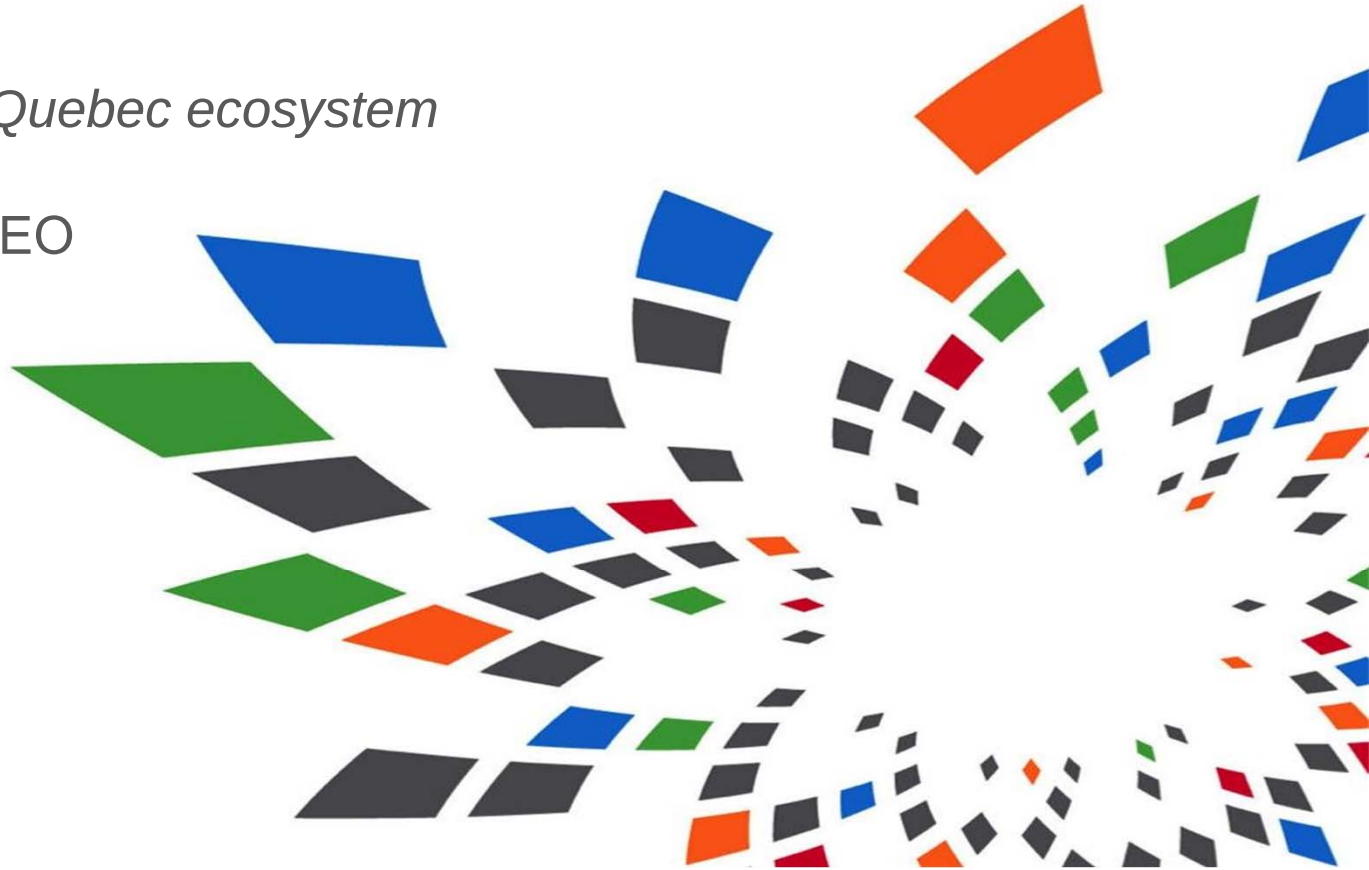
Institute for Data Valorization
IVADO

IVADO and the Quebec ecosystem

Gilles Savard, CEO
IVADO

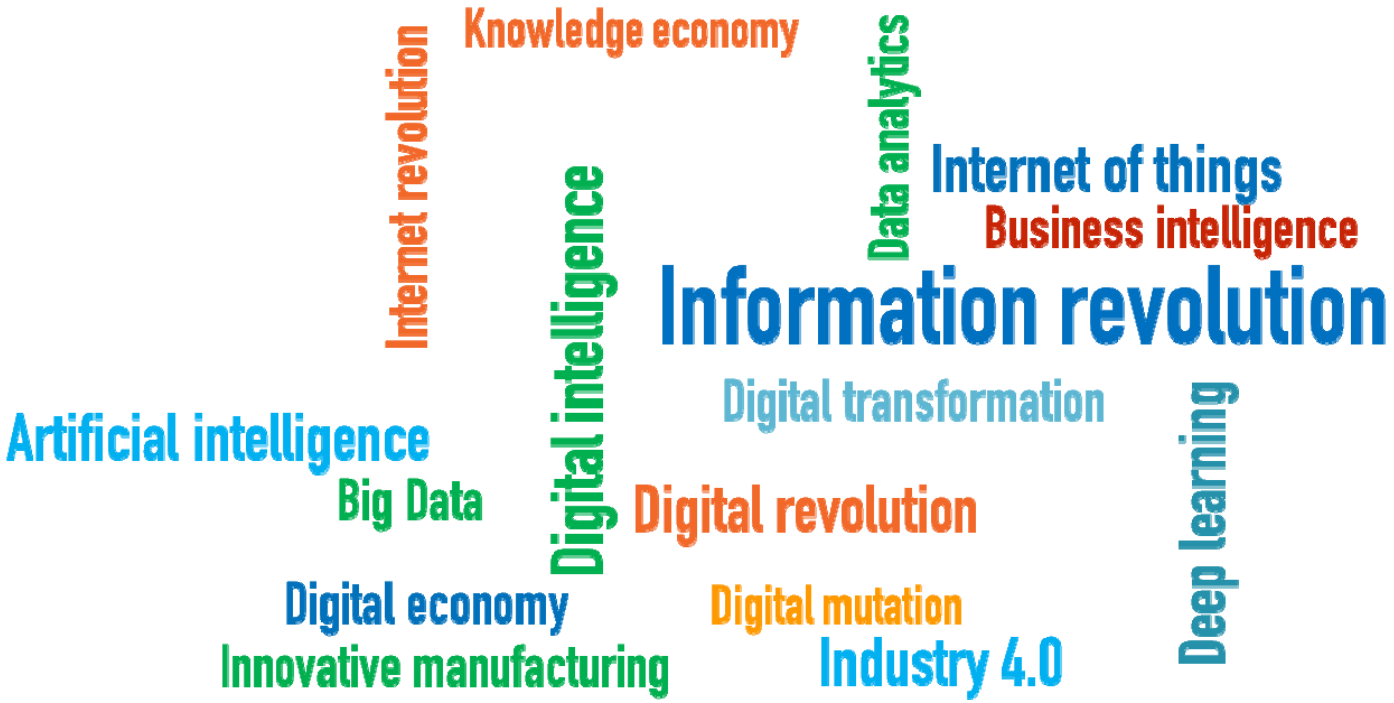


Outline

- Digital technologies, the creation of value and the value of data

- The AI ecosystem of Montréal

Beyond the words…



the fundamentals…

- **Computing power**: Moore's law + GPU

  2 x more powerful by 1,5 year at the same cost
  20 years : factor 10000 (100000 with GPU)

- **Telecommunication network**: exponential growth in network capacity (speed, bandwidth, storage, etc.)

- **Software engineering**: flexible programming, agile, embedded system

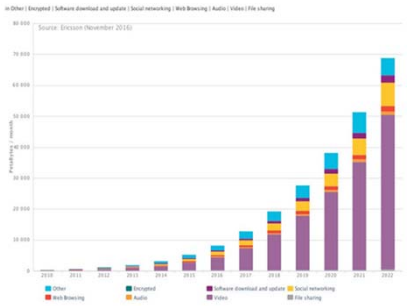
with now the data…

Digitization of the physical world into a virtual world

Usages

IDC: 4,4 to 180 zettabytes from 2013 to 2025

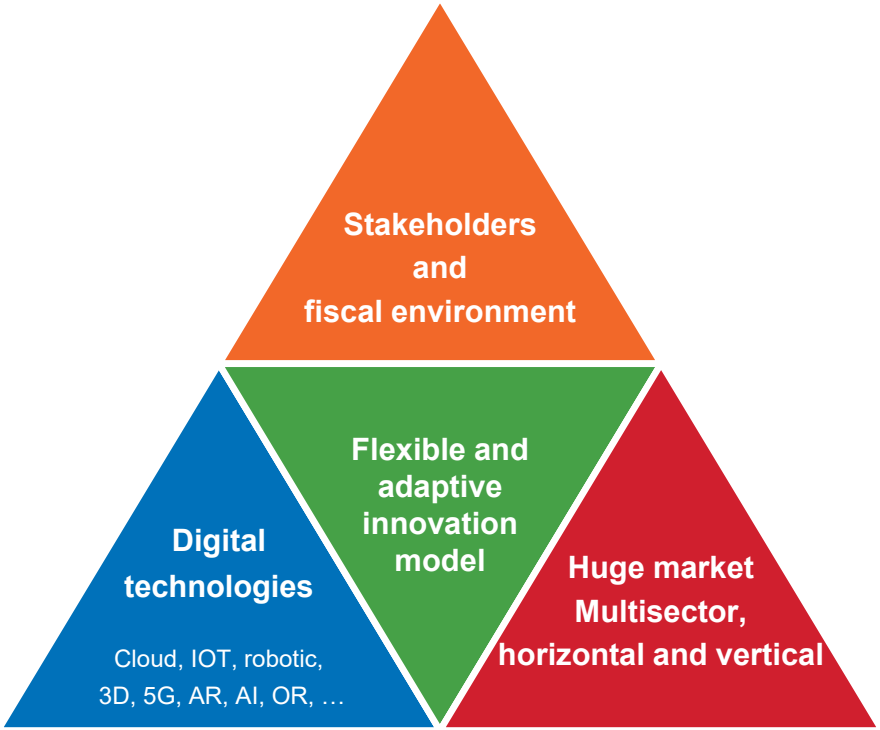
Multiples of bytes				
SI decimal prefixes		Binary usage	IEC binary prefixes	
Name (Symbol)	Value		Name (Symbol)	Value
kilobyte (kB)	10^3	2^{10}	kibibyte (KiB)	2^{10}
megabyte (MB)	10^6	2^{20}	mebibyte (MiB)	2^{20}
gigabyte (GB)	10^9	2^{30}	gibibyte (GiB)	2^{30}
terabyte (TB)	10^{12}	2^{40}	tebibyte (TiB)	2^{40}
petabyte (PB)	10^{15}	2^{50}	pebibyte (PiB)	2^{50}
exabyte (EB)	10^{18}	2^{60}	exbibyte (EiB)	2^{60}
zettabyte (ZB)	10^{21}	2^{70}	zebibyte (ZiB)	2^{70}
yottabyte (YB)	10^{24}	2^{80}	yobibyte (YiB)	2^{80}
See also: Multiples of bits · Orders of magnitude of data				



Internet of things (IOT)

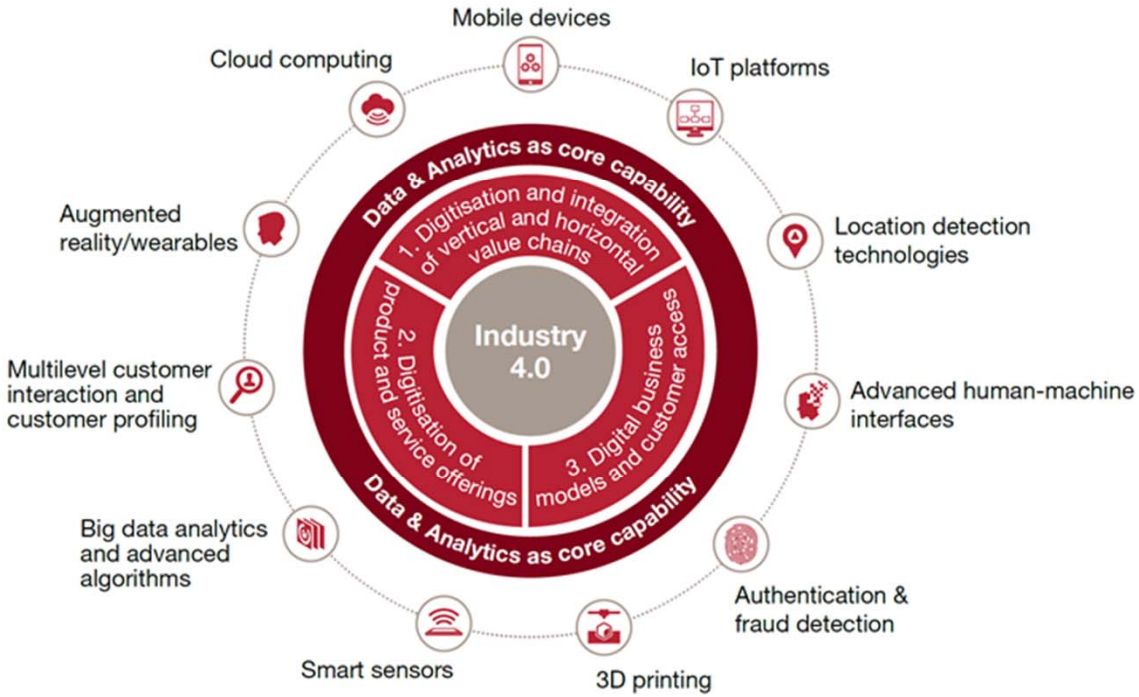
Ericsson: 30 G connected devices in 2022
and even…
Siemens: 200 G connected devices in 2025

and an outstanding convergence of innovation pillars



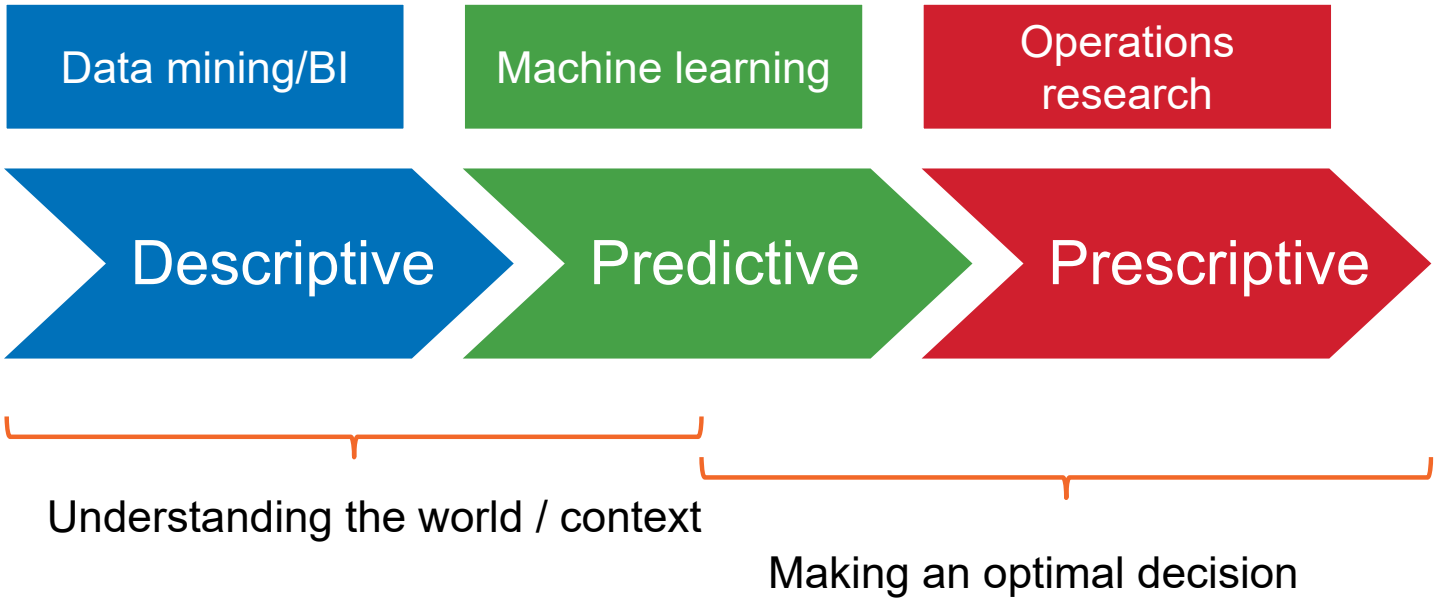
Industry 4.0 : creation of value

Industry 4.0 framework and contributing digital technologies

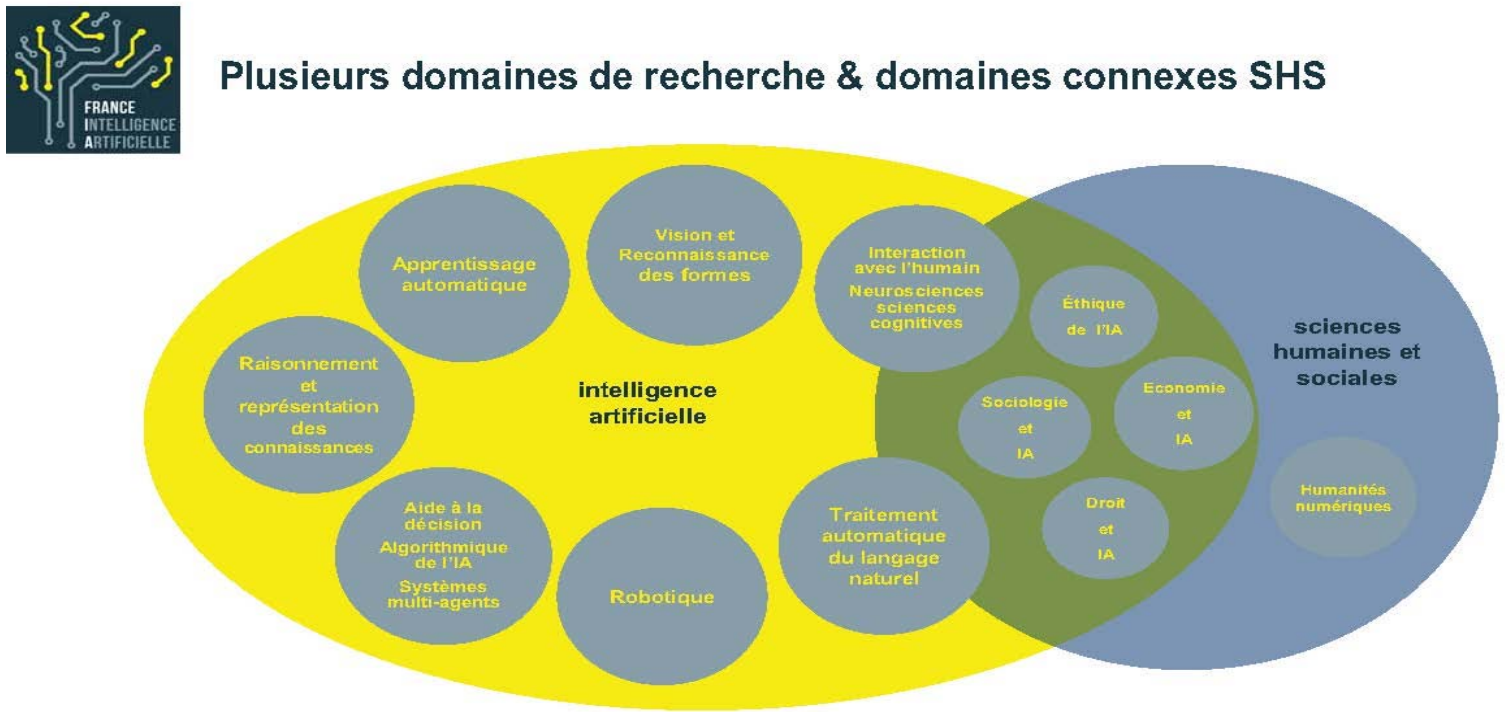


Source : www.pwc.com/industry40

Data analytics: the true value of the data

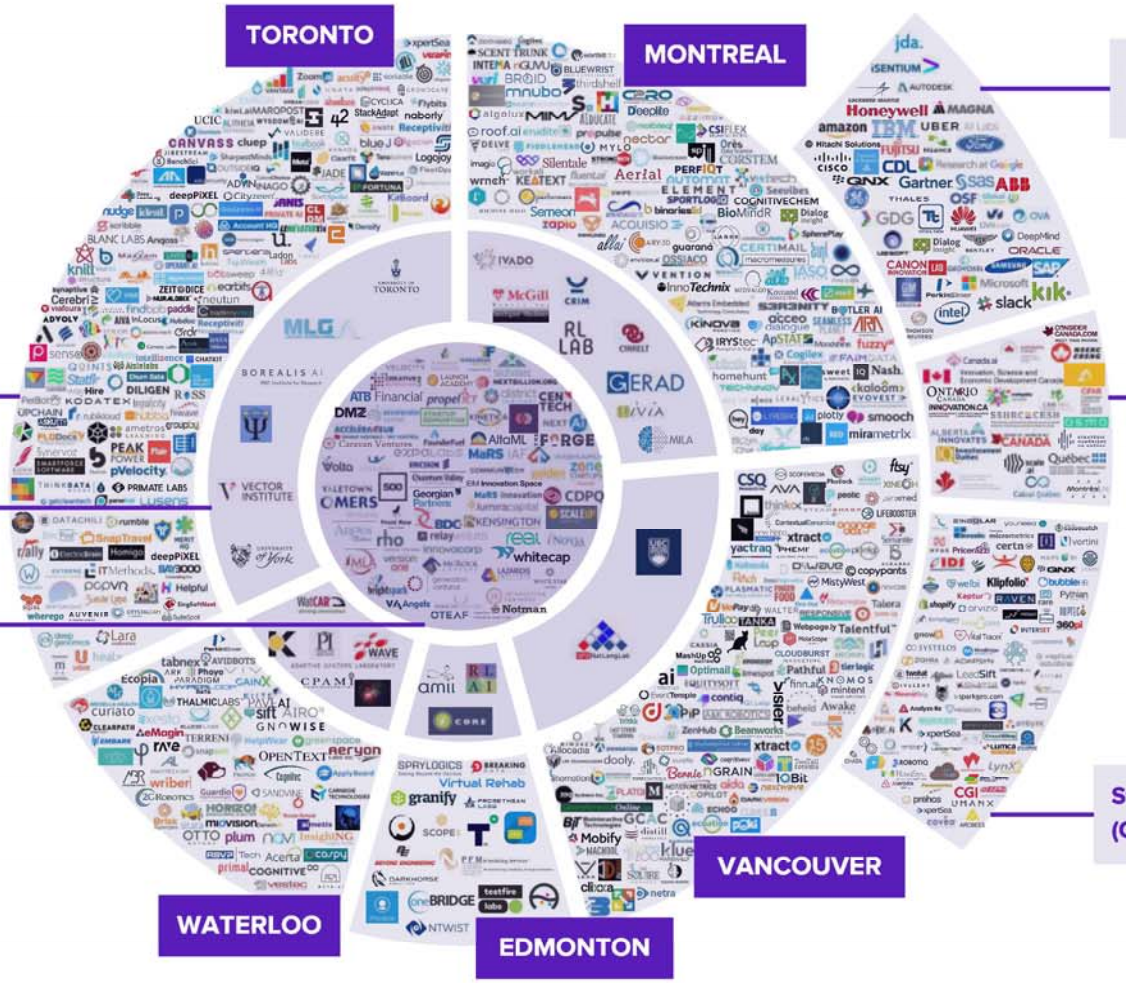


BI vs AI vs OR: extensive research topics



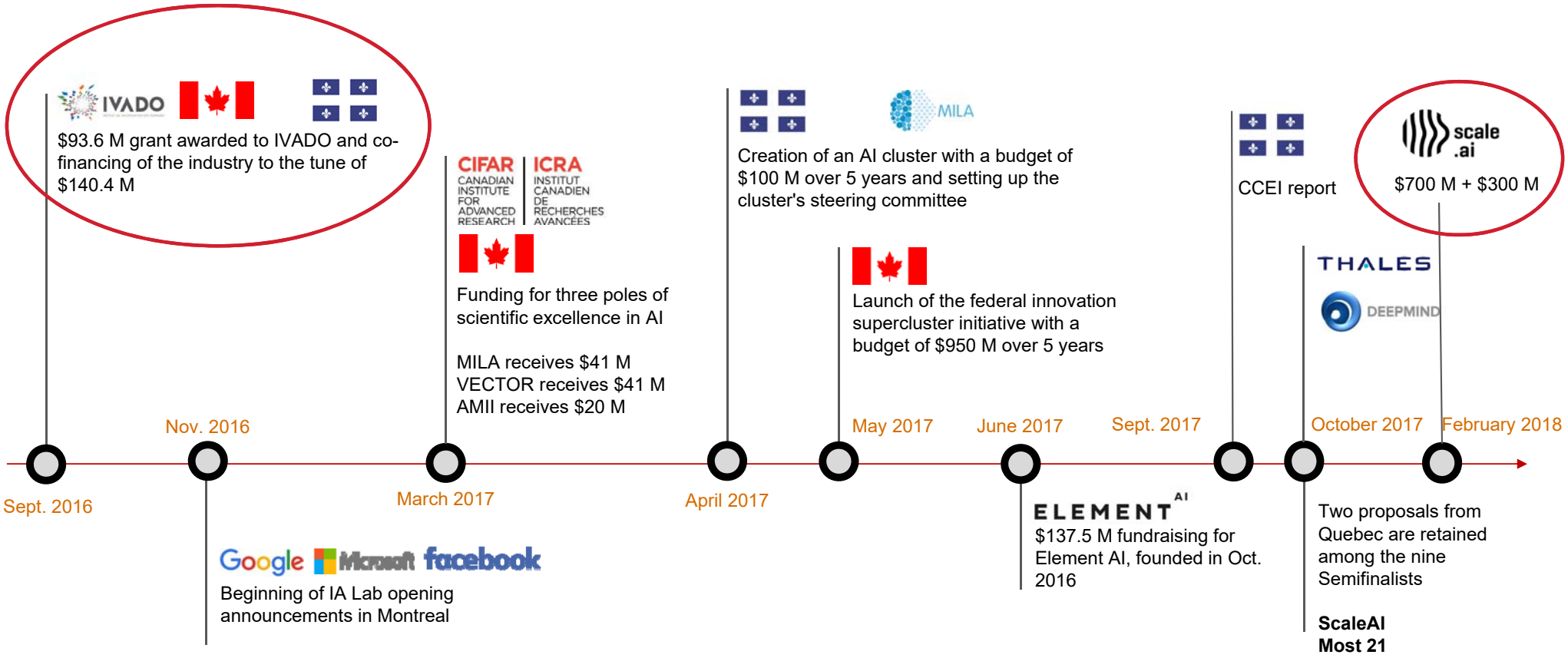
Canadian AI Ecosystem 2018

ELEMENT AI



2018-05-01 jfgagne.ai

Overview of recent developments in AI in Montréal: > $2 G

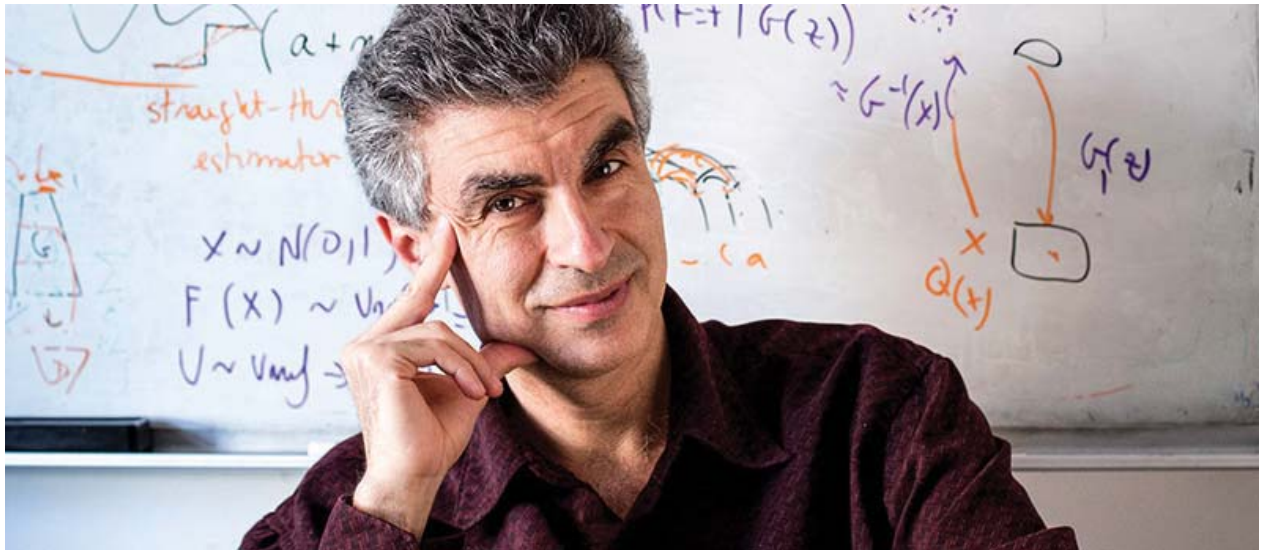


Montreal:
A Unique Synergy Between Deep Learning and Operations Research

- Montreal is a worldwide leader in both deep learning and operations research (OR)
- Campus Montreal pioneered the deep learning revolution
- Largest worldwide academic center for deep learning;
- #1 in publications on deep learning according to Sementic Scholar
- Strongest operations research cluster in the world (#1 in research impact)
- Only Canadian Excellence Research Chair in applied mathematics and computer science to Prof. Andrea Lodi
- IVADO has established research partnership innovation and commercialization channels with more than 70 partners
- Attraction of best PhD students in the world: 90% of applicants to MILA and 60% in OR are international students coming from renowned schools
- Thriving Montreal entrepreneurial ecosystem in AI/OR

Yoshua Bengio
as Scientific Program Leader

- Member of pioneering trio who invented deep learning
- Only one of the trio to stay in academia despite pull from industry
- Among the most cited computer scientists in Canada:
  - h-index=84
  - 42,000 citations
- Canada Research Chair since 2000
- NSERC Chair 2005-2015
- Head of the Montreal Institute of Learning Algorithms
- Program Co-director and Senior Fellow, CIFAR
- One of only four Canadians invited to last Bilderberg meeting, a select forum of world leaders discussing megatrends and major issues facing the world, to address the economic and political impact of AI



Operations research: **Taking optimal decisions in a complex context**

Canada Excellence Research Chair in Data Science for Real-Time Decision-Making at Polytechnique Montréal, **Dr. Andrea Lodi** holds Canada's main chair in Operations Research.

Jean-François Cordeau holder of Canada Research Chair in Logistics and Transportation was appointed to the College of New Scholars, Artists and Scientists of the Royal Society of Canada.

Pr François Soumis, IVADO's general director received the Prix Lionel-Boulet—one of the highest awards handed out to researchers by the government of Québec—in recognition of his career, research results, leadership in scientific development and contribution to economic growth in Québec.

IVADO in a few figures ...

70+ Industrial partners and international partners

234M$ Global budget IVADO :
110,4 M$ (industrial partners)
+ 93,6 M$ (CFREF Canada)
+ 30,1 M$ (HEC Montréal, Polytechnique Montréal et l'Université de Montréal).

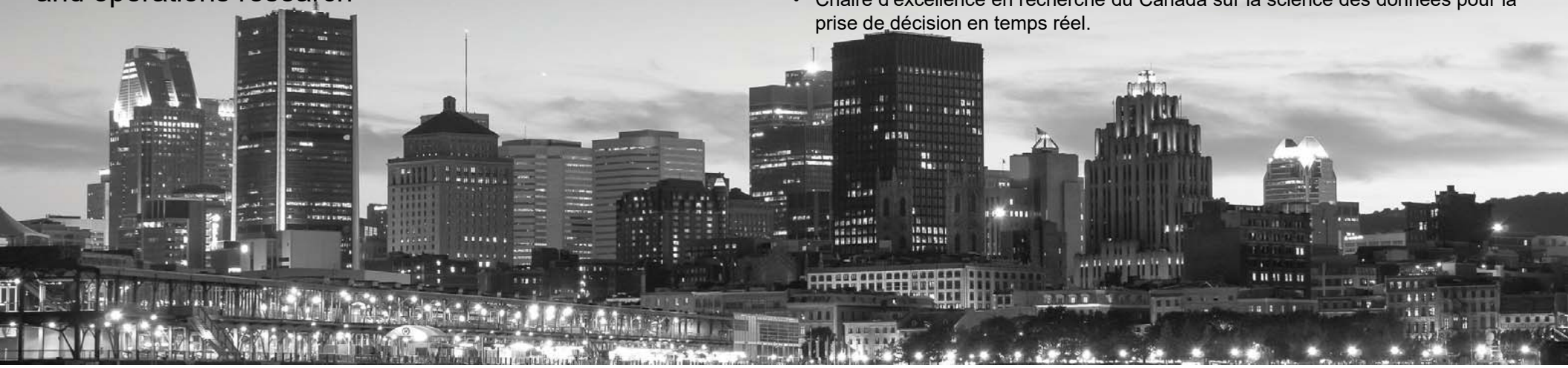
9

Research centers and academic departments

- GERAD
- CIRRELT
- MILA
- DIRO de l'Université de Montréal,
- Département de mathématiques et de génie industriel de Polytechnique Montréal,
- Département de sciences de la décision de HEC Montreal,
- Tech3Lab,
- Centre de recherches mathématiques (CRM)
- Chaire d'excellence en recherche du Canada sur la science des données pour la prise de décision en temps réel.

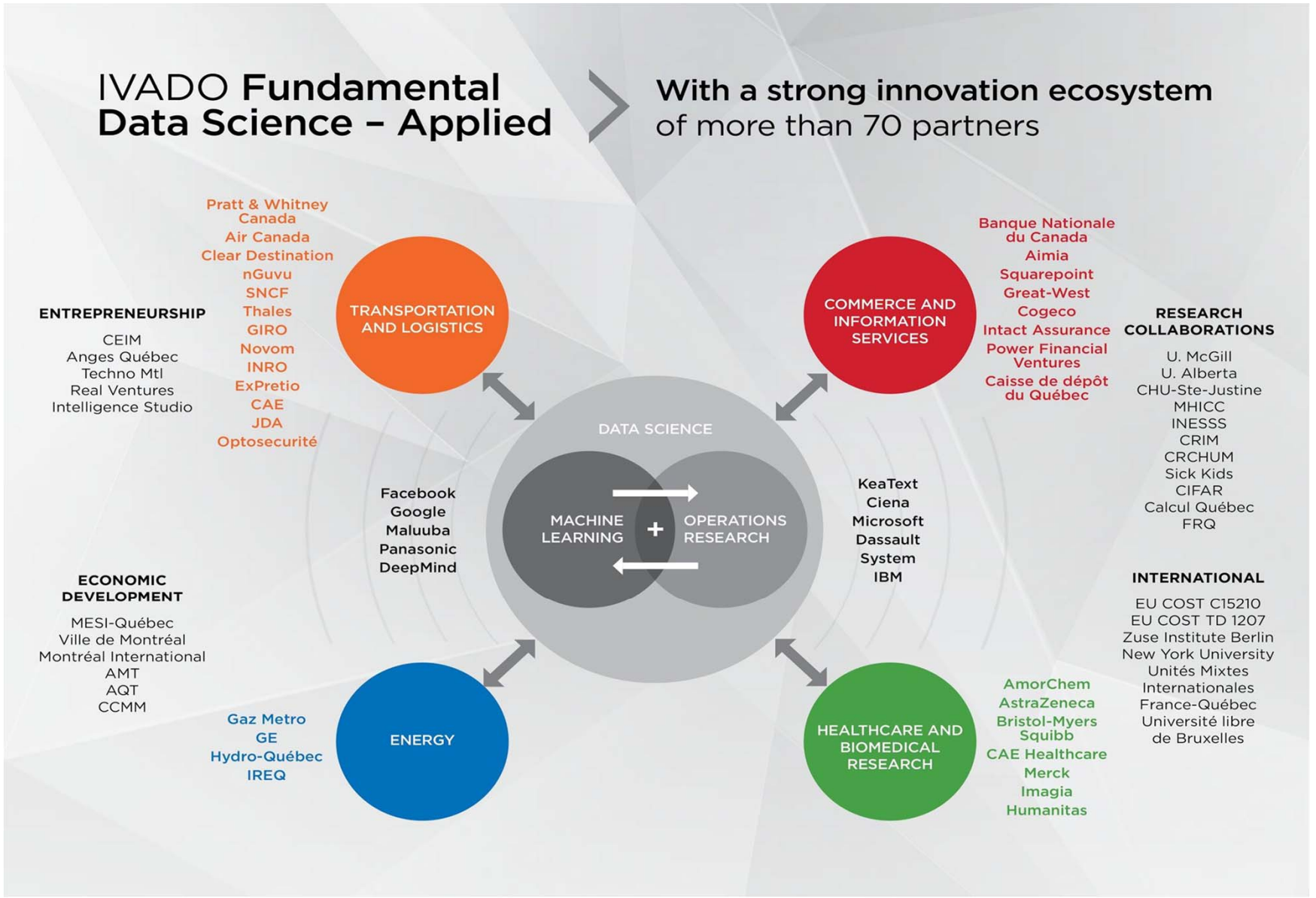
1000

Scientists in data science, artificial intelligence and operations research



IVADO: world-class research centers

and more than 20 research chairs


IVADO Fundamental
Data Science – Applied
With a strong innovation ecosystem
of more than 70 partners
ENTREPRENEURSHIP
CEIM
Anges Québec
Techno Mtl
Real Ventures
Intelligence Studio
Pratt & Whitney Canada
Air Canada
Clear Destination
nGuvu
SNCF
Thales
GIRO
Novom
INRO
ExPretio
CAE
JDA
Optosecurité
TRANSPORTATION AND LOGISTICS
COMMERCE AND INFORMATION SERVICES
Banque Nationale du Canada
Aimia
Squarepoint
Great-West
Cogeco
Intact Assurance
Power Financial Ventures
Caisse de dépôt du Québec
RESEARCH COLLABORATIONS
U. McGill
U. Alberta
CHU-Ste-Justine
MHICC
INESSS
CRIM
CRCHUM
Sick Kids
CIFAR
Calcul Québec
FRQ
DATA SCIENCE
MACHINE LEARNING
+
OPERATIONS RESEARCH
Facebook
Google
Maluuba
Panasonic
DeepMind
KeaText
Ciena
Microsoft
Dassault System
IBM
ECONOMIC DEVELOPMENT
MESI-Québec
Ville de Montréal
Montréal International
AMT
AQT
CCMM
INTERNATIONAL
EU COST C15210
EU COST TD 1207
Zuse Institute Berlin
New York University
Unités Mixtes Internationales
France-Québec
Université libre de Bruxelles
Gaz Metro
GE
Hydro-Québec
IREQ
ENERGY
HEALTHCARE AND BIOMEDICAL RESEARCH
AmorChem
AstraZeneca
Bristol-Myers Squibb
CAE Healthcare
Merck
Imagia
Humanitas


SCALE AI
AI-Powered Supply Chain Supercluster

THE INDUSTRIAL CONSORTIUM FOR SUPPLY CHAINS POWERED BY AI

scale .ai

Technological foundation: **AI techniques, from ML to operational research**

- Integration and reinforcement of other technologies: IoT, Blockchain, robotics ...

Functional foundation: **industrial applications on the supply chain, ideal function**

- Data generation, use of data, transverse to industrial sectors, goes beyond silos of value chains, link with exports, leverage on growth ...

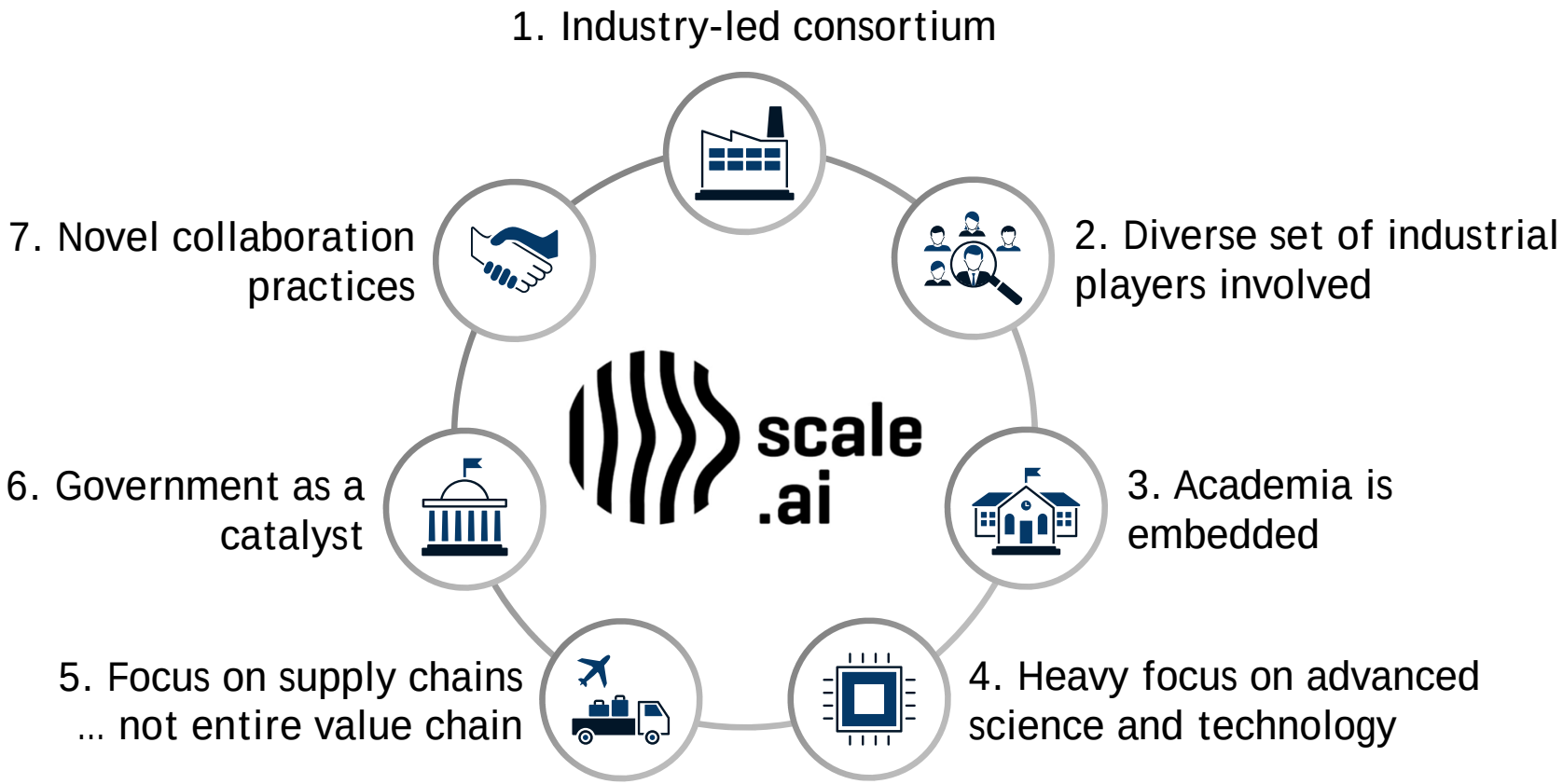
Roadmap of innovation shared by industrial and academic partners

- Adapt, adopt and transfer point-to-point AI solutions
- Build and industrialize the foundations of the technological ecosystem
- Generalize the integration of AI in the running of companies

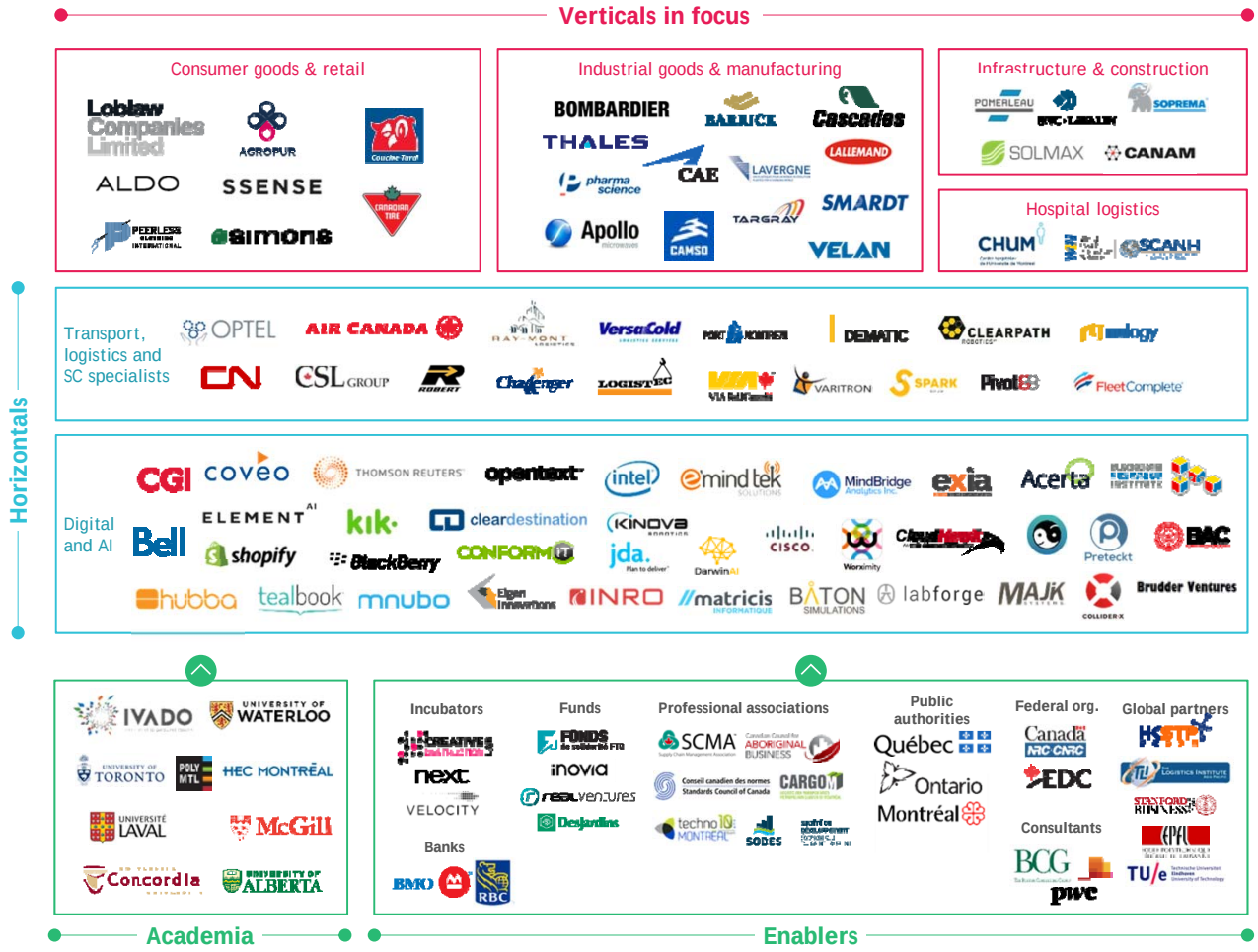
Strong anchorage in Quebec and Ontario

- Industrial jewels: CN, CGI, Aldo, Agropur, Couche-Tard, SNC, Bell ...
- "Great Future": Optel, Coveo, Ssense, Ray-Mont ...
- Ecosystem of initiation and growth: start-ups, CDL, Next AI, Real Ventures, Desjardins, Solidarity Fund, iNovia ...
- IVADO and Waterloo Leadership plus an Extended Academic Network

7 key elements that make SCALE AI innovative



118 members to date incl. ~80 industrial partners



Technology roadmap: Two key axes

Consumer & Retail | **Industrial & Manufacturing** | **Infra. & Construction** | **Transports & Logistics**

1 Drive adoption of AI-powered solutions to supply chains needs

- Demand forecasting & planning
- Capacity & inventory planning and replenishment
- Automated sourcing and procurement
- Automated warehousing & in-plant logistics
- Scheduling and predictive disruption analysis
- Real-time data integration, traceability & visibility

- Generalized and adapted to enable portability across segments

Extract, generalize, standardize

2 Develop foundational intelligent supply chains building blocks

Orchestration & Integration

Operations	Data	AI	Device mgmt.	Infra
End-to-end SC solutions	Data capture accelerators	Predictive/ Prescriptive Models	Industrial & Mobile IoT	Network & comms
Business solutions	Secure data exchange	Training / Simulation	Autonomous logistics robots	Real-time / SOC engines
Marketplace		Auditing & debugging		

SC Security & resiliency

Generally Available Market Solutions

- Compatible building blocks to enable integration and maximize synergies

Conclusion

Behond the hype of AI and even if we are far away from the *strong* AI…

our society will go inevitably toward the ***intelligent digital mesh***[1]
the entwining of people, devices, content and services

Thus, and back to the ultimate goal of creation of values, the ecosystem will need resources from many other organizations not named in this short presentation as: CNRC, CQDM, CRIM, CRIQ, CEFRIO, ADRIQ,…

Ref 1: https://www.gartner.com/smarterwithgartner/gartner-top-10-strategic-technology-trends-for-2018/