Montreal, Smart City
Gilles Savard, CEO
A smart city incorporates information and communication technologies (ICT) to enhance the quality and performance of urban services such as energy, transportation and utilities in order to reduce resource consumption, wastage and overall costs. The overarching aim of a smart city is to enhance the quality of living for its citizens through smart technology.

- service planning and management
- infrastructure services
- human services

Ref: https://www.techopedia.com/definition/31494/smart-city
Table 1: Definitions of "smart city."

A Smart City is a city well performing in a forward-looking way in its "smart" characteristics, built on the "smart" transformation of productions and activities of self-sufficient, independent and autonomous citizens, who are smart consumers.

A city is smart when it combines human and natural capital and traditional transport and renewable (TT) communication infrastructure to sustain economic growth and quality of life, with ample management of natural resources, through participatory governance (Gargiulo et al. 2009).

A well performing in a forward-looking way in its "smart" characteristics, people, governance, mobility, environment, and housing, built on the "smart" transformation of productions and activities of self-sufficient, independent and smart citizens (Crilligan et al. 2010).

A city that integrates and controls all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, energy, even major buildings, can better optimise its resources, plan its preventive maintenance activities, and monitor near its aspects while meeting services to its citizens (Hall 2000).

A city connecting the physical infrastructure, the TT infrastructure, the social infrastructure, and the business infrastructure to forge the collective intelligence of the city (Harcourt et al. 2010).

A community of average technology size, interconnected and sustainable, comfortable, attractive, and secure (Massimo and Renato 2011).

The application of information and communications technology (ICT) with the role of human capital, education, social and intellectual capital, and environmental issues is often indicated by the notion of smart city (Sewald 2012).

The use of Smart Computing technologies to make the critical infrastructure components and services of cities, which include city administration, education, healthcare, public safety, and transportation, and utilities - more intelligent, more efficient, and cost-effective (Stanislaw et al. 2010).

"Being a smart city means using all available technology and resources, in an intelligent and environment-friendly manner to develop urban contexts that are well integrated, habitable and sustainable." (p. 50) Bertolucci et al. (2011).

"A smart city, according to (X), is a city that prepares to provide conditions for a healthy and happy community under the challenging conditions of urbanization, social, environmental and social movements, which bring." (p. 20) (Sum 2011).

Information technology space represents the key concept. The main of an intelligent city is not confined to economic excellence but can be for information technologies, but an integral part of this is no concern for the quality of life for the ordinary citizens. (Iacovou 1991, Hourani 2002).

"The first cities gives us further reason to start doing something to transform our cities for the new global integration - a "smart city" community. While a "smart city" community - a community which makes a conscious decision to aggressively develop technology as a catalyst to solving its social and economic needs - will certainly focus on building its high-speed broadband vehicular systems (Ep. 2009),..." (p. 177).

The real opportunity is in its reconfiguring and rethinking of its place, and in the process of a "smart" upgrade. (p. 3) "Smart" communities are not at their core, systemic in the deployment and use of technology, but in the promotion of economic development, job growth, and an increased quality of life. In other words, technological logics of smart communities isn't an at all in itself, but also a means to rethinking cities for a new economy and society with smart and compelling community benefit. (see 197-210).

"...A truly "smart" community is a community that has made a conscious effort to use information technology to transform lives and works within its regime to "significant and fundamental," rather than incremental, ways." (p. 50).

"Cities of the Future - Address in the Information Age - will be truly smart communities, sustainable, healthy, culturally strong, dynamic, and exciting places to live and work and play." (p. 50).

"...smart cities will take advantage of communications and sensory capabilities even in the city's infrastructure to optimise electrical transportation, and other topological operations supporting daily-life, thereby improving the quality of life for everyone." (p. 203) (Chen & Liu 2010).

"...two major streams of research ideas. 1) smart cities should always act in harmony with human and nature..." (p. 15) Bertolucci et al. (2010).

"The term is now used to specifically describe a city with certain attributes, but used for various aspects which range from Smart City as an ER district to a Smart City regarding the structure of the institutions." (p. 50).

A Smart City is a city well performing in a forward-looking way in its "smart" characteristics: economy, mobility, environment, people, living, governance, built on the "smart" combination of productions and activities of self-sufficient, independent and smart citizens. (p. 12) (Haddad 2007).

Smart cities "set the results of their knowledge intensive and creative strategies aiming at enhancing the socio-economic, ecological, logistic, and competitive performance of cities. Smart urban policies are based on a growing role of human capital (e.g., skilled labor forces), institutional capital (e.g., high tech communication facilities), social capital (e.g., intense and open network flogics) and entrepreneurial capital (e.g., creative and risk taking business activities)." (p. 213) (Billari and Magnani 2013).

"Smart cities have a high productivity as they have a relatively high share of high educated people, knowledge intensive jobs, output oriented planning systems, creative activities and sustainability oriented initiatives." (p. 23) (Billari et al. 2012).

"Smart cities are used as a synonym of "cities," "creative or smart city experiments," aimed at increasing a creative economy through innovation in quality of life which in turn attracts knowledge and skilled to live and work in smart cities. (p. 213).

"The sense of competitive advantages has shifted to those regions that can generate, retain, and attract the best talents." (p. 64) (Theo 2011).

"Smart cities of the future will need sustainable urban development policies where all residents, including the poor, can live well and the attractiveness of the towns and cities is preserved. ... Smart cities and ... cities that have a high quality of life, those that pursue sustainable economic development through investments in human and houses (2011)." (p. 99).

"...also consider "smart" cities to be metropolitan areas with a large share of the adult population with a college degree." (p. 99) (Sum 2011)

"Smart cities as "...centres with high capacity for learning and innovation, which is built in the creativity of their population, their institutions of knowledge creation, and their digital infrastructure for communications and knowledge management," (2006) (Sum 2011).

The term "smart city" is centered on a certain intellectual skills that addresses an urban innovation across local and socio-economic aspects of growth. These aspects lead to smart city concepts as "green" referring to urban infrastructure for environment protection and reduction of CO2 emission, "sustainable" related to resolution of broad economy, "intelligent" declaring the capacity to produce added value information from the processing of city level data from sensors and actuators, whereas the term "innovative." Knowledge cities internationally refer to the city's ability to a rule innovation based on knowledgeable and creative human capital (Sum 2011).

"...countries with high capacity for learning and innovation, which is built in the creativity of their population, their institutions of knowledge creation, and their digital infrastructure for communication." (Holland 2006)

A city is to be smart urban investments in human and social capital and traditional infrastructure and modern (ICT) communication infrastructure that sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance (Gargiulo et al. 2012).

However, there is a common assumption for all these different meanings: the "smart city" is a data-driven city. In this sense, "big data is [...] the indispensable tool to allow the emergence of real smart cities, structured by a knowledge of the city updated in real time and a form of permanent ubiquity" (Douay & Henriot, 2016, p.89).

The city becomes a platform for generating data and algorithms.

Ref: LA VILLE INTELLIGENTE Origine, définitions, forces et limites d’une expression polysémique, Sandra Breux et Jérémy Diaz, INRS, 2017
Two ways to see the smart city:

(a) the approach centered on technologies and means of communication and information: the materiality of the phenomenon, the "hardware",

b) the people-centered approach (Angelidou, 2014); areas that do not necessarily require the involvement of information and communication technologies: new technologies must be used to produce "intelligent" citizens, workers and officials, that is, capable of new public programs and policies, produce better products, foster local entrepreneurship and attract foreign investment.

Ref: LA VILLE INTELLIGENTE Origine, définitions, forces et limites d'une expression polysémique, Sandra Breux et Jérémy Diaz, INRS, 2017
Smart City & Montreal: technology push

Source: www.pwc.com/industry40 (adapted)
Smart City & Montreal: technology push

Data mining/BI  Machine learning  Operations research

Descriptive  Predictive  Prescriptive

Understanding the world / context

Making an optimal decision
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 Semantic 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
Smart City & Montreal: technology push

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

$93.6 M grant awarded to IVADO and co-financing of the industry to the tune of $140.4 M

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Funding for three poles of scientific excellence in AI

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Creation of an AI cluster with a budget of $100 M over 5 years and setting up the cluster’s steering committee

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Launch of the federal innovation supercluster initiative with a budget of $950 M over 5 years

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Two proposals from Quebec are retained among the nine Semifinalists

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CCEI report

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Beginning of IA Lab opening announcements in Montreal

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Element AI

Element AI

Element AI

Element AI

$137.5 M fundraising for Element AI, founded in Oct. 2016

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Thales

Thales

Thales

Thales

DeepMind

DeepMind

DeepMind

DeepMind

ScaleAI

ScaleAI

ScaleAI

ScaleAI

Most 21

Most 21

Most 21

Most 21
IVADO in a few figures ... 

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).

70+ Industrial partners and international partners

234M$ Scientists in data science, artificial intelligence and operations research

1100-9 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 Montréal,
- 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.
IVADO Presentation

**RESEARCH**
- 1000 scientists in data sciences
- 8M$ in scholarships
- 50+ research projects in artificial intelligence, research operation and data science

**OUTREACH**
- Renowned researchers
- International collaborations
- Worldwide events

**TRANSFER**
- 40+ industrial members
- Coaching
- 80 collaborative projects

**TRAINING**
- Three level program
- Summer schools
- Workshops and seminars
# IVADO High level research centers

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<th>Research centers</th>
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<th><a href="#">tech³lab</a></th>
<th><a href="#">CIRRELT</a></th>
<th><a href="#">GERAD</a></th>
<th><a href="#">CENTRE DE RECHERCHES MATHÉMATIQUES</a></th>
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+ 20 research chairs & labs
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1. Collect TRANSPARENT MANAGEMENT, OPEN GOVERNMENT
2. Communicate ACCESS SYSTEMS, INFORMATION DISTRIBUTION
3. Coordinate DIGITAL PUBLIC SERVICES
4. Colloborate SUPPORT INDUSTRIES, STIMULATE INNOVATION AND CREATIVITY
Montreal - Becoming Smarter

A Smart City plan introduced in 2014 is the most recent contributor to this transition.

1. Developing the broadband multiservice urban telecommunications network
2. Unlocking and valuing prioritized open data
3. Put in place an open and interoperable technology architecture
4. Develop, in co-creation with the community, solutions to urban issues
5. Optimize real-time user mobility in the territory
6. Increase the digital offer of direct services to citizens and businesses
7. Develop spaces to support urban innovations and reduce the digital divide
8. Improve access to democratic life and consolidate the culture of transparency and accountability
9. Foster the growth of a leading-edge sector by building on the Smart City's niche as a lever for project advancement and as a driver of economic development
Montreal - Becoming Smarter

... But the past three years have shown that the technological solution that make a smart city cannot do it without the other dimensions but it has emerged that in many cases, it is often better to completely evacuate the technological dimension...

Digital smart city office

Montreal Urban Innovation Laboratory

Data Collection  Open Data  Call for Proposals  Values for citizens
Montreal smart city: Worldwide prizes

Intelligent Community of the Year 2016
Smart 21 2014 | 2016
Top7 2016

Canada Smart Cities Challenge Finalists (Announcement: March 2019)
Smart applications

MONTREAL
Montréal, Smart and Digital City consists of 70 projects to develop Montréal based on collaborative innovation, the latest technologies and Montrealers’ daring and creativity.
Info-neige

Adjusted road width based on traffic

Autonomous bus
Research projects

• **Modelisation of the daily traffic** on the STM network with Machine & deep learning (SNCF, Keolis and Polytechnique Montreal)

• **Autonomous shuttle** at parc Olympique (Polytechnique Montreal & City of Montreal)

• **Modelisation of autonomous shuttle lines** on the last mile (Polytechnique Montreal, University of Montreal)

• **Smart Sensors systems for city trucks** to avoid collision with pedestrians & collect traffic data via image recognition (Jalon with Polytechnique Montreal and University of Montreal)

• **Carpool matching application** (Netlift and Polytechnique Montreal)
Conclusion

Smart city goes inevitably toward interconnectivity

Big data, AI and analytics are the indispensable tool to allow the emergence of real smart cities

…even to learn how people use cities

But, it is not so much a technological issue as a societal and citizen issue

Smart cities represent an interdisciplinary challenge that must take advantage of open innovation spaces
Something BIG is happening in Montreal

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Montréal, MÉGA branchée

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IVADO

HEC Montréal
Polytechnique Montréal
Université de Montréal