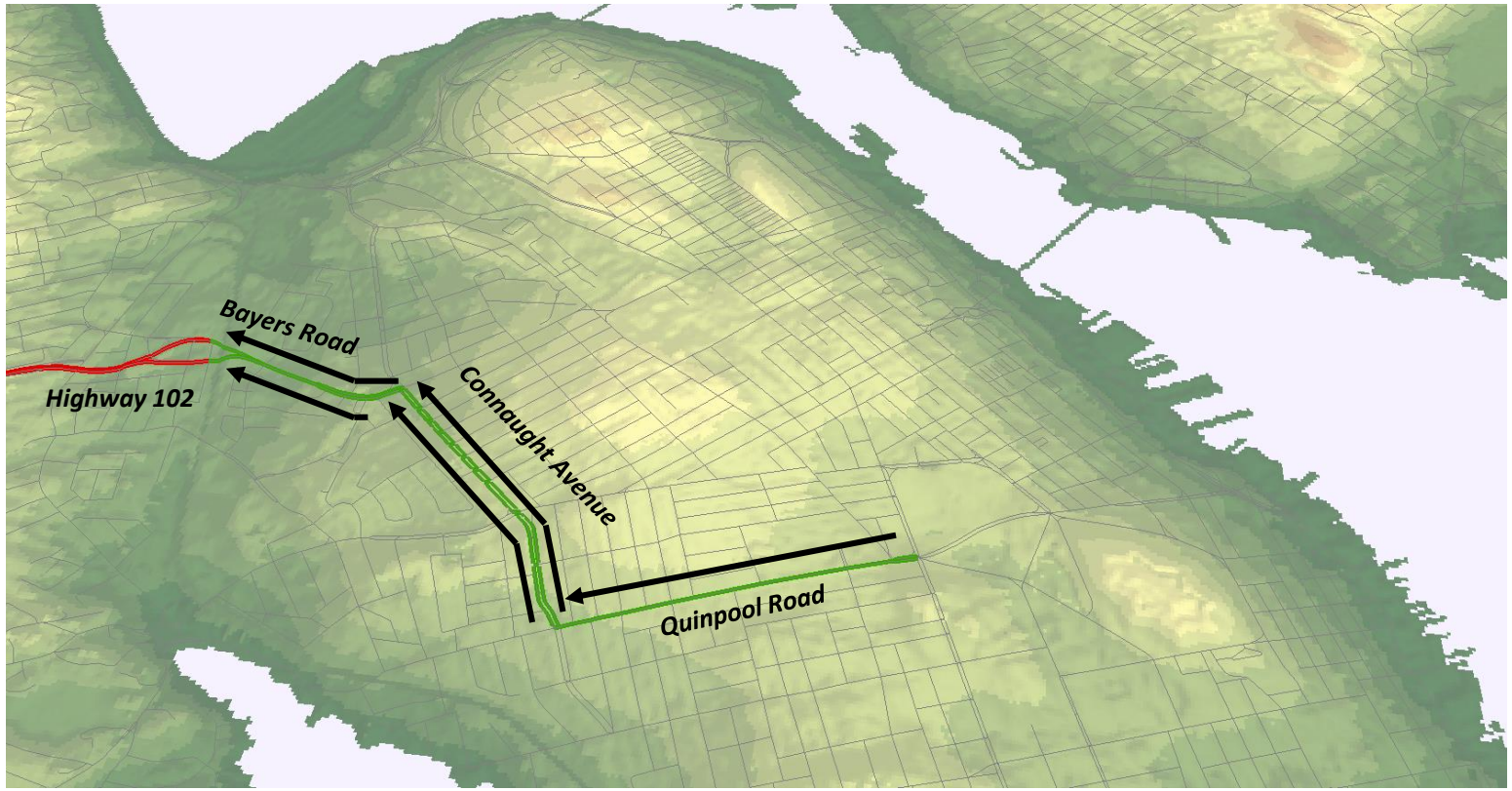
Evacuation hour	Base case		Scenario 1		Scenario2		Scenario 3		Scenario 4		Scenario 5	
	Hourly	%Cumulative	Hourly	%Cumulative	Hourly	%Cumulative	Hourly	%Cumulative	Hourly	%Cumulative	Hourly	%Cumulative
1	3666	5.63	4174	6.35	4175	6.24	4078	6.24	4189	6.42	4139	6.25
2	5560	14.17	6566	16.33	6581	16.08	6642	16.41	6778	16.8	6772	16.47
3	6217	23.73	6371	26.01	6291	25.48	6299	26.06	6025	26.03	6371	26.09
4	6416	33.58	6336	35.64	6071	34.56	5178	33.99	5492	34.45	5504	34.4
5	6076	42.92	4749	42.86	4658	41.52	4511	40.89	5236	42.47	3592	39.82
6	4345	49.6	3901	48.79	3854	47.28	3845	46.78	4600	49.51	3096	44.49
7	4223	56.08	3400	53.96	4216	53.59	4167	53.16	2437	53.25	3870	50.34
8	3289	61.14	2502	57.76	3076	58.18	2447	56.91	2577	57.19	3794	56.06
9	3517	66.54	2109	60.97	2660	62.16	2110	60.14	2648	61.25	1555	58.41
10	3290	71.59	1830	63.75	1821	64.88	1935	63.1	2739	65.45	877	59.73
11	2942	76.12	1921	66.67	2093	68.01	2021	66.2	2228	68.86	599	60.64
12	2077	79.31	2165	69.96	1817	70.73	1959	69.2	2016	71.95	701	61.7
13	2199	82.68	2255	73.39	2132	73.92	1913	72.13	1874	74.82	1128	63.4
14	2059	85.85	1609	75.84	2072	77.01	1856	74.97	1893	77.72	1328	65.4
15	1566	88.25	2253	79.26	2310	80.47	1842	77.79	1717	80.35	1542	67.73
16	1407	90.42	2053	82.38	1920	83.34	1930	80.74	1607	82.81	2062	70.85
17	1391	92.55	2077	85.54	2260	86.71	1856	83.58	1588	85.25	2281	74.29
18	1665	95.11	2406	89.2	3015	91.22	2142	86.86	1701	87.85	1420	76.43
19	905	96.5	1643	91.7	1978	94.18	2156	90.17	1513	90.17	844	77.71
20	874	97.84	1328	93.71	1274	96.08	1291	92.14	1287	92.14	899	79.06
21	885	99.2	1340	95.75	1307	98.04	1294	94.12	1264	94.08	926	80.46
22	518	100	1109	97.44	1313	100	1263	96.06	1285	96.05	916	81.84
23	-	-	836	98.71	1290	-	1281	98.02	1279	98.01	887	83.18
24	-	-	850	100	326	-	1294	100	1302	100	954	84.62
25	-	-	-	-	-	-	-	-	-	-	900	85.98
26	-	-	-	-	-	-	-	-	-	-	854	87.27
27	-	-	-	-	-	-	-	-	-	-	946	88.7
28	-	-	-	-	-	-	-	-	-	-	1501	90.97
29	-	-	-	-	-	-	-	-	-	-	1217	92.8
30	-	-	-	-	-	-	-	-	-	-	910	94.18
31	-	-	-	-	-	-	-	-	-	-	859	95.47
32	-	-	-	-	-	-	-	-	-	-	837	96.74
33	-	-	-	-	-	-	-	-	-	-	2162	100



Countermeasures: Evacuation Route Planning

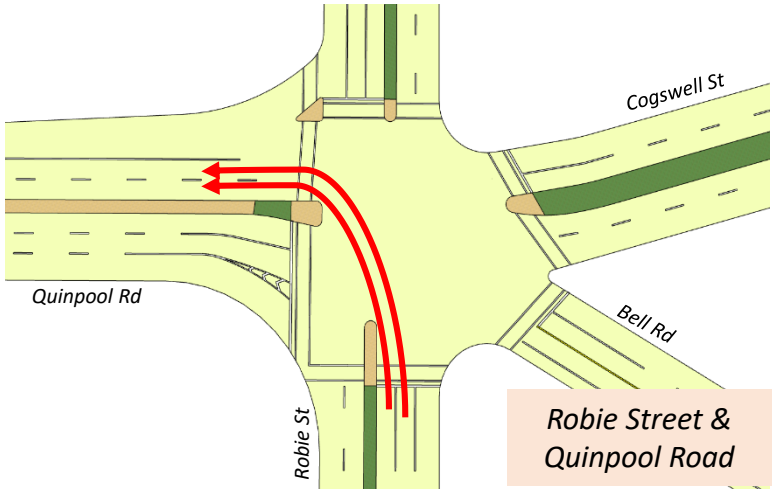


Countermeasures: Dedicated Route

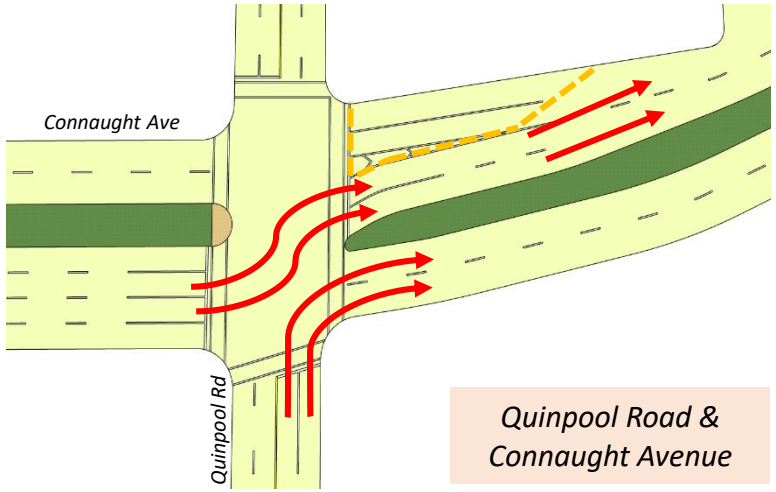


Countermeasure: Contraflow

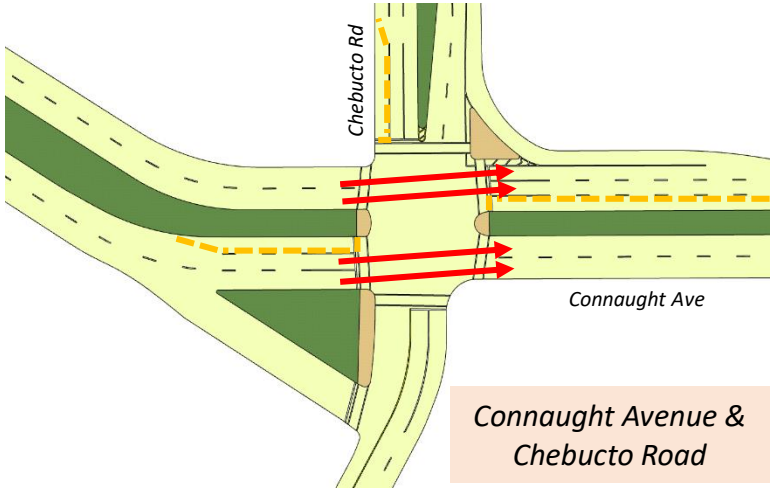
Contraflow Traffic Operation



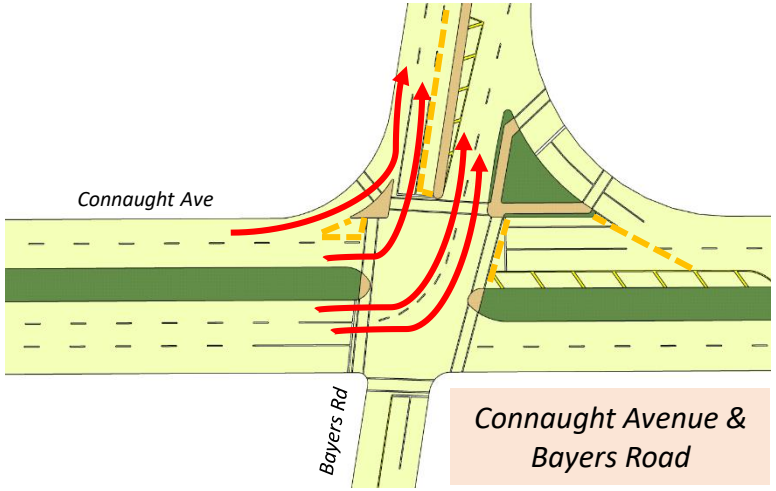
Robie Street & Quinpool Road



Quinpool Road & Connaught Avenue



Connaught Avenue & Chebucto Road



Connaught Avenue & Bayers Road

Conclusion: Lessons Learned

- Absence of a direct evacuation route
- Traffic bottlenecks
- Probability of incidents such as collisions
- Temporary traffic operations in emergency scenarios
- Communication strategies
- Urban design & development

Tantallon wildfire evacuation

New emergency exit following Tantallon wildfire

Conclusion: Future Work

- Research on Countermeasures
  - Transit-supported Evacuation
  - Different types of contraflow traffic operations and testing
  - Vulnerable populations (e.g. people with disabilities)
  - Shelter location modelling
- Planning and Disaster Management
  - Multiple types of natural disasters
  - Scenario planning
  - Evacuation drill and community preparedness
  - Shelter assessment
  - Communication plans

Transit-supported evacuation

Contraflow traffic operation

Thank You!

Acknowledgements

- MEOPAR, NSERC, Jahedul Alam, my terrific Graduate Students

Wednesday, June 21

Panel Discussion

Chaired by Barbara Hamilton-Hinch & Rohini Bannerjee

Ursula Gobel

David Budtz Pedersen

Chafic Mokbel

Ahsan Habib

Up next

11.15 – 11.45	**Coffee and Tea break**	Lobby
11.45 – 13:00	**Parallel sessions + Workshop**	
	Engaging Citizens in the Science to Policy	2016
	The role of AI and Big Data on Science and Societal	2021
	Research Security and Ethics	2017
	Integrating Societal Impact in an Institutional	2102
	Workshop: How to make your research (impact) interesting - storytelling	2116

Thank you!

Enjoy your coffee break

11.45 - parallel sessions and workshop