

ARTIFICIAL INTELLIGENCE IN QUEBEC'S LIFE SCIENCES AND HEALTH TECHNOLOGY SECTOR

OVERVIEW OF THE PROVINCE'S ECOSYSTEM

By Montreal InVivo and Accenture



FOREWORD



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Quebec's Artificial Intelligence community in Life Sciences and Health Technology is booming. Its actors work hard to push the boundaries of innovation.

In Quebec, we have a rich community of experts dedicated to improving the health of patients at all levels. We need to build on our tradition of excellence in life science research, a world-class hub, and build on our important ecosystem of AI research. We need to leverage our strengths in these areas to build new, AI-based capabilities for clinical research, drug discovery and health policy-making guided by potential population health advancements.

Québec's community of researchers and experts in these two fields, as well as Québec's social and political stability, make it not only fertile ground for innovation, but also a magnet for high-caliber talent; which is crucial for its development.

The access and interoperability of health databases in Quebec are prerequisites for the advancement and deployment of life sciences research and ultimately for its recognition here and internationally. It is indeed time to capitalize on our assets and create this connected ecosystem where researchers, industry leaders, startups, government and patients see all the benefits of life sciences AI.

Actions at the highest provincial levels must be carried out. Innovation related to AI is therefore important and needs to be built on a strong foundation of community dialogue and public engagement. This will ensure the creation of training, research and entrepreneurship programs that equip students as well as the entire life sciences community to develop healthy AI in a responsible and positive way for the community and the broader Quebec population.

This important study by Montréal InVivo is a first step towards a better alignment between the needs and the assets of the ecosystem, thus ensuring its development in order to continue to position itself as an innovative ecosystem. We thank all these collaborators for agreeing to participate in this major project.

OPENING STATEMENT



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The future of health and life sciences will be strongly influenced by digital technology - prevention, screening, diagnosis, follow-up will be non-invasive and AI is at the heart of this transformation. The application of AI in the life sciences and health sector is indeed inevitable, both in medical technology solutions applied to health care and in the biopharmaceutical field, particularly through the accelerated development of innovative therapies and the development of new technologies on the basis of patient data.

In Quebec, we have an ecosystem that is favorable to SMEs and to research in AI and life sciences with world-renowned opinion leaders. It provides many opportunities for collaboration and diverse affiliations, here and internationally. To be able to stand out and compete on a global scale, we need to leverage our innovative strengths and benefit the industry. We need to combine the expertise of ecosystem members not only for research and discovery but for clinical adoption through international commercialization of discoveries. Among other things, we need to capitalize on this, and develop the opportunity for collaboration between large pharmaceutical companies, medical technology manufacturers and SMEs to accelerate innovation and deployment in clinical settings.

This report aims to illustrate the strengths and levers of growth for the economic development of this sector, particularly at the level of companies that develop products and services. This report will also serve to initiate decisions to implement new concrete actions for the success of the sector in Quebec, actions that will support organizations that develop IA in life sciences and health technologies, as well as for those who use or wish to use AI in their activities. It is through these commercial successes, guided by the principles of responsible AI, that we will be able to ensure the economic and social prosperity and sustainability of the sector as well as a positive impact on the patients who will benefit from it.

On behalf of the life sciences community, as well as the AI community, we thank all the contributors who participate to this study.

Thanks also to the steering committee comprised of Frank Béraud, Vanessa Claveau, Jacques deGuisse, Christelle Fasano, Pierre-Alexandre Fournier, Sarah Jenna, Benoît Larose, Frederic Laurin, Erika-Esther Luamba who, under the leadership of Marie-Lise Dion, were able to guide the objectives and achievements of the study.

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WHY STUDY AI IN QUEBEC'S LSHT SECTOR?

As an economic development agency, Montréal InVivo supports the life sciences and health technology sector. This sector is currently undergoing a transformation thanks in part to AI, which is being used both to improve processes and methods and to develop new health and life science solutions. In an effort to align the ecosystem needs with the AI-related efforts of stakeholders and to optimize the application of resources to this emerging technology, Montréal InVivo has embarked on an exercise to identify and prioritize strategic actions in support of the sector.

Montréal InVivo has mandated Accenture to analyze the current LSHT ecosystem and make strategic recommendations that will guide the prioritization of Montréal InVivo's actions for the period 2019-2020.

Accenture relied on a mix of qualitative and quantitative methodologies to capture a broad range of activities, initiatives and needs of the ecosystem. An online questionnaire was sent to more than 860 ecosystem stakeholders and collected valuable information about respondents and their views, with a response rate of more than 13%. These responses as well as public information about the stakeholders were used to build a qualified database of the current ecosystem. The survey team also conducted 34 in-person or telephone interviews with stakeholders, including representatives from educational institutions, recognized AI and LSHT experts, companies in the LSHT sector, Canadian Hubs in AI and health, investors and financial supporters of AI and LSHT as well as startups in AI-LSHT with great potential and inspiring stories. Finally, the survey team facilitated a workshop with representation from across the ecosystem to review preliminary findings and provide unique perspectives.

The information gathered from the online survey and during interviews was analyzed to identify the strengths and weaknesses of the ecosystem and target strategic recommendations in support of the economic development mandate of Montréal InVivo and also to foster the development of the ecosystem as a whole.

The AI ecosystem in Quebec is flourishing, with many talented researchers (including several that are internationally renowned) and promising start-ups. The LSHT sector, in particular, benefits from this AI strength as well as from a concentration of players in the sector. There are 3 broad categories of actions that can help facilitate the accelerated adoption of AI and expanded economic development of the sector: centralized coordination of the initiatives currently being undertaken and planned, a deliberate program of adoption supported by explicit policy and clear objectives, and a recognized measurement approach. This report recommends some strategic actions to both increase adoption and use of AI in the LSHT sector and expand the ecosystem's capabilities in support of these themes.

OVERVIEW OF QUEBEC'S AI-LSHT ECOSYSTEM

Quebec's AI-LSHT ecosystem is rich in stakeholders who play various roles and support its growth. Here is a snapshot of the ecosystem based on our research.

**MORE THAN 650
COMPANIES IN LSHT,¹
AND 55 STARTUPS
WITH AI-LSHT AS A
CORE BUSINESS**

Representing a total of more than 32 280
jobs in the sector across the province²

**92 FUNDING
PROGRAMS
SUPPORTING
ECOSYSTEM
INNOVATORS**

Which can help companies grow,
including those in the AI-LSHT sector³

**71 VC AND INVESTMENT
FIRMS FINANCIALLY
SUPPORTING
INNOVATION**

From which more than 20 are or have invested
in AI-LSHT initiatives⁴

**MORE THAN 100
COURSES,
PROGRAMS AND
TRAINING IN AI**

From which 14 are building bridges
between AI and LSHT⁵

¹ <https://www.economie.gouv.qc.ca/bibliotheques/secteurs/sciences-de-la-vie/recensement-des-entreprises-2018/>

² <https://www.montreal-invivo.com/en/the-lsht-cluster/sector-based-portal/>

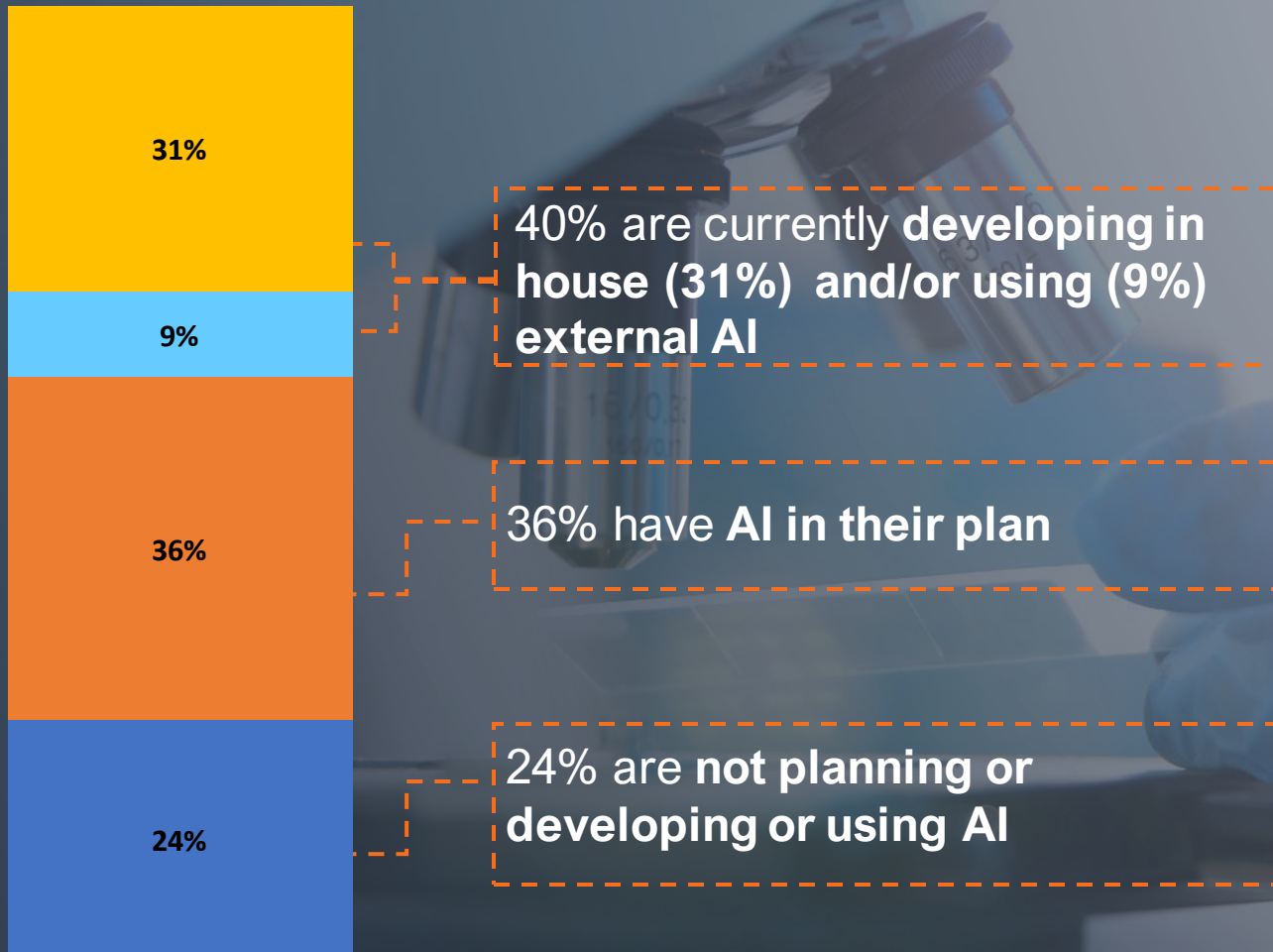
³ <https://www.montreal-invivo.com/en/ressources/toolbox/financing-programs/>

⁴ <https://www.crunchbase.com/hub/quebec-venture-capital-investors#section-overview>

⁵ Based on ecosystem scan

ARE WE USING AI IN THE QUEBEC LSHT SECTOR?

Out of 426 LSHT companies surveyed, 67 (16%) answered the online questionnaire and provided information on their AI related activities and pursuits*



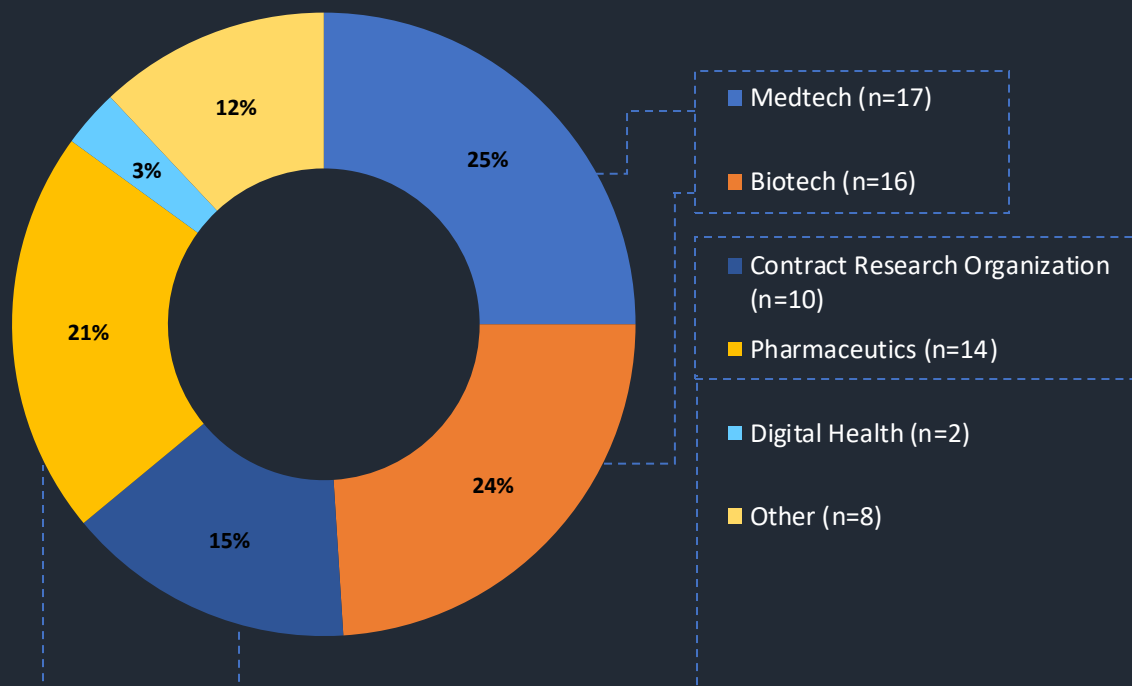
LSHT companies in Quebec are aware that AI is going to disrupt their market, with more than three quarters either developing, using, or planning to use AI.

*It is likely that companies who are not planning on using AI were underrepresented in the survey as they likely had less interest in completing the survey'

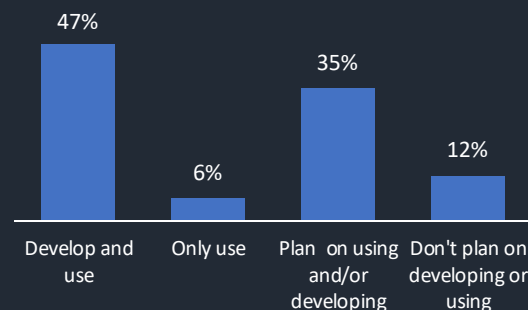
WHO IS USING AI IN QUEBEC'S LSHT SECTOR?

From the 67 LSHT companies that answered the survey, 40% are currently developing and using AI; Medtech, Pharmaceuticals and Biotech companies are leading the way.

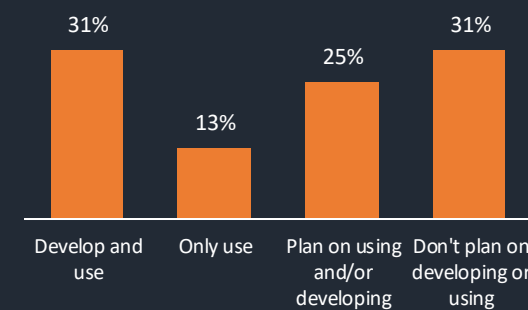
Composition of survey respondents



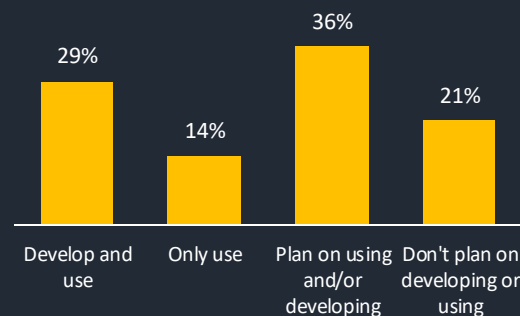
Medtech



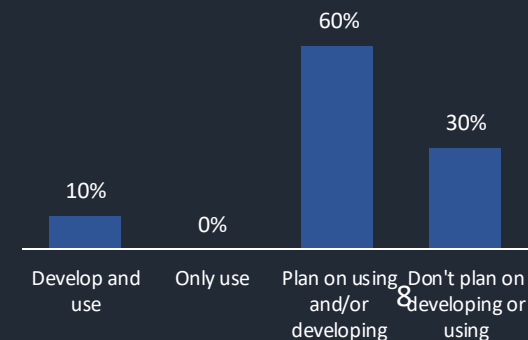
Biotech



Pharmaceuticals

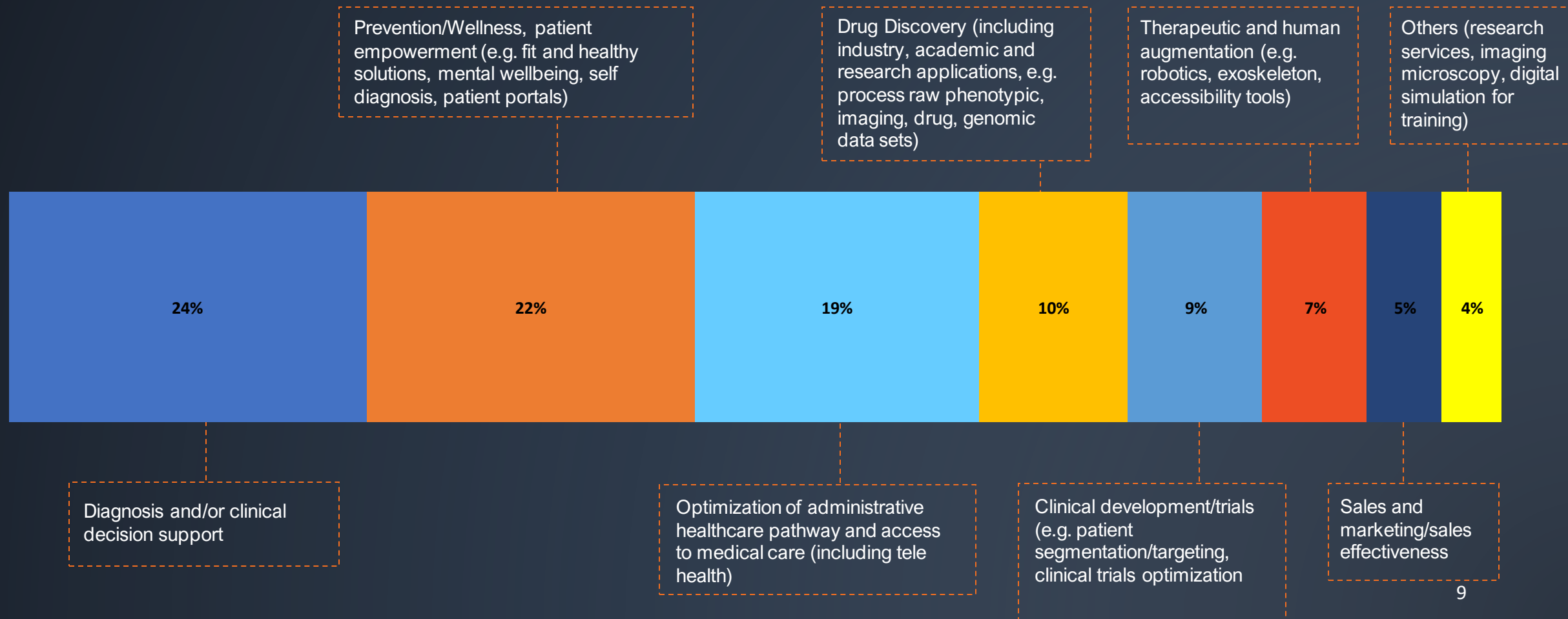


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WHAT IS AI BEING USED FOR IN QUEBEC'S LSHT SECTOR?

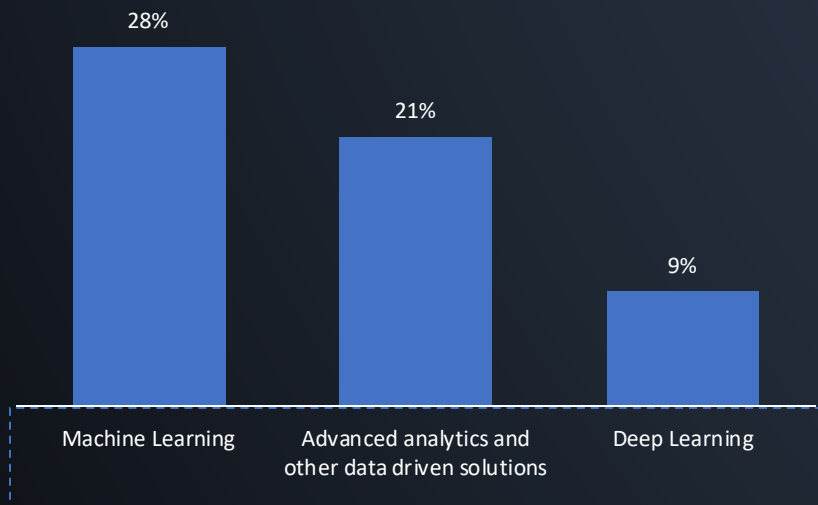
55 companies have AI in the LSHT sector as their core business. 10 of the 55 companies (18%) answered the survey and 65% of these companies are developing AI solutions focused on the 3 following areas: Diagnosis and/or clinical decision support; Optimization of administrative healthcare pathways/access to medical care; Prevention, wellness and patient empowerment.



WHAT KIND OF AI SOLUTIONS ARE BEING DEVELOPED IN QUEBEC'S LSHT SECTOR?

The majority of companies are developing therapeutic agnostic solutions and are also using Machine Learning technology.

Most AI-LSHT solutions developed in Quebec **don't have any therapeutic focus**. Although, 1 companies out of 4 are developing solutions that target neurology or mental health/psychiatry.



More than half of the companies (58%)* developing AI-LSHT solutions are using one or all of the following:

- Machine Learning
- Advanced analytics and other data driven solutions
- Deep Learning

*Based on survey responses and publicly available information of 47 out of the 55 companies

WHAT ARE QUEBEC'S **STRENGTHS** IN AI WITHIN THE LSHT SECTOR?



AN ECOSYSTEM SUPPORTING STARTUPS AND INNOVATION

- Existence of diverse accelerators, incubators and venture programs for startups in the AI-LSHT field, including District3, REAL Ventures, Amplitude VC and others
- Presence of major tech companies' AI labs in Montreal, including Facebook, Microsoft, Google helping to develop local technology talent and providing further collaboration opportunities in Health
- Financial support programs from Quebec Government, including commitment in 2019-2020 budget to support AI adoption which included \$25K grants for AI startups



NUMEROUS INITIATIVES COLLECTING AND MANAGING HEALTH DATA

- Health data initiatives for research purposes at the provincial and federal levels, including the Digital Health Discovery Platform (DHDP) and CIFAR's AI4H
- Important health databases available for researchers, including RAMQ data and CARTaGENE
- ISQ service point (guichet d'accès) with the intention to improve availability of data for research purposes that will simplify and improve access to data held by government ministries and other public research agencies
- CHUM's CITADEL database integrating patient and administrative data collected directly at the hospital



VARIOUS SOURCES OF FINANCIAL CAPITAL AND INVESTMENT

- More than 71 VC and investment firms active in Quebec, with at least 20 investing in AI applied to LSHT as a theme
- 92 funding programs available from public-private and private entities aiming to help companies grow, including those in the LSHT field. For example, PARTENAR-IA offering up to \$500K per innovation project in biopharmaceutical as well as medical technologies R&D



A STRONG FOCUS ON AI RESEARCH AND TALENT DEVELOPMENT

- Significant AI research funding from both federal and provincial governments, each with Health as a key objective
- Internationally renowned institutions and leaders in AI which attract top talent to Quebec universities, and provide training opportunities for students at all levels
- Ecosystem also known for world class medical research
- CHUM's School of AI in Health (SAIH) and the MILA are strong assets for both adoption and development of AI in LSHT
- The Pôle Montréalais d'enseignement supérieur en IA which serves to mobilize educational institutions and ensure AI talent alignment



A STRUCTURE IN PLACE SUPPORTING GROWTH OF THE SECTOR

Strong programs and organizations that allow for economic growth and development of the LSHT sector, both organically within Quebec and through attraction of foreign investment

WHAT ARE THE **CHALLENGES** FOR GROWTH IN QUEBEC'S AI-LSHT SECTOR?



GAP BETWEEN ECOSYSTEM CAPABILITIES AND STARTUPS NEEDS

- Startups find it difficult to navigate funding programs available within the province as they are numerous, and change often; programs include things like mentorship, funding, tax incentives, etc.
- No simple way to promote collaboration across the ecosystem as players are geographically spread out



COMPREHENSIVE HEALTH DATA STRATEGY STILL IN DEVELOPMENT

- Lack of a comprehensive provincial health data strategy and blueprint that supports research and development across patient and life science value chains, also challenged to address issues such as anonymization and data quality
- Limited collaboration to date across provinces to support collection and curation of LSHT related data
- Even though the service point (guichet d'accès) has the intention to improve access to data for research purposes, the current framework is not ready to work with AI



LACK OF COORDINATED ECONOMIC SUPPORT FOR HEALTH INNOVATIONS

- Perception of the provincial healthcare system as not having an innovation mindset means limited opportunities for deployment and adoption
- While early stage funding opportunities exist, startups experience difficulty in scaling, especially regarding early stage financing (e.g Seed, Series A and B)
- Strong AI talent, but VCs report a lack sales and operational talent required to attract additional funding



DIFFICULTIES REGARDING TRAINING AND RETENTION OF APPROPRIATE AI-LSHT TALENT

- Lack of incentives for international talent to remain in the ecosystem makes it difficult to retain top researchers and experts
- Necessity for competency development beyond AI research (e.g. AI Engineering, AI Business Analysis), so that talent is able to apply and commercialize the solutions developed in the ecosystem



LACK OF ECOSYSTEM COORDINATION

- Disparate leadership with no clear and structured guidance with regards to AI-LSHT research, development and commercialization
- A lot of silos both in the healthcare system and AI community which makes it hard to have a comprehensive view of the ecosystem and its initiatives in both sectors

LOOKING AHEAD

What should Quebec focus on to facilitate the accelerated adoption of AI and expand economic development of the LSHT sector? This report suggests collaborative efforts to support the centralized coordination of initiatives currently being undertaken and planned, to foster a deliberate program of adoption supported by explicit policy and clear objectives, and establish an agreed upon measurement approach. This report recommends the following strategic actions to both increase adoption and use of AI in the LSHT sector and expand the ecosystem's capabilities in support of these themes.



Promote collaboration between healthcare organizations, research and startups, VCs and commercial firms in the Montreal and Quebec regions



Work with stakeholders to design and deploy a measurement program that will track progress against talent, adoption and procurement, scaling and overall economic growth outcomes



Support the development of a comprehensive provincial health data strategy focused on needs across the patient and life sciences value chains with access for AI-LSHT research



Work with industry and academia to identify non-research AI skills that are essential to adoption and to coordinate programs that will build this talent



Consolidate and promote tools for new businesses in the AI space with resources to support funding, financials, data access, export, mentorship and be readily accessible to all members of the ecosystem



Support existing partners and foreign agencies focused on promoting Montreal / Quebec as a destination for global investment and innovation in LSHT

