AI for Health
by startupinside

Capgemini invent

AI for Health Digital book

November 2020

Introductory statement

Innovation in health is impacting us all. In that respect, Artificial intelligence (AI) is instrumental. It has become our collective duty to learn, connect and understand what the health of tomorrow will look like. And it starts today!

Based on the experience of **Capgemini** and **Startup Inside**, the **first edition** of this *AI for Health Digital Book* highlights how **AI applied to healthcare** value chains is **perceived** and **deployed** today within the organizations as well as in ecosystems, in a highly changing environment where the COVID crisis has brought an unprecedented disruption.

In connection with the **third edition** of the **'AI for Health global conference',** held on November 10, 2020 this report is based on the answers from **54 respondents** to an online survey, among which **17 in-depth interviews** were performed. Players from **major companies** (Pharma, MedTech), **startups**, **insurance** companies and **hospital and research labs** have contributed to sharing their views on how AI impacts health.

This report fixes a first '**AI temperature check**' that makes it possible for actors to decrypt and understand **AI main strategic stakes**, what are the **top areas of uses cases** to go into, while giving insights to decision makers on **maturity steps**, how to **overcome roadblocks** and **address emerging ethics considerations** together with a support to navigate in their day-to-day **operating model**.

Healthcare organizations are **accelerating their conversion to AI** after an 'hype phase'. Data and AI now appear as a strong pillar to radically transform value chains for patients first and foremost but also for health practitioners, payers and society as a whole. We believe that you can **'Get the future you want'** and for sure, a better healthcare system greatly contributes to that endeavor.

We hope you enjoy reading and using this report as we much as we appreciated working on it.
Join us in shaping the future of AI for Health!

Damien Gromier
*Founder **AI for Health***
Co-Founder and CEO
Startup Inside

Charlotte Pierron Perlès
EVP AI and Data Services,
Head of Insight Driven Enterprise
Capgemini Invent France

Table of content

Table of content

Study objective and methodology

Scope and intent of the AI for health Digital Book

In the context of this study, we will take the term ***Artificial Intelligence (AI)*** in a broad definition comprising ***Data services and AI***

AI is defined at the attempt to replicate human cognitive capabilities through advanced technology, to reach goals in an autonomous way by taking into account constraints and obstacles of the environment

AI for Health refers to **data and AI issues** aiming to **transform the healthcare sector** through **use cases** development and deployment

This Digital Book provides **a system-wide view of how data and AI are being used today**. It also highlights **opportunities** for greater use and **barriers** to further adoption.

It covers the key items of AI development in healthcare…

- **AI strategy**
- **Maturity and applications of AI**
- **Operating model**
- **Limits and ethics**
- **Technological choices**

…And encompasses key players involved in the development of AI for Health:

- **Major companies**
- **Startups**
- **Insurance companies**
- **Hospitals and research Labs**

Study objective and methodology

Methodology

Themes

AI strategy

Strategies related to AI for Health implementation and development

Maturity and application of AI

Maturity KPIs and segmentation, use cases of interest (today and tomorrow) in AI for Health

Operating model

Organization, internal processes and role of the ecosystem in AI for Health projects

Limits and Ethics

Roadblocks to greater development of AI in healthcare, focus on privacy and ethics considerations

Technological choices

Infrastructure and solutions to support data ingestion, storage, cleansing, algorithm build and visualization

Scope

A comprehensive study

Organization involved

- ***Major companies*** *(pharma, MedTech)*
- ***Startups*** *specialized in AI for Health solution*
- ***Insurance companies***
- ***Hospitals and research labs***

Profiles targeted

- ***CDO, CIO, R&D directors***
- ***Founders, CEOs, Operations Director***
- ***R&D Directors, CDOs***
- ***Head of Labs, Professors***

Method

A two-steps study approach

- **Quantitative and qualitative online survey**
- **1.5 hour interviews with AI for health key opinion leaders**

Study objective and methodology

Overview of companies

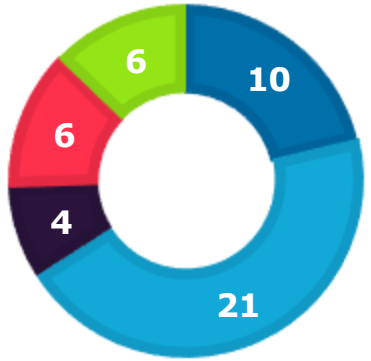
47 ***Companies surveyed***

Footprints

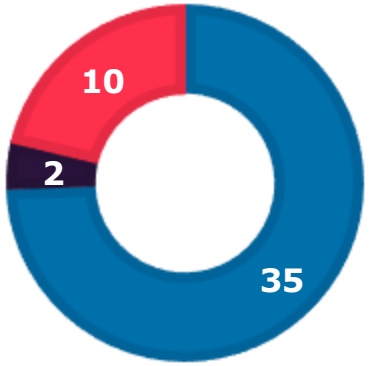
22
Worldwide

25
France

Categories



Revenue



Study objective and methodology

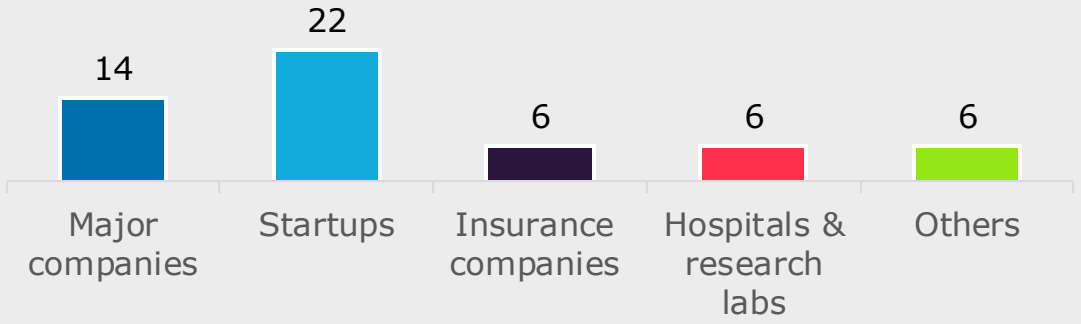
Overview of study panel (respondents)

The study is based on the insights **provided by 54 respondents** in an open online survey
Out of those respondents, **17 were interviewed** face to face to derive deep-dive insights

Categorisation

AI for Health online survey

54 ***Survey respondents***



Key opinion leaders' viewpoints

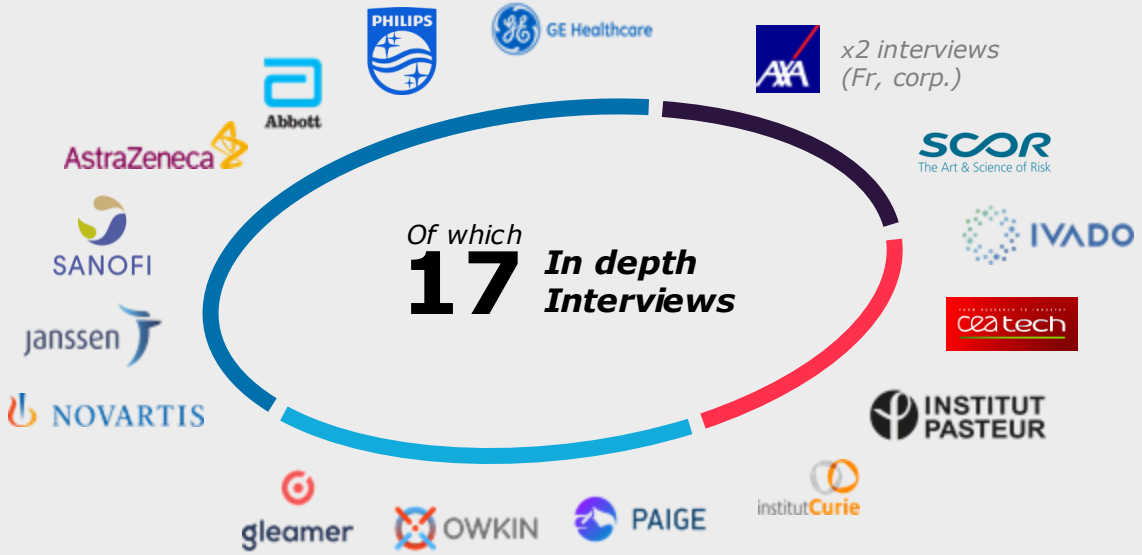


Table of content

AI strategy

Take-home messages

AI strategy

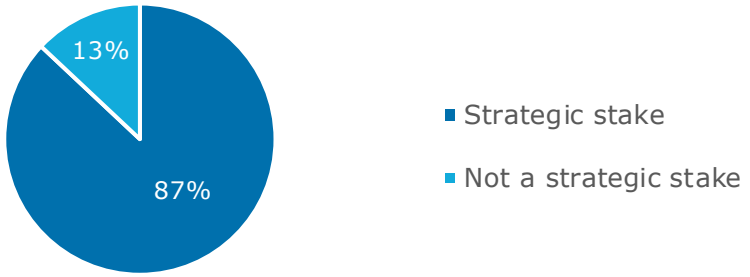
1. Level of executive engagement	AI is considered to be a **strategic stake for CEOs and C-level executives by majority of the panel** (87%), 77% when excluding startups. Significantly, ~30% of executives from major companies do not consider the topic to be strategic. Strategic objectives and KPIs related to AI are at best defined at C-level. Acculturation is not very widespread among executives, with only **48% of respondents considering acculturation to be strong**. Levels are particularly low for major companies (36%) and hospital and research labs (20%) vs a high level for insurance companies (83%). This is why **most companies** (~80%) **have launched acculturation initiatives** to get their organizations started on the topic od AI.
2. Budget	Budgets dedicated to AI range **from EUR5–EUR20 million** (67% of panel). **Use case development** and **IT enablers** consume most of the budgets, around 35% each. Spending on partnerships comes right after at ~20%. Some organizations (three in the panel, all major companies) are spending **more than EUR50 million** and unsurprisingly, it turns out that they are also the most mature.
3. Business priorities	Overall, organizations in healthcare are using AI as a lever to **deliver better care for patients** (68% of respondents). **Improve patient and health care practitioner satisfaction** (53% – key for major companies) and **reduce the cost of care** (51% - key for insurance and hospitals) complete the podium. Developing **new business opportunities** (45%) and **mitigating the risk across value chains** (23%) follow.
4. Governance and processes	**Most respondents** (69%) **claim to have governance bodies** involved in the decision-making process on AI projects. However, only a 23% are positioned at ExCo level (mostly insurance, hospitals and research labs). **The decision barycenter is located at C-level** (54%), the remainder (46%) is split evenly between under C-level and ExCo. The panel **does not consider tracking the value delivered by AI as a key stake** since 62% of respondents do not have processes or tools to specifically follow it up and when they do, they would not be mutualized across the organization.
4. Business model of startups in AI	Startups have matured their business model. Only 9% claim not to have a stable business model yet. **The top business models are license** (64%), **fixed fee** (41%) **and freemium** (27%).

Level of executive engagement

AI is a strategic stake but followed-up at C-level or below

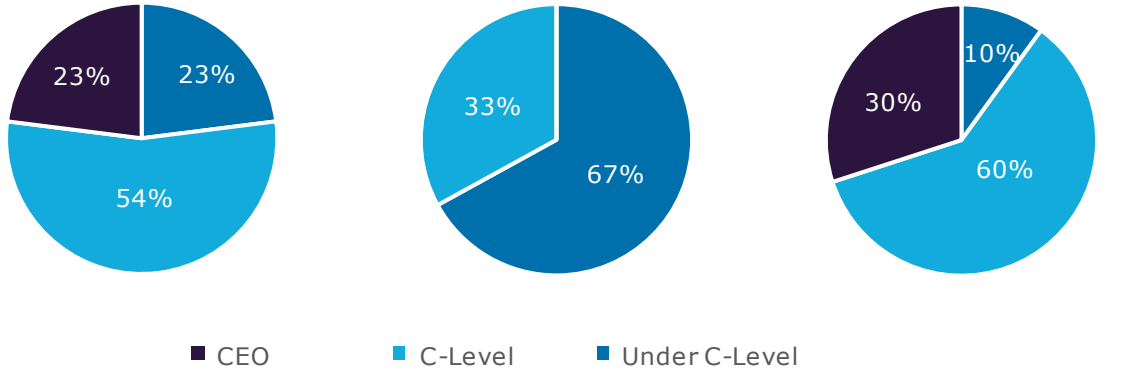
Is AI considered as a strategic stake by the CEO and other C-level executives?

Full panel



At which hierarchical level are the strategic objectives and KPIs defined and followed?

Full panel | Major companies | Others



Based on a set of 53 respondents (incl. 14 major companies, 22 startups, 6 insurance companies, 5 hospitals and research labs, and 6 others)

- Although **AI is widely considered to be a current strategic stake** across all stakeholders, **most organizations do not have a centralized committee at Group level** to set strategic objectives and KPIs. AI topics are mostly followed and steered at C-level or under (mostly under C-level in major companies), coupled sometimes with **an ExCo sponsorship.**

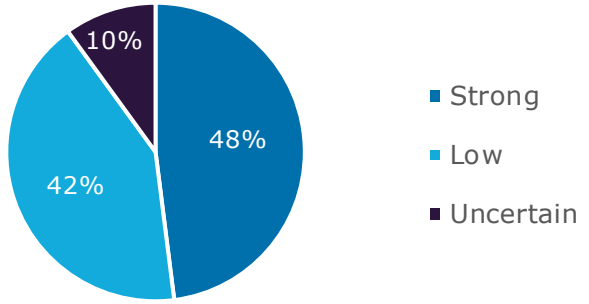
- The **CEO is more involved** in data and AI initiatives **within hospitals and research labs.**

Acculturation

Organizations are taking on the challenge

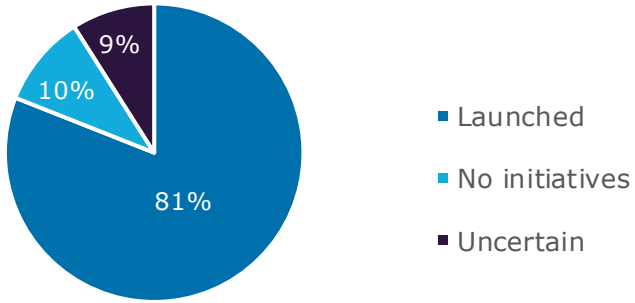
How would you evaluate the current data and AI acculturation of your executives (ExCo and C-level)?
Did you launch initiatives on data and AI topics?

Acculturation level (ExCo and C-level)



Based on a set of 13 respondents (incl. 3 major companies, 5 insurance companies, and 5 hospitals and research labs)

Acculturation initiatives



Based on a set of 29 respondents (incl. 13 major companies, 6 insurance companies, 5 hospitals and research labs, and 5 others)

- Although **acculturation splits the population into two groups -** only half of the panel for which it is strong -, most organizations (81%) have already launched acculturation initiatives to spread the word on AI potentialities and support ongoing projects.

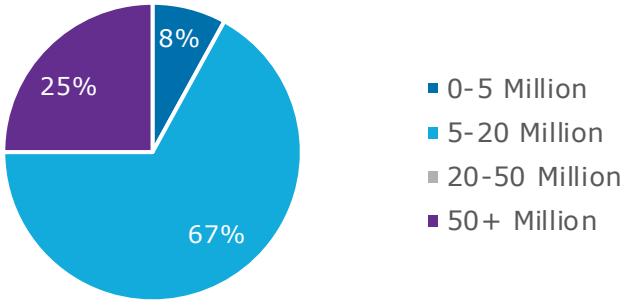
- Initiatives are mostly addressed through **training programs** (mainly in major companies and insurance companies) with dedicated sessions delivered at C-level. We also noticed some **reverse mentoring** initiatives. Some players go until **innovation labs** creation (mostly hospitals and research labs, also some major companies). In general, the scheme is **voluntary**.

Budget

Average spend of EUR5 – EUR20 million , mostly allocated to use cases and IT enablers

How much of your annual budget was dedicated to your AI for Health initiatives in the last three years? How was it divided?

Annual AI budget (€)



Based on a set of 12 respondents (incl. 6 major companies, 3 insurance companies, and 3 hospitals and research labs)

Division of annual budget (% of companies)

% of budget	Use case	IT enablers	Partnerships	Training	Other
0-20%	13%	13%	63%	100%	100%
20%-60%	88%	88%	25%	0%	0%
60%+	0%	0%	13%	0%	0%

Based on a set of 12 respondents (incl. 6 major companies, 3 insurance companies, and 3 hospitals and research labs)

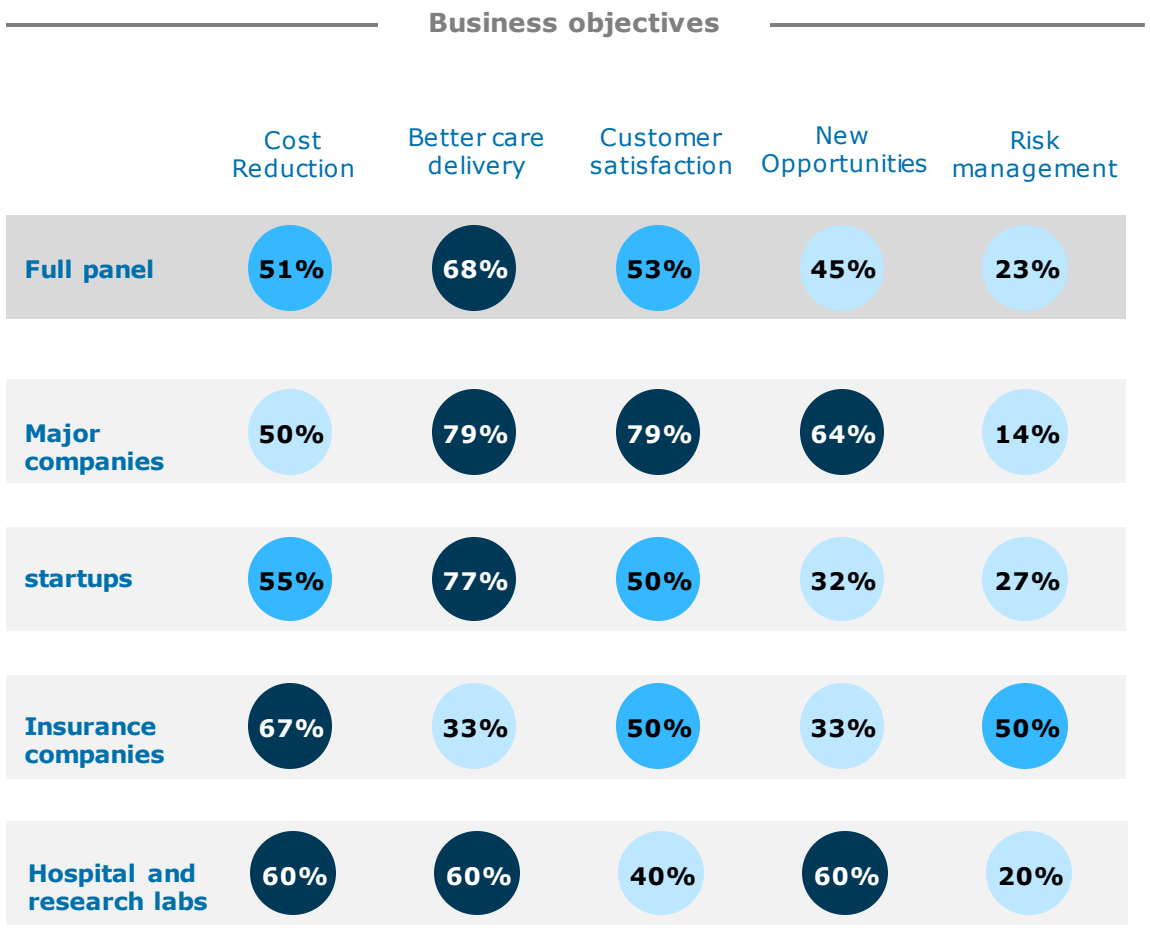
- **75% of organizations** (excluding startups which do not reveal their budgets) **spend less than EUR20 million annually** on AI for Healthcare, with 67% of the panel in the EUR5-EUR20 million range. Three companies (all major companies) spend more than EUR50 million and unsurprisingly, their maturity level is AI.

- **Use case development** and **IT enablers** consume most of the budgets, around 35% each, followed by spending on **partnerships,** at ~20%. Training spending seem quite marginal.

Business priorities

Delivering a better care delivery, improving customer satisfaction and reducing costs come first

What are the main business objectives within your AI portfolio of projects?



Based on a set of 53 respondents (incl. 14 major companies, 22 startups, 6 insurance companies, 5 hospitals and research labs, and 6 others)

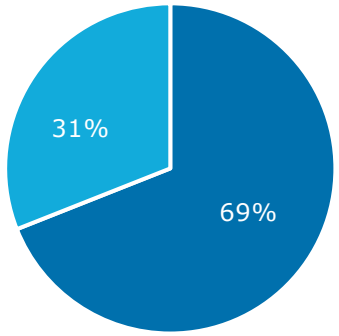
- Although business priorities vary strongly by organization type, they all primarly use AI to **enhance care delivery** (68%, strong for major companies, startups and hospitals and research labs) and to a lesser extent, **customer satisfaction** (53%, very strong for major companies probably because they are, by regulation, not allowed to reach patients and tightly regulated in their interactions with doctors). **Cost reduction** (51% consider it to be a key factor) is a topic of top interest for insurance (controlling level of risk of their contracts) and hospitals and research labs (to keep their budgets under control).
- **New opportunities** (45% of projects) can also be an option when looking at the medium to long terms, which are time horizons applicable to major companies and hospitals and research labs.
- On the contrary, **risk management** (23% of the projects) is not identified as a key topic.

Governance and Process

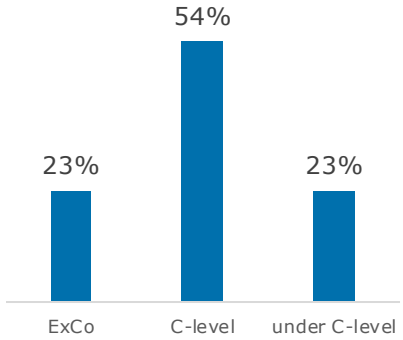
An operational governance that is existing, but sub-optimal

Is there a governance body involved in the decision process along the development of AI projects?

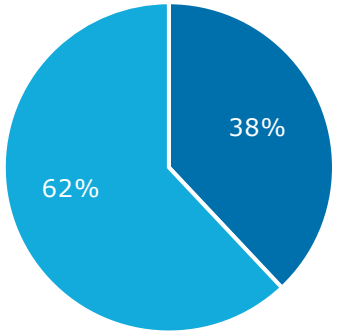
Governance bodies



- Dedicated
- Not dedicated



Value tracking process



- Formalized
- Not formalized

Based on a set of 13 respondents (incl. 3 major companies, 5 insurance companies, and 5 hospitals and research labs)

- **Most organizations** have dedicated operational **governance bodies** involved in the decision-making process along the development of AI projects, mostly at **C-Level.** This governance is mainly in charge of AI project coordination and roadmap steering and can sometimes be involved in the budget processes.

- **Nevertheless,** few organizations have a **formalized dedicated value tracking process**. Only some players that are already mature are equipped (mostly major companies) but still need to develop the mutualization of their processes and tools to bring homogeneity in the way the projects are monitored. In general, custom non-industrialized reportings are set up to ensure project follow-up.

Maturity and application of AI

Take-home messages

Maturity and application of AI (1/2)

1. Project maturity

The «hype» phase of AI in healthcare is now behind us but **the industry is still in its infancy**. Although **60% of the panel consider their organizations to be mature** in data and AI, we notice heterogeneity: 85% of startups claim maturity, falling to 17% for major companies. **Funnels are mostly loaded with use cases at POC** (the median is 23 projects) and **Build** (the median is 5 projects) stages. Also, 53% of the panel is **confident about their capacity to scale-up**. Projects that are considered to have reached the **'1st launch'** (the median is 3 projects) and even more the **'full scale'** status (the median 1 project) are **very scarce**. The most mature players in terms of pipeline have the following characteristics:

- Major companies, insurance companies and startups with a mature business model
- Constant flow of AI-powered projects, with several at full scale
- Internalization of work on use cases development for at least three years, with at least 50 million of budget/year spent on AI and an initial thinking on ethics

2. Value measured

The level of satisfaction of the panel with regards to AI initiatives is **high to very high** (69% of respondents), which is quite typical of the enthusiasm shared in early days before adopting a more pragmatic approach to initial expectations, consciousness of required enablers and of the timing. While startups claim to be very happy (100%), major companies (71%), insurance companies (67%) and hospital and research labs (33%) have mixed feelings. Interestingly, some major companies with a high maturity have a low to medium satisfaction, claiming that much more can be done.

3. Time to market

Time to market from ideation to first roll out in production **varies significantly** with the nature of use case being developed, ranging from **6 months to 5 years** when regulated and/or complex features, the median being at 15 months. **The move from '1st launch' to 'full scale' is usually quicker** with a median of 12 months but this depends on the scope of full deployment and the need to adapt to local needs and regulations, with some players deploying during cycles that are longer than 3 years.

Take-home messages

Maturity and application of AI (2/2)

4. Use cases of interest

When looking at healthcare value chains, **three major areas of interest emerge:**

- **AI for managing innovation and post-market cycles:**
  - AI to enhance drug discovery, drug / device development, market access, post market surveillance and epidemiology stand out in the magic value / accessibility quadrant, but with few active projects as of today
  - Today, significant effort is put on improving marketing and sales processes, which, although accessible, are considered to be less valuable than the latter
- **AI to better manage the patient journey**:
  - We expect a progressive shift from care management (the majority of use cases today) toward prevention for patients and even citizens
  - Diagnosis will remain a strong domain, especially in oncology, where early detection and accuracy are strong differentiators
- **AI to manage risk**:
  - Being able to stratify patient populations depending on their risk level is currently improving the way insurance products are designed and population is followed-up, paving the way to value-based healthcare.

Pattern of maturity facing IA

Few experienced companies, most players are learning or transitioning

Learners

39%

The Learners are in the early stages of their AI journey, with first use cases launched in production, at best.
They have a limited budget (under EUR5M for major companies, early fundraising for startups). For their development, they would mostly rely on external parties.
Practices across these organizations are quite heterogenous, ethics is not yet a clear topic. They tend to have difficulties in assessing their level of maturity.

Transitionals

46%

Transitionals have set up core capabilities to deliver AI-powered projects with budgets from EUR5 to EU50M. Some of their projects involve transforming business processes, which mobilizes the teams. ExCos and CEOs understand the added value of AI to transform healthcare.

Experienced

15%

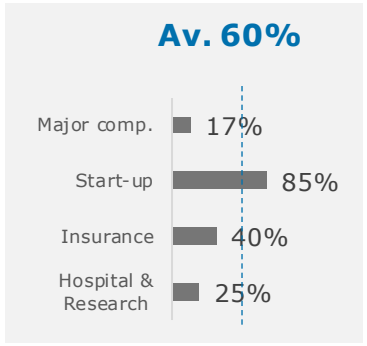
Experienced are able to roll out a constant flow of AI-powered projects, with several at 'full scale'. Significant budgets are dedicated to AI (EUR50M+ for major companies, recent fundraising of EUR10M+ for startups).
Development is mostly internalized, and performance is tracked.
There is some initial thinking on ethics.

Based on a set of 53 respondents (incl. 14 major companies, 22 startups, 6 Insurance, 5 hospitals and research labs, and 6 others). Companies will tick most of the above mentioned characteristics, the tagging has been done by Capgemini.

Project maturity

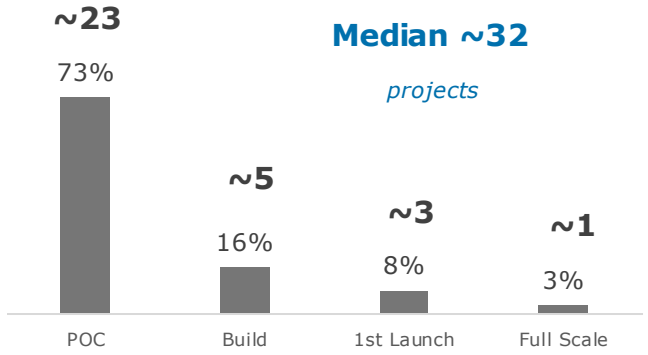
There are very few full-scale projects

Companies with high to very high data and AI maturity

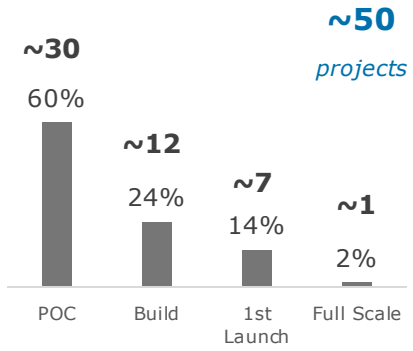


Within your portfolio, what is the proportion of projects in POC, build, production, and full scale?

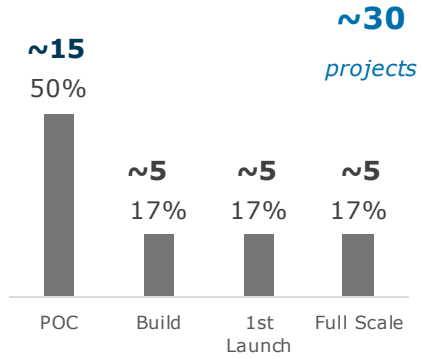
Full panel



Major companies



Others



Based on a set of 13 respondents (incl. 5 major companies, 3 startups, 3 insurance companies, and 2 hospitals and research labs).

- The healthcare industry is in **its infancy when it comes to AI**. Although **60% of the panel** consider their organizations to be mature, we see strong heterogeneity: 85% of startups claim maturity (by design), a figure reaching only 17% for major companies. Insurance companies (40%) and hospitals and research labs (25%) are in between.

- On average, players would have **32 uses cases** in their portfolio

- Funnels are mostly loaded with **use cases at early stages** with only a few candidates having hit the wall of 'first launch' yet:

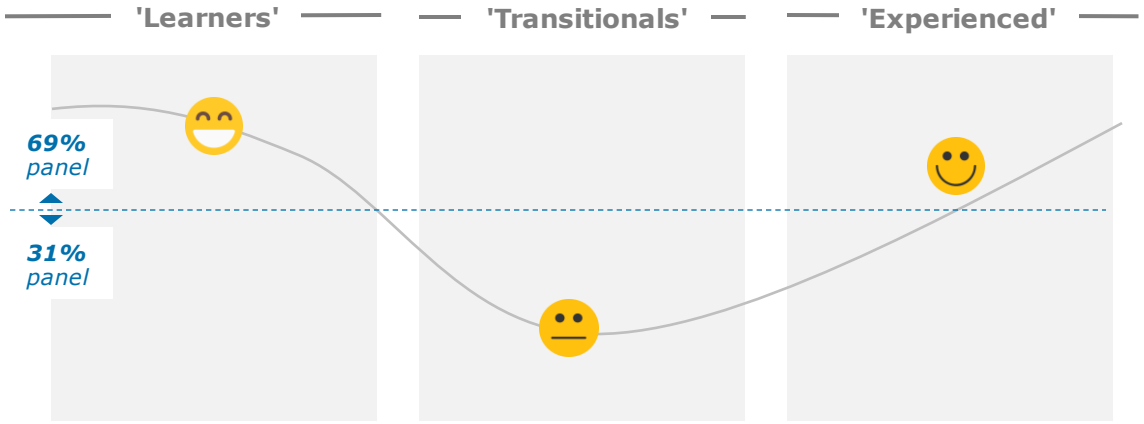
  - POC and Build gather a median of 28 projects and represents 89% of the use cases combined. Major companies show a greater proportion of Build projects (24%, with a median of 12 projects)

  - Only a few projects have reached the 'first launch' stage (8%, with a median of 3 projects), which is even more true for 'full scale' (3%, with a median of only 1 project). Major companies have more projects in 'first launch' phase than the full panel, showing that they starting to deliver tangible results.

Value measured

Mature players testify that there is a light after the 'valley of death'

Would you say that your initiatives have met your expectations?



	'Learners'	'Transitionals'	'Experienced'
Pro's	▪ Large number of projects / use case ideas in the backlog ▪ First use cases already delivering results ▪ Ongoing culture change toward AI	▪ Transformation of business processes (concrete outputs) ▪ Team mobilization, increasing skills	▪ Top management commitment ▪ Results observed on innovative use cases ▪ Strong user satisfaction
Con's	▪ Capability gap ▪ Time to get results ▪ First exposition to data governance issues ▪ Ability to scale to other geographies	▪ Persisting perception of magic by business ▪ Need to reinforce foundations (data, IT) ▪ Lack of standardization ▪ Siloed ▪ Focus on short term	▪ Insufficient results compared to AI capabilities (not breakthrough yet) ▪ Data accessibility / quality

Based on a set of 16 respondents (incl. 8 major companies, 3 startups, 3 insurance companies, and 2 hospitals and research labs)

- Satisfaction follows a **classical "valley of death"** progression, with enthusiasm at the beginning of the journey, followed by doubts as investments get higher and the value delivered fails to meet initial expectations.

- As the organizations mature and manage to transform to secure the required enablers, more **realistic expectations** are defined, and the results become more tangible and recognized by internal stakeholders (e.g., R&D, operations, post-market follow-up, etc.) that are accepting its positive impact vs the transformation induced in their day-to-day assignments.

- Overall, the **level of satisfaction** of the panel is **high to very high** (according to 69% of respondents):

  - Startups claim to be very happy (100%)

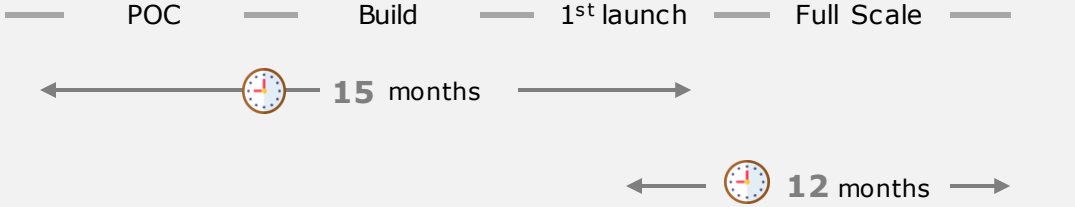
  - Major companies (71%), insurance companies (67%) and hospitals and research labs (33%) have mixed feelings depending on their level of maturity.

Time to market

Time to market can vary from months to years depending on nature of the use cases

For the project that got to this stage, how long did it take from ideation to first rollout in production? And until full scale? - *median*

Full panel



Major companies

From POC to first launch:
14 months

From first launch to full scale:
15 months

Others

From POC to first launch:
18 months

From first launch to full scale:
12 months

Based on a set of 13 respondents (incl. 5 major companies, 3 startups, 3 insurance companies, and 2 hospitals and research labs)

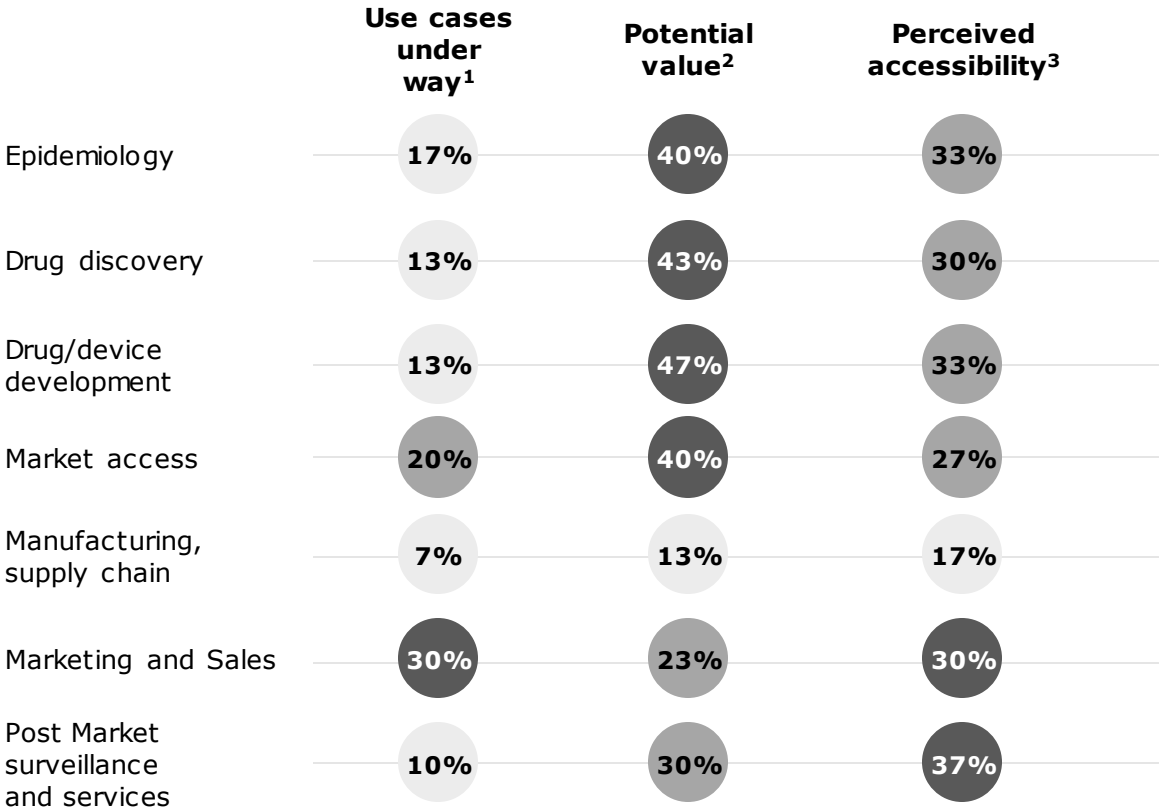
- **Time to market from ideation to full scale** show the **low maturity** together with the **dispersion** linked with the nature of the use case developed:
  - **From ideation to first rollout**, depending on the nature of use case developed (features, regulation involved or not), timings range **from 6 months** to improve an existing basis **up do 5 years** to have a medical device embedding AI approved by regulatory authorities, the median being 15 months.
  - Moving **from '1st launch' to 'full scale' is quicker** from there due to high replicability of use cases in most cases. **Major companies will take more time** than the full panel for this step - 15 months vs 12 months -, driven by a broader scope of deployment (use cases to be deployed across geographies, across BUs) and in some cases the need to adapt to local needs and market authorization regulations when required (e.g., medical imagery).

Use cases of interest

Pharma / MedTech value chain

Macro repartition of uses cases currently under way, their potential value and their perceived accessibility

Full panel



Based on a set 30 respondents (incl. 11 major companies, 11 startups, 1 insurance, 4 hospitals and research labs, and 3 others)
1. % of companies with 'many projects' and 'majority of projects' / 2. % of companies rating as 'rather high value' / 3. % of companies rating as 'rather accessible'

- Within the value chain of major companies (i.e., Pharma and MedTech), AI can contribute to **accelerating** and **de-risking innovation cycles** of new molecules / indications and medical devices as well as **maximizing the lifetime value of products** once placed on the market.

- In the magic quadrant (i.e., high value / high accessibility), AI to enhance **drug discovery** (e.g., lead identification, target identification), **drug / device development** (clinical trial patient recruitment, trial design, and follow-up), **market access**, **post market surveillance and services,** and **epidemiology** stand out. The ultimate target of AI is to shape personalized healthcare, where treatments are tailored to patient specifics. However, with only few active projects in this area, efforts will likely be concentrated here.

- On the other hand, significant effort is placed on improving **marketing and sales** processes and outcomes (patient / doctor targeting, salesforces support etc…), which, although accessible, is considered to be less valuable than innovation and post-market stakes.

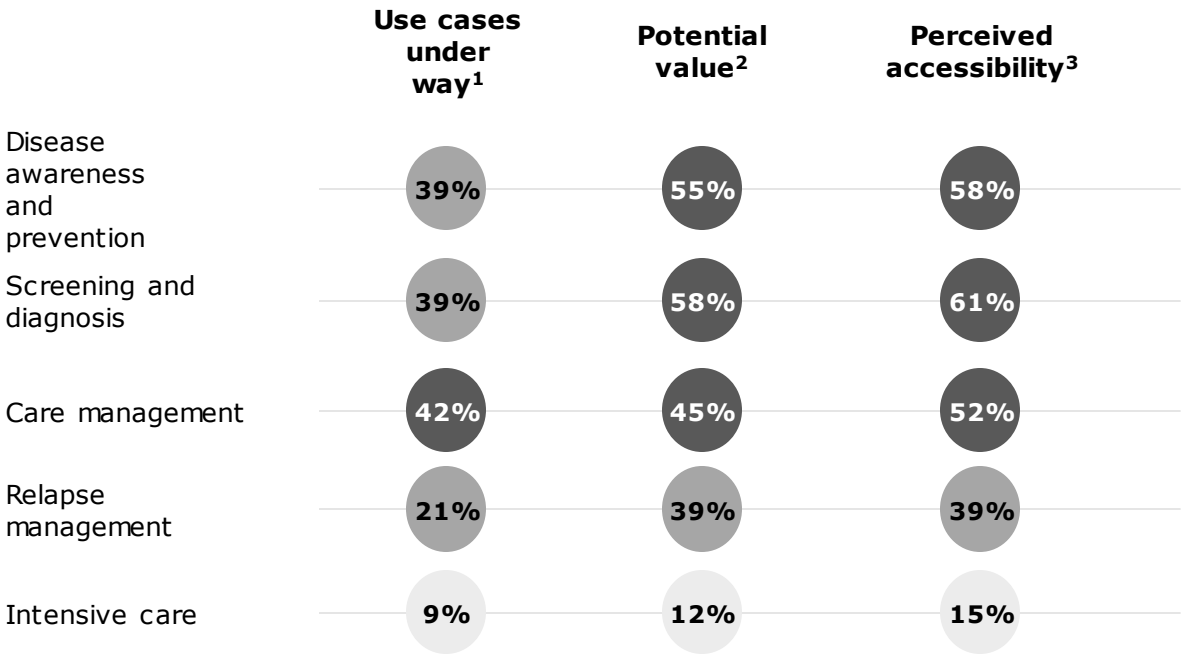
- On manufacturing and supply chain, the result is non-representative given the panel of respondents that were not knowledgeable in that area.

Use cases of interest

Patient pathway

Macro repartition of uses cases currently under way, their potential value and their perceived accessibility

Full panel



Based on a set 30 respondents (incl. 11 major companies, 11 startups, 1 insurance, 4 hospitals and research labs, and 3 others)
1. % of companies with 'many projects' and 'majority of projects' / 2. % of companies rating as 'rather high value' / 3. % of companies rating as 'rather accessible'

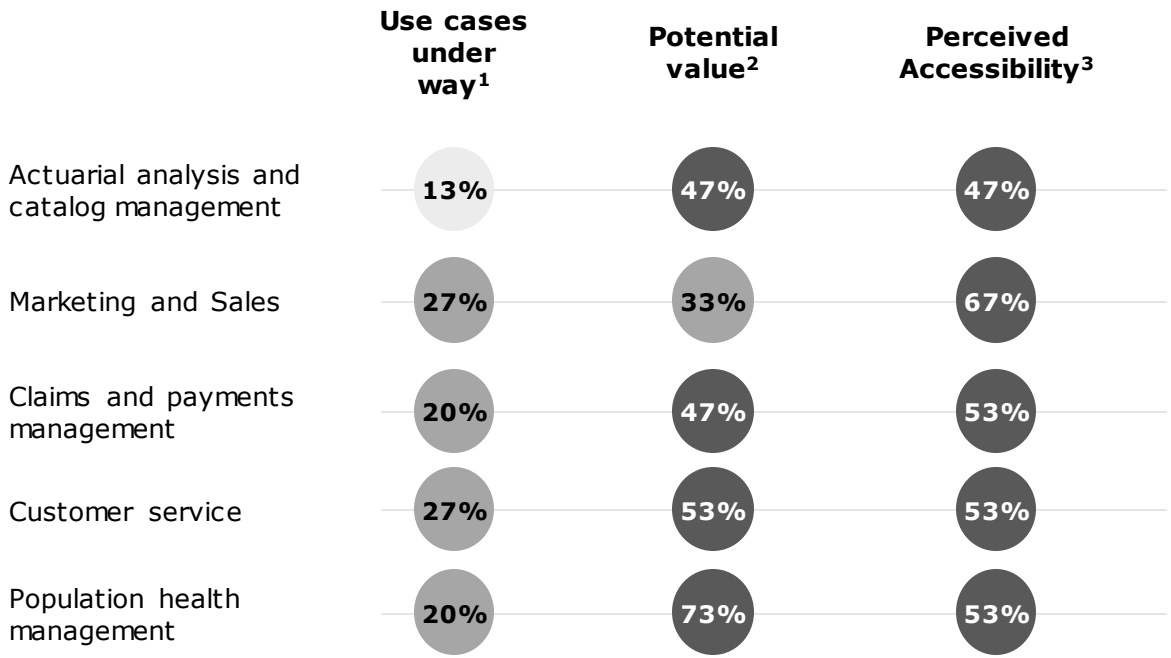
- Looking at use cases from a patient journey perspective, the motto could be **'the earlier the better'**. Patients should be taken care of early on, ideally before they ever become patients.
  - We expect a **progressive shift from care management** (the majority of use cases claimed today) toward earlier stages of the journey (i.e., disease awareness and prevention, especially for citizens presenting risk factors and diagnosis of patients so that they can get the adequate diagnosis and relevant prescription).
  - This trend is particularly strong in **oncology**, where early detection and accuracy will become strong differentiators to better manage the patient journey (better treatment efficiency, better safety, better quality of life).
- Meanwhile, many players are focusing today on the **care management** segment, due to the fact that our healthcare systems are still much more curative than preventive.

Use cases of interest

Population risk management chain

Macro repartition of uses cases currently under way, their potential value and their perceived accessibility

Full panel



Based on a set 30 respondents (incl. 11 major companies, 11 startups, 1 insurance, 4 hospitals and research labs, and 3 others)
1. % of companies with 'many projects' and 'majority of projects' / 2. % of companies rating as 'rather high value' / 3. % of companies rating as 'rather accessible'

- **Risk management** at citizen/patient or population level can be dramatically improved by computing patient data.

- The ability to stratify and monitor patient populations depending on their risk level, **(population health management)** is currently improving the way insurance products are designed and the population is followed-up in a longitudinal way. This is paving the way to value-based healthcare (paying for results rather than for treatment). The source of value for all stakeholders (patient, care system, payer) is enormous and accessibility looks high, as the initiatives rolled-out in the US have shown in recent years.

- Players see a room for improvement in the **customization of the risk products** proposed to their customers so that they are charged for their corresponding risk level. Actuarial for insurance companies is currently being disrupted and projects involving new insurance products powered by AI will dramatically increase.

- From a process perspective, AI can also generate efficiencies through projects around **claims and payment management** and **customer service** as the panel highlighted.

Operating model

Take-home messages

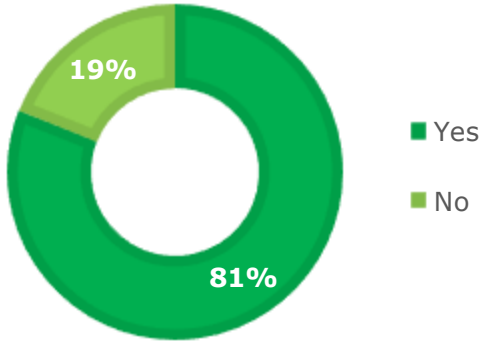
Operating model

1. AI leadership	**81% of organizations have set up a department** in charge of data, AI and innovation and **87% of organizations claim to have a position whose role is to steer the data and AI roadmap**. However, in most cases this position does not sit at ExCo level (72% of the panel, 100% for hospitals and research labs), showing that the topic can lack sponsorship and corporate guidance.
2. Organization and processes	Roughly half of the organizations (54%) have defined a **demand management process** to collect, qualify and prioritize use cases. With regards to portfolio monitoring, **27% manage it centrally**, **35% have a hybrid model** (i.e., split between corporate and BUs) while **38% do not have this information**, meaning that there is probably nothing in place.
3. Profiles and externalization	Departments are **well-equipped** with expert profiles: mostly **data scientists** (77%), **product owners** (68%), and **data engineers** (62%). Startups favor the data scientist profiles (present in 91% of startups) while major companies prefer the hybrid profiles of product owners (in 86% of them). Most companies also **externalize** certain profiles to manage **workload** and **capability gaps** when they are considered to be non-core: data engineers – 56%, frontend developers – 44%, and, to a lesser extent data scientists – 44%.
4. Work in ecosystem	**Many organizations (68%) work with external actors**, a scheme that has emerged as **the new paradigm to deliver value.** Open innovation is predominant for major companies (83%), even though externalization is often considered on a case-by-case basis. **Academics/researchers**, **startups** and **technology providers** come on top of the list of usual partners. Data providers also supply organizations with data (with different level of quality), in particular major companies and insurance companies. On the contrary, hospitals and research labs are more selective in their collaborations.

AI leadership

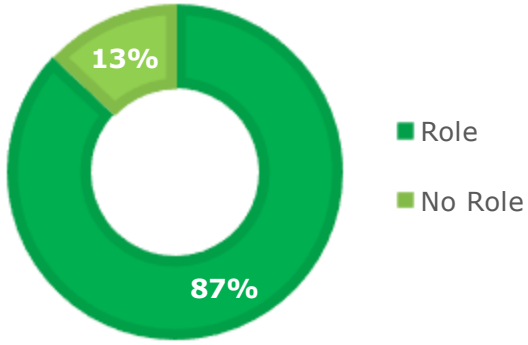
AI organization units exist but are still far from ExCos

Do you have a dedicated department in charge of data, AI and innovation ?



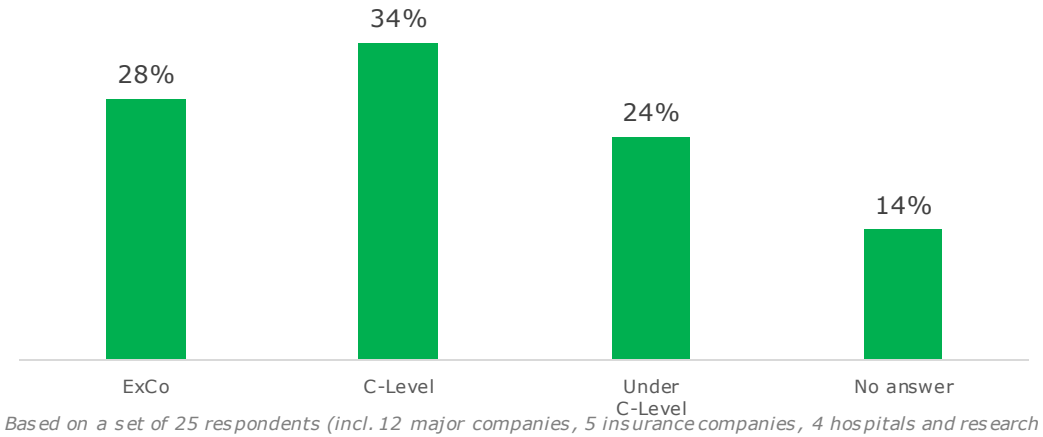
Based on a set of 26 respondents (incl. 12 major companies, 5 insurance companies, 4 hospitals and research labs and, 5 others)

Is there a role in your organization to steer your data and AI roadmap?



Based on a set of 30 respondents (incl. 14 major companies, 6 insurance companies, 5 hospitals and research labs and, 5 others)

Where is the role in charge of steering data and AI roadmap positioned in the organization?



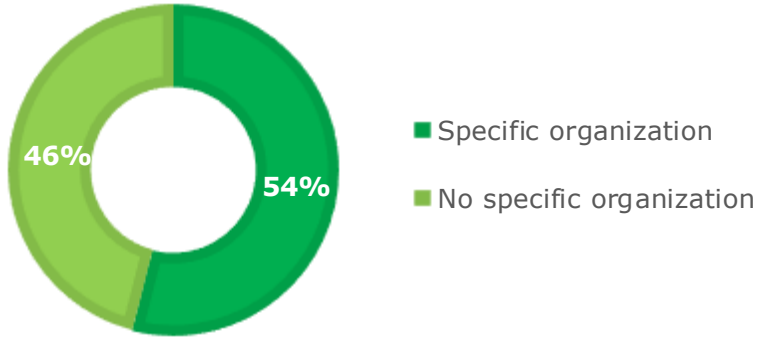
Based on a set of 25 respondents (incl. 12 major companies, 5 insurance companies, 4 hospitals and research labs and, 5 others)

- Most organizations have set up their **dedicated department and/or team in charge of data**, AI, and innovation (81%), and 87% have set up a **dedicated role to oversee the AI roadmap**.
- **In most cases**, the scope of responsibility is large and covers **coordination** and **roadmap steering**, but rarely address budget allocation and delivery of use cases.
- **For 72% of the organizations, AI roadmap steering lies beyong ExCo considerations**, which highlights a lack of corporate interest in AI project coordination.

Organization and processes

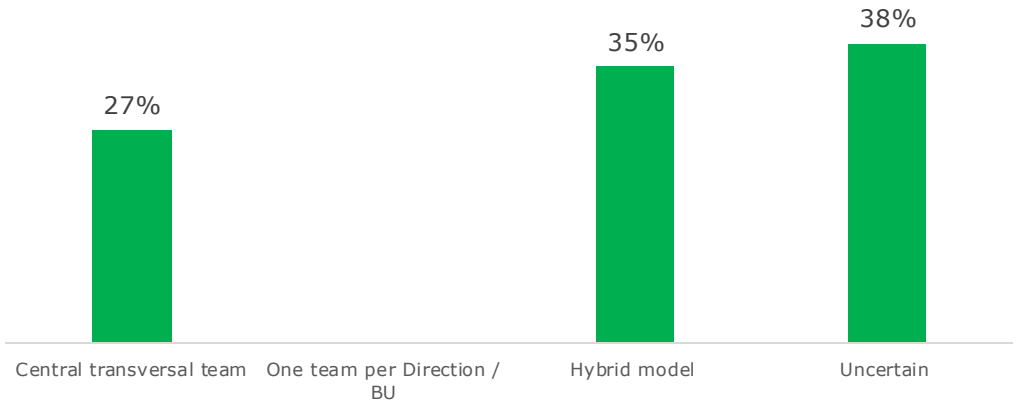
Half of organizations have engaged in use case demand management

Have you set up an organization to collect, qualify and prioritize the use cases ('demand management')?



Based on a set of 26 respondents (incl. 12 major companies, 5 insurance companies, 4 hospitals and research labs and, 5 others)

Which organizational model did you choose?



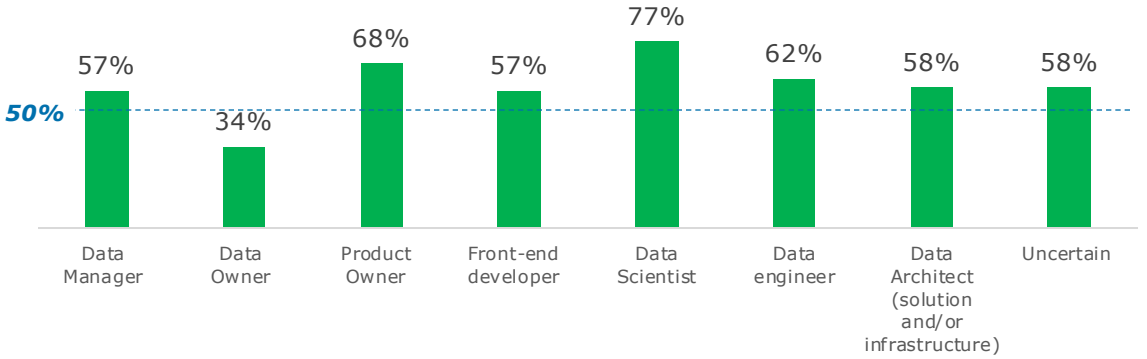
Based on a set of 16 respondents (incl. 7 major companies, 3 insurance companies, 2 hospitals and research labs and, 4 others)

- **A small majority of stakeholders** are working on a **'demand management' model**, a scheme that is particularly true for hospitals and research labs (75%), while major companies (42%) and insurance (40%) lag behind.
- When organizations are mature, it is the **hybrid model** that is applied, with responsibility and action split between the central team (use cases opportunities/initiatives) and local teams (use cases day-to-day management and development of use cases).
- **Use case ideas and concepts** are easily shared, as it is usually part of the core responsibilities of central team to orchestrate the roadmap.

Profiles and externalization

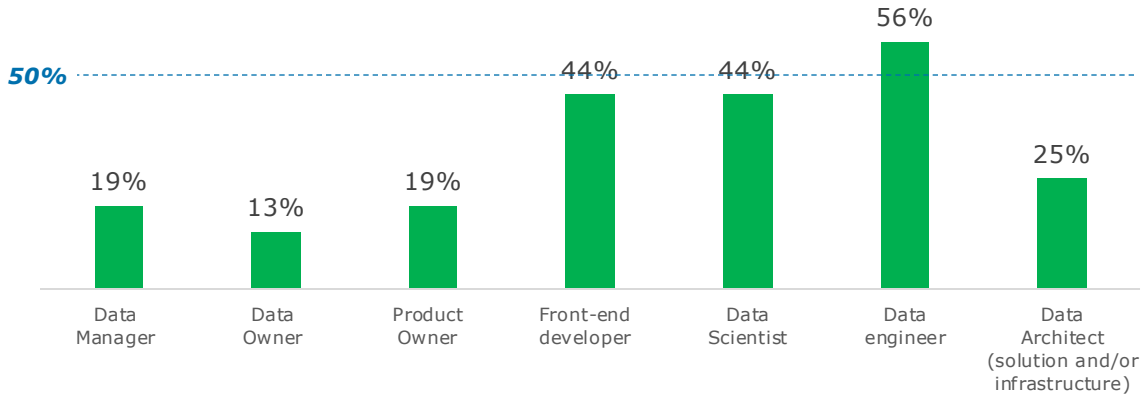
Organizations have in-house specialized data and AI profiles and externalize when necessary

What are the types of profiles in your data and AI department?



Based on a set of 53 respondents (incl. 14 major companies, 22 startups, 6 insurance companies, 5 hospitals and research labs, and 6 others)

Do you outsource some of them?



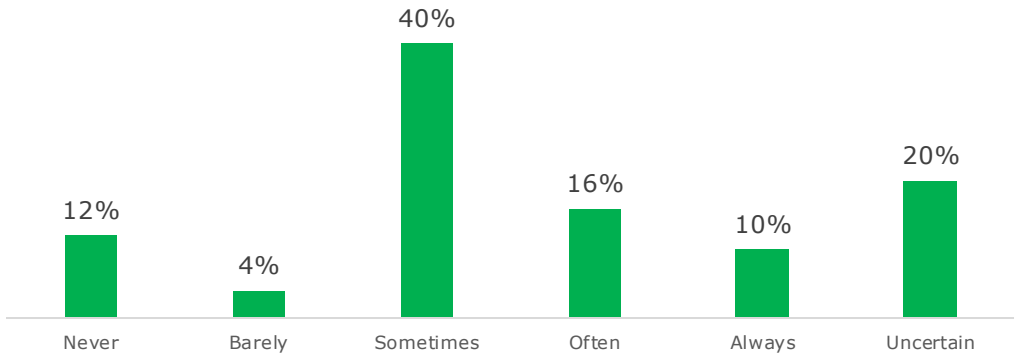
Based on a set of 13 respondents (incl. 7 major companies, 3 insurance companies and, 3 hospitals and research labs)

- Data department of **startups** are mainly composed of **Data Scientists** where **major companies and insurance** are more investing in **product owner positions**.
- For the **hospital and research labs**, the needs are mixed between **data engineering** and **data science**.
- **Major companies** and **insurance companies** used to resort to outsourcing while **startups** favor internal expertises.
- The **three main profiles outsourced** over the full panel (startups excluded) are **data engineers** (56%), **data scientists** (44%) and front-end developers (44%), mostly for one-off or punctual assignments, that require specific knowledge.
- For **major companies**, **product owner function**, which represents the most recursive profiles in data department, is also the most outsourced one.'

Work in ecosystem

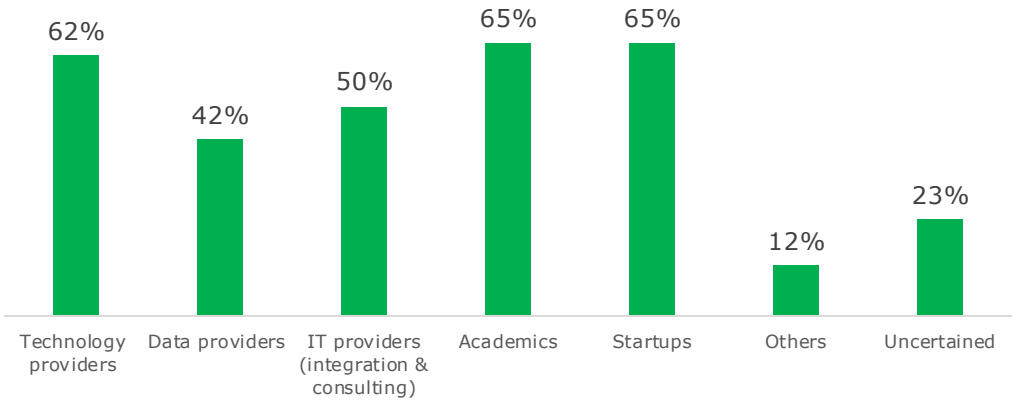
Open innovation with startups, academics and tech providers is a common practice

Do you work with external actors to deliver data / AI use cases?



Based on a set of 26 respondents (incl. 12 major companies, 5 insurance companies and, 4 hospitals and research labs , 5 others)

Which kind of actors are they?



Based on a set of 25 respondents (incl. 14 major companies, 6 insurance companies and, 5 hospitals and research labs)

- **Open innovation** is a **common practice** but most of the time, it will be considered on a case-by-case basis (26% very frequent as opposed to 44% less often).
- **Major companies (83%)** are becoming used to work with external actors when building and deploying AI solutions. These actors are mainly **technology providers, Academics/researchers**, **startups** and **IT providers**.
- **Insurance companies** are conducting collaborations **(60%)**.
- **Hospitals and research labs** are less familiar with external collaboration **(25%).** Most collaboration is with **academics / researchers** when identifying use cases opportunities (mainly on the patient pathway) and, **technology providers,** when it comes to data collection and management.

Limits and ethics

Take-home messages

Limits and ethics

1.Main roadblocks

Certain barriers may slow down the development and adoption of AI in healthcare.

- On the one hand, players face major barriers:
  - **Data availability and quality** is the top barrier for 74% of respondents, which is particularly true for major companies and insurance companies but less so for startups
  - This is followed by: **difficulties in the adoption of AI solutions** (47%), **lack of IT enablers** (45%), **lack of budget** (45%), and **privacy and ethics considerations** (45%)
- On the contrary, other topics do not inhibit the development of AI in healthcare:
  - **Internal organizational friction** is not a barrier for 62% of respondents (to a lesser degree for major companies and insurance companies).
  - **Lack of skills** is not a barrier for 60% of respondents (to a lesser degree for hospitals and research labs).
  - **Difficulty to engage stakeholders** is not a barrier for 51%, with the exception of major companies

2. Privacy and ethics considerations

Privacy (GDPR in the EU, HIPAA in the US) **has now become part of business-as-usual considerations** whereas the other dimensions of ethics, being less clear and more prone to interpretations, as far less watched out.

- **Privacy** (*personal / sensitive health data management*) is **a barrier for 66%** of the panel (including 40 pts strong barrier), a proportion that is lower for startups (55%) and higher for major companies (86%). Privacy is also systematically considered during projects (75%).
- **Explainability** (*solutions and methodologies to explain algorithm decisions*) is **a barrier for 51%** of respondents, with insurance (67%) and hospitals and research labs (60%) more affected. Explainability is systematically considered by only 42% of the panel.
- **Fairness** (*avoidance of bias and discrimination in datasets and algorithms*) is **a barrier for 40% of respondents**, with the exception again of hospitals and research labs (60%) and insurance (50%), which have greater exposure to the aftermath of unfair decision making.
- **Accountability** (*division of roles and responsibilities between human and machine*), is **a barrier for 40% of the panel.**

3. Documentation and governance of privacy and ethics

Half of organizations (47%) have **documented privacy and ethics considerations in a reference document.** However, only one-third (31%) of them follow this up through an ad-hoc governance process, which is in most cases, integrated with existing decision-making bodies.

Main roadblocks

Data availability and quality is the number-one barrier

What are the main barriers that slow down the lead time of your AI initiatives?

Full panel

	Not a barrier	intermediate	Strong barrier	Uncertain
Organizational frictions	63%	17%	17%	4%
Data availability and quality	25%	49%	24%	2%
Lack of IT enablers	53%	32%	13%	2%
Lack of skills	62%	17%	17%	4%
Difficulty to engage business stakeholders	55%	15%	19%	11%
Difficulties in the adoption of AI solutions	49%	36%	11%	4%
Lack of budget	47%	25%	19%	9%
Ethics and privacy	53%	26%	17%	4%

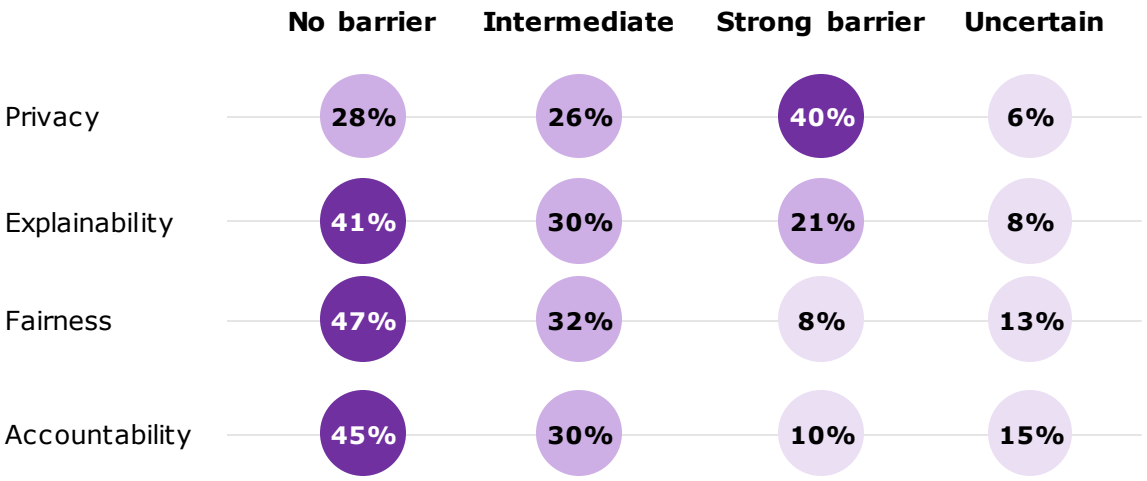
Based on a set of 53 respondents (incl. 14 major companies, 22 startups, 6 insurance companies, 5 hospitals and research labs and, 6 others)

- **Data** is the main roadblock that all organizations face, regardless of their maturity level. At first, the main challenge is to secure **availability**; organizations need to access data**. The next challenge is quality,** which is a never-ending task that determines the quality of models and the success of scale-up phases down the line.
- **Difficulties in adopting AI solutions** evolve with the actors but remain a common issue, in particular for major companies.
- The **'lack of IT enablers'** is a challenge when implementing AI projects, but diminishes once the organization is equipped with state-of-the-art development and production-ready platforms.
- **Ethics and privacy** are considered to be a barrier by only 45% of the panel, possibly because the maturity of the topic in terms of regulation – privacy aside – is quite low.
- On the contrary, **other topics do not inhibit the development of AI in healthcare**: internal organizational friction (less so for major companies and insurance companies), lack of skills (less for hospitals and research labs that have difficulty in attracting top talent) and in engaging stakeholders (with the exception of major companies).

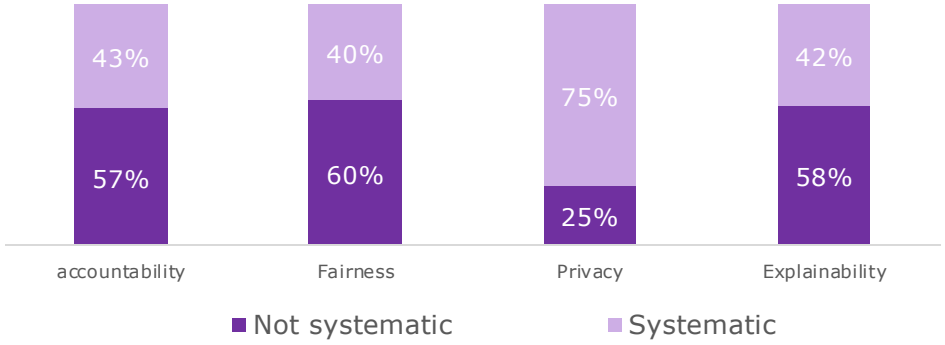
Privacy and ethics considerations

While privacy is now business-as-usual, other ethical dimensions will emerge in the near future

Ranking of dimensions of ethics in AI as main barriers



Dimensions of Ethics systematically taken in consideration in project



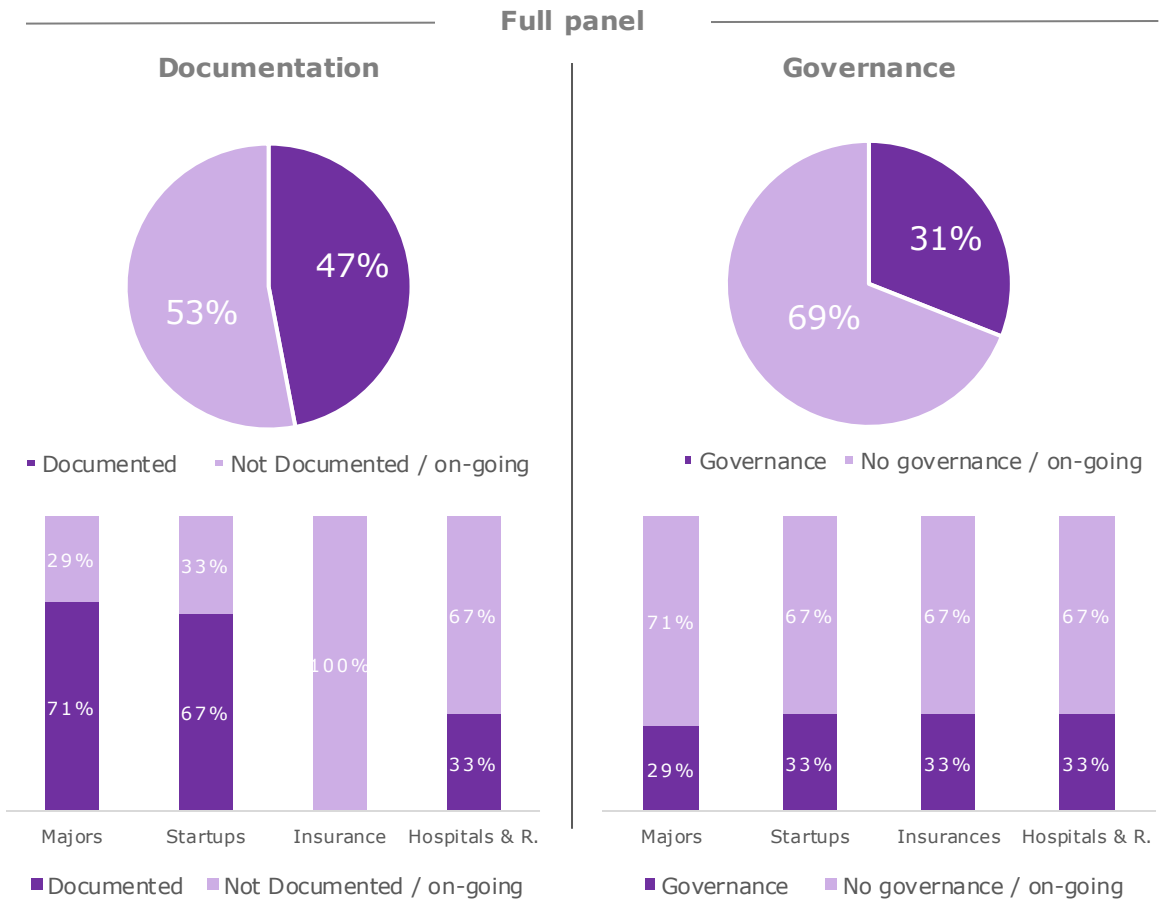
Based on a set of 53 respondents (incl. 14 major companies, 22 startups, 6 insurance companies, 5 hospitals and research labs, and 6 others)

- **Privacy** (personal/ sensitive health data management) is a significant barrier, regardless of the actors' maturity, **with a focus on GDPR requirements** (data collection and processing, security measures, etc.) which are systematically taken into consideration when developing or implementing AI projects.
- **Explainability** (solutions and methodologies to explain algorithm decisions) is considered as a barrier for 51% of respondents. Insurance companies, hospitals and research labs seem more impacted.
- **Fairness** (avoidance of bias and discrimination in datasets and algorithms) is also a barrier, mostly affecting insurance companies and hospitals and research labs that are more impacted than others.
- **Accountability** (division of roles and responsibilities between human and machine) is primarily a barrier for startups.
- Except for privacy, **the other dimensions of ethics (explainability, fairness, and accountability) are not systemically taken into consideration** in projects since they are less clear and more prone to interpretation at this stage.

Documentation and governance of privacy and ethics

Half of organizations have documented the topic, only one third follow it up

Have you defined an AI and Ethics reference document and/or governance?



Based on a set of 16 respondents (incl. 8 major companies, 3 startups, 3 insurance companies, 2 hospitals and research labs)

- Fewer than half of organizations have defined an **AI and ethics reference document**. When documented, there is a strong focus **on privacy requirements** (mostly GDPR for the panel surveyed). Majors companies (71%) and startups (67%) are the most mature in that respect.

- However, two-thirds of players have not yet defined an **AI and ethics governance yet**, which is consistent across the panel segments.

Technological choices

Take-home messages

Technological choices

1. Cloud vs. on premise

Cloud infrastructures are now as a market standard, with most organizations (67%) currently developing their AI projects on these infrastructures, with a **50/50 split** between packaged **Platform-as-a-Service** (PaaS) and the more modular **Infrastructure-as-a-Service** (IaaS). The **on premise** model is still very present in healthcare, especially for research institutes and startups when they have demanding needs in terms of computation and/or need to interface with hospital infrastructures for which on premise is still the norm.

2. Priorities on technological stacks

Priorities are set **depending on the maturity** of the different technological stacks:

- **Ingestion** is a weakness for 57% of respondents, especially for major companies and insurance companies. Hence it is an area of priority investment
- **Data cleansing, storage, and API** is a weakness for 50% of the panel, especially for major companies which together with startups, put their efforts in that direction.
- **Data computing, algorithms** has never been identified as a weakness by our panel – it is more commonly considered to be a strength. This suggests that algorithms have become a commodity thanks to technological advances and the available manpower to build them. Startups want to go beyond by improving their algorithm capital.
- **Visualization** is more of a strength (57%) but with room for improvement, especially for major companies, insurance companies and hospitals and research labs.

3. Health specificity

On the upper stacks (i.e., data computing, algorithms and visualization), companies prefer **health-related specifics over standard all-industries products**. When working with standard products, organizations split evenly between 'Make or Buy' strategies for their development and integration effort, while when dealing with health-related specifics, 'Make' strategies dominate.

Cloud vs. on premise and priorities on technological stacks

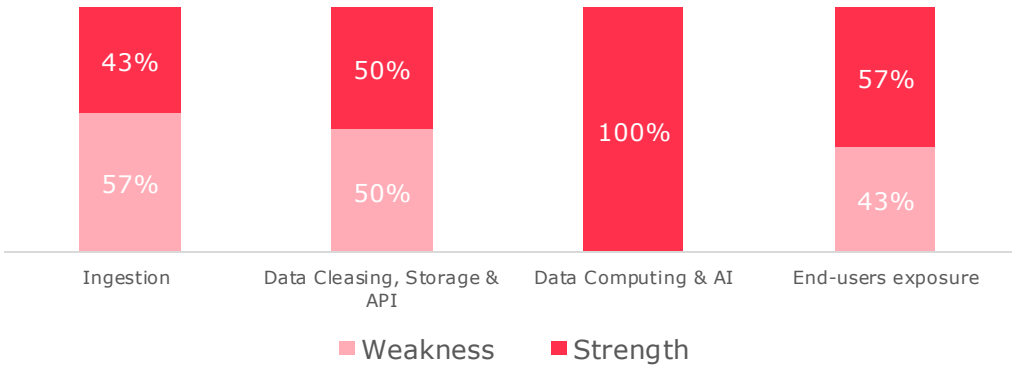
PaaS is the new black

What proportion of projects use cloud managed services in production?

MODEL 1 Cloud - PAAS	MODEL 2 Cloud - IAAS	MODEL 3 on premise
PaaS	Data platform	Data platform
	IaaS	on premise data center
67%		33%

Based on a set of 16 respondents (incl. 8 major companies, 3 startups, 3 insurance companies, 2 hospitals and research labs)

Where are your strengths and weaknesses?



Based on a set of 16 respondents (incl. 8 major companies, 3 startups, 3 insurance companies, 2 hospitals and research labs)

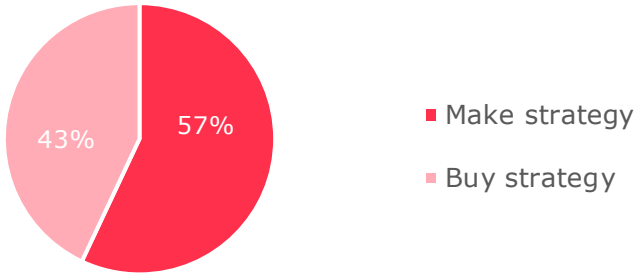
- **Cloud infrastructures** and more especially **PaaS** and **IaaS** (67%) **are the new standard.** Most organizations are currently developing their AI projects (or intend to) on these infrastructures.
- Legacy reasons aside, **The on premise** model is chosen for projects that have specific **security constraints**, **privacy** and/or **computation concerns** (e.g. data confidentiality, data considered as a strategic assets with a high privacy concern, historical choices linked with very demanding computation needs etc).
- Choice of i**nfrastructure** is an **important IT prerogative,** few organizations have **multiple on-production infrastructures**, with the exception of the experienced firms. At cloud level, **~85%** have only **one cloud provider** to concentrate their effort.
- **Ingestion** and **data cleansing** are a concern for more than **50% of the panel**. Data quality is the strategic oil for AI algorithms to produce actionable results.
- **Data computing and AI is a 'consensual effort'**. Although it is s a strength for the entire panel, effort is maintained in that area and startups consider it to be their unique differentiator to build and maintain their position.

Health specificity

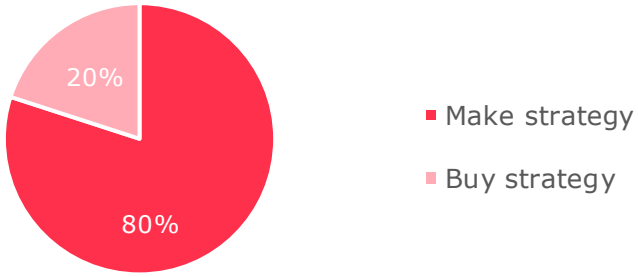
Most actors rely on health-related specifics products

Do actors rely primarily on standard products/ algorithms of the market or do they leverage health-related specifics?

Standard products / algorithm of the market



Health-related specifics products



Based on a set of 16 respondents (incl. 8 major companies, 3 startups, 3 insurance companies , and 2 hospitals and research labs)

- Robust **peer-reviewed clinical evaluation** is the gold standard for evidence generation, meaning dedicated and robust methods need to be present in the tooling used for AI in healthcare. Most developers of AI algorithms in healthcare are alert to potential dangers, including dataset shift. The challenges of generalization could have unintended negative consequences on health outcomes.

- Companies favor **health-related specifics** vs **standard non market products**.

- **When working with standard products**, organizations split almots **evenly between 'Make or Buy' strategies** for their development and integration whereas when dealing with **health-related specifics**, 'Make' strategies prevail because they provide greater control.

Table of content

AstraZeneca | **AstraZeneca**

James Weatherall

Vice President,
Data Science and AI, R&D

> Develop a lean mentality: think big, start small, scale fast!

Learnings from leaders

What do you see as main opportunities and risks in AI for health in the next 3 years?

'Data science and AI have the potential to transform the way we discover and develop new medicines. To ensure we maximise its potential, I see a number of opportunities and challenges that mirror each other. For example, we have **access to more diverse, rich datasets than even before**, but the challenge comes in the effort to make the data FAIR: findable, accessible, interoperable and reusable. Another example is around the **hype surrounding AI in healthcare** – how can we manage expectations? One way we're doing this at AstraZeneca is to ensure our data scientists collaborate with our scientists every day, to communicate effectively and uncover insights together, to solve problems that matter.

What is your main challenge today to accelerate the data/AI trajectory within your organization ?

'The are 2 main challenges. The first one is to **ensure alignment** across the enterprise. We know the best science doesn't happen in isolation which is why we work collaboratively and have created a hub and spoke model to provide a strong central capability support combined with localised, specific expertise. The second is to **make sure we progress the right use cases** in our pipeline.'

Can you cite use cases you are particularly proud of ?

'**Machine learning on clinical trials data**: to identify sub-groups of patients that are most likely to respond to treatment

NLP for pharmacovigilance: this lends itself well to NLP due to scale'

AI for chemistry: use of deep neural networks to design molecular structures.'

Which company do you find particularly inspiring?

'We generally look to and benchmark ourselves against the **tech companies**, which we believe are best in class when it comes to centralization of decision and capacity to industrialize.'

What are your most important lessons learned from your past experience in the area ?

'Lean mentality: **think big**, **start small** (most relevant use cases), **scale fast**!'

If you had one piece of advice for someone willing to engage in AI for health, what would it be?

'**Don' think twice!** Healthcare is definitely the **place to be** if you're interested in AI and want to make a meaningful difference. The impact we see is both tangible and evolving, and we have the potential to positively impact patients' lives!'

Interview realized on October, 13th 2020

GE Healthcare

Adeline Bahuon Digard

Director

Digital Product Management

> Keep in mind the purpose and the problem to be addressed with AI

Learnings from leaders

What do you see as main opportunities and risks in AI for health in the next 3 years?

'AI allows us to work on **critical medical issues** of our time, e.g in the **field of oncology** for a player like GE Healthcare. The main risk would be to go for an **'all AI' strategy**; we need to keep our feet on the ground on AI potentialities and properly manage the high-risk patient profiles.'

What is your main challenge today to accelerate the data/AI trajectory within your organization?

'The biggest challenge today is the **selection of focus areas**. From oncology to rare disease management, GE Healthcare has been working with healthcare professional on a wide span of domains. Also, **the technological environment** is evolving at a fast pace and we need to keep track of it.'

Can you cite use cases you are particularly proud of?

'**AI DReAM**, launched on September 29, a French consortium designed to accelerate AI development in medical imaging. It will help to achieve greater efficiency, improve patient outcomes, and ensure better patient care in medical imaging by enhancing collaborations (innovative French SMEs, startups, well known research labs and clinical centers …)
PROView, bringing automatic prostate segmentation and creating standardized reports within a single dedicated AI application.'

Which company do you find particularly inspiring?

'In terms of AI deployment, I feel more inspired by bringing benefit to the **patient** than by any company in particular.'

What are your most important lessons learnt from your past experience in the area?

'Do not underestimate the level of regulatory constraint when implementing AI. GE Healthcare updates its Quality Management System on a regular basis for instance to comply with regulation requests and deliver high level of quality products. As algorithm is trained on dataset, you need to pay attention to the **quality** of those sample for your AI to perform.'

If you had one piece of advice for someone willing to engage in AI for health, what would it be?
'Keep in mind the **purpose** and the **problem** to be addressed with AI. Do not engage in **systematic prediction** that would could be detrimental to the patients superior interest.

Interview realized on October, 14th 2020

Janssen

Emmanuelle Quilès

MD, Janssen France

> Don't go there on your own!

Learnings from leaders

What do you see as main opportunities and risks in AI for health in the next 3 years?

'Increasing and facilitating **access to health data**, especially real world data, is key to the development of AI applications in healthcare. Main risks are **the regulatory and legal complexity of the field,** incl. sensitivity of health data access (this is where the French Health Data Hub can help), the current **lack of an economic model around data sharing** (a fair model is needed to compensate data producers for collecting and formatting health data) and **poor confidence from citizens** (around the sharing and use of health data).

What is your main challenge today to accelerate the data/AI trajectory within your organization ?

'Embracing the subject of AI requires us to **operate a mind shift**. Pharma is a very conservative industry and when it comes to AI, we need to find a way to combine this mindset **with a longer-term vision**. This also means **accepting the part of risk-taking that comes with innovation.** Not everything will work immediately, but that doesn't mean we shouldn't do it!'.

Can you cite use cases you are particularly proud of ?

'**The Mylord Project,** in collaboration with French data science company HEVA, based on the collection, use and analysis of data from the French National Health Insurance (SNDS) on patients with Multipe Myeloma at each stage of the disease, and the use of an innovative AI algorithm to identify and classify treatment lines with 92% accuracy.
The AI and Cancer Project, a public-private consortium gathering 8 pharma partners, the French National Institute for Cancer, the French Public Investment Bank, and the Health Data Hub, to create an oncology database that is unique in age, volume and diversity.
The MELLODDY Project (At the EU level) a consortium of 10 major pharma players led by Janssen EMEA reunited with the objective of speeding-up the drug discovery step of R&D, in which we know pharmas currently spend a lot of time and effort. The objective is to leverage the federated learning platform of Owkin to build a predictive algorithm able to identify molecules with high potential'

Which company do you find particularly inspiring?

'**La Poste**. They operated a full digital transformation based on very innovative capabilities to facilitate mailmen's day-to-day activities and improve customer relationships. In addition, they also make an impressive use of AI and are committed to enforcing a responsible and ethical use of the technology (transparency, cybersecurity,…) that always puts humans at the center of the decisions.'

What are your most important lessons learned from your past experience in the area ?

'Do not seek AI for AI, but rather **start from a use-case with a clear need for the technology and a well-defined scope.**

Do not undermine the importance of change management! To get started, you need to have your team onboard with you. There is some real work to make in terms of acculturating our teams to the importance of AI and digital.'

If you had one piece of advice for someone willing to engage in AI for health, what would it be?

'Don't go there on your own!' While pharmas hold the business knowledge, players like startups bring us complementary expertise on the technology. French and European collaborative approaches between pharmas also allow new approaches to overcome the barriers of competition and unite our capabilities to produce new AI solutions for R&D, for instance through the use of federated learning.

Interview realized on October, 13th 2020

Philips Healthcare

Nicolas Villain

Director Research Lab

> AI is a great asset to personalize care pathways

Learnings from leaders

What do you see as main opportunities and risks in AI for health in the next 3 years?

"AI is a great asset to **personalize care pathways**. Indeed, AI allows to implement **automated triage**, **detection** and **alerts** based on images or other data. In addition, it makes possible to generate **automated reports, quantification and measurements**.
On the other hand, AI requires **validation/regulatory approval**. Integration within the **broader workflow** must be considered as well as **AI monetization** when deploying solutions to the market.'

What is your main challenge today to accelerate the data/AI trajectory within your organization?

'I would say that the most challenging part when it comes to AI implementation is to **convince internal business managers on AI business cases and ROI.'**

Can you cite use cases you are particularly proud of?

'**Early Warning Scoring (EWS)** integrated in IntelliVue Guardian Software is a customizable clinical data management system for the general ward, combining software, clinical decision support and mobile connectivity to help identify the right patient at the right time for early, effective intervention.

IntelliSpace AI Workflow Suite to seamlessly integrate a marketplace of (3rd party) AI applications across the radiology workflow

VitalEye and **SmartExam** that make MRI imaging faster, easier and more consistent (VitalEye to help simplifying MR workflow with a camera and Smartexam that uses intelligent software which automatically plans scanning geometries, based on the validated scanning preferences of the healthcare professional).'

What are your most important lessons learnt from your past experience in the area?

'When developing AI, it is necessary to **involve medical experts in the early phase** (as data providers and end-users), but also **other stakeholders who are key** for deployment (incl. IT for workflow integration, insurance for adoption, etc.)'

If you had one piece of advice for someone willing to engage in AI for health, what would it be?

'When engaging in AI for Health, **patience is of the essence**' 'Healthcare is a regulated and quite closed ecosystem in which adoption is slow'

Interview realized on October, 12th 2020

Sanofi

Dominik Geller

Head of Group Digital Governance

> Learn quantitative biologics. This skill is key for companies in the years to come

Learnings from leaders

What do you see as main opportunities and risks in AI for health in the next 3 years?

'With AI, we can support **better diagnosis, compliance and access** for the patients. Internally, AI can trigger **productivity gains across R&D**, reach higher **efficiency standards in our operations** and **better target our patients and customers**.The main risks according to me are the ability to access and use **personal data**, **undetected bias**, **unreliable performance** and **unclear regulatory pathways** to the market.'

What is your main challenge today to accelerate the data/AI trajectory within your organization ?

Beyond the data patrimony that Sanofi has been building over years, the **accessibility and quality data** (external and internal) is our main challenge to bring AI to the next level.

Can you cite use cases you are particularly proud of ?

'**Real World Evidence generation (DARWIN) –** compiling and analyzing de-identified data from several hundreds of millions of patients across disease states.'

'**Natural Language Generation (NLG) -** streamlining Sanofi's Clinical Study Report (CSR) generation, thus reducing the time taken to make drugs accessible on the market.'

'**Target Molecule Design**' – generating and selecting targets based on their anticipated characteristics

Commercial Next Best Action – anticipating our customer needs.'

Which company do you find particularly inspiring?

Big tech companies have good practices that they communicate in the public domain (Google, Microsoft, IBM)

What are your most important lessons learned from your past experience in the area ?

'Sometimes AI is embarked as a **magic tool** whereas it is necessary to leverage it only for use cases where the conditions for success are there.

AI can reproduce results in situations as long as they are stable. But when you have dynamic evolution, then it may not succeed. For instance, you will meet difficulties to automate non standardized operations and you should rather fix/correct that beforehand before contemplating the use of AI to solve a problem you failed to well describe.'

If you had one piece of advice for someone willing to engage in AI for health, what would it be?

'Learn **quantitative biologics**. This skill is key for companies in the years to come'

Interview realized on October, 14th 2020

AXA

Marcin Detyniecki

Head of Research and Development and Group Chief Data Scientist

> The main challenge today is making sure this topic is a collective one, and not a matter of a few experts.

Learnings from leaders

What do you see as main opportunities and risks in AI for health in the next 3 years?

'The potential of AI in Health is even greater than anywhere else. **It is not only about reducing costs** by automating processes, but also about **making better diagnosis and treatments**.
On of the main risks is ignoring the human factor, whether by providing AI diagnosis without explanations or having AI solutions bias that are biased towards some populations, but also by exacerbating the hype without providing adequate delivery.'

What is your main challenge today to accelerate the data/AI trajectory within your organization ?

'The main challenge today is **making sure this topic is a collective one**, **and not a matter of a few experts**. It is not obvious because the technology is not yet that accessible and also because it requires several successive steps so that all are part of the **associated transformation**. This is a clearly identified challenge for us and we put quite of an effort into it.'

Can you cite use cases you are particularly proud of ?

'We have put tremendous effort in the recent years to **humanize AI**, in particular with regards to our health applications. We believe this will be key in business adoption of AI and the basis for building a better world – where technology serves humans and not the other way around. To know more on explainable AI, Fairness and regulation, you can visit https://axa-rev-research.github.io/'

Which company do you find particularly inspiring?

'***Doctors without Borders***. Not only because of their concrete and positive contribution to our society, but also because of **the strong convictions, perseverance and humility** they share collectively. All done as one team by a mix of very differently skilled people.'

What are your most important lessons learned from your past experience in the area ?

'The main lesson learnt when implementing AI in Health or anywhere else, in the real world, **is not ignoring it is the real world**. It is important to know from the beginning that **it will take time and effort**, and acknowledge that there is legacy with which you will need to interact and that it is going to impact people and processes.'

If you had one piece of advice for someone willing to engage in AI for health, what would it be?
If come primarily **from the health sector**, learn AI fundamentals, look at data science, IT, statistics. If you are rather **from AI**, study the health domain you would like to engage, should it be diagnosis, managing patients or anything else. It is not about being an expert in both, **but being able to understand each other**, so that together you unleash AI potential in Health

Interview realized on October, 12th 2020

SCOR
The Art & Science of Risk | SCOR

Thibault Antoine

Deputy Chief Knowledge Officer

> AI for Health makes it possible to improve prevention based on non-intrusive methods

Learnings from leaders

What do you see as main opportunities and risks in AI for health in the next 3 years?

'AI for Health makes it possible to improve **prevention based on non-intrusive methods**, for instance connected watch.

However, there is an issue around the retribution of the **healthcare service provider business models** to make them sustainable for players in the industry.'

What is your main challenge today to accelerate the data/AI trajectory within your organization ?

'The main challenge we are facing is the **access to external data**. Indeed, we are talking about health related data which can come with a series of issues in the data collection process.'

Can you cite use cases you are particularly proud of ?

Our **Biologival Age Model product (BAM)** – IoT. Making the most of wearable data, BAM not only continuously assesses how we are living, but empowers and coaches us to make the right choices to live healthier lives.
New **VITAE Underwriting Engine**: new inclusive underwriting engine using an increased number of factors including Age, Gender, Tobacco status, ect. Vitae is currently being deployed through our API system in multiple SCOR solutions.
Internal OCR Block Scanned: a tool that allow to extract key information for the underwriting process and ensure the automatic anonymization of such unstructured documents.

Which company do you find particularly inspiring?

BNP Paribas Cardif in the na
Ping-An for their massive their use of massive data and their network of hospital enabling to collect data

What are your most important lessons learned from your past experience in the area ?

'You should create a product **for the business**, **with the business** and **validated down the line by the business** to make it a commercial success.'

If you had one piece of advice for someone willing to engage in AI for health, what would it be?

Be very concrete, start with 1 or 2 products that seem to bring value.
Then build on success and think on how to generate greater impact.

Interview realized on October, 9th 2020

gleamer | Gleamer

Christian Allouche

Co-Founder and CEO

> Working as close as possible to doctors is necessary to decode the way they work.

Learnings from leaders

What do you see as main opportunities and risks in AI for health in the next 3 years?

AI for Health improves **patient pathway management**. It has a positive impact for the patient and a decrease in related costs for the payer. More than a risk, I believe that reimbursement models is a key stake for software in the medical space.

What is your main challenge today to accelerate the data/AI trajectory within your organization ?

In the radiology space, the **annotation of the training datasets** has significant impact on our models accuracy. On that topic, we should move from craft to industrial processes, in order to cover the largest medical area.

Can you cite use cases you are particularly proud of ?

Lastly, outside of Gleamer, the **VIZ.AI** platform, supporting the management of patients subject to strokes, has reached reimbursement by Centers for Medicare and Medicaid Services (CMS) on a criteria of reduction of time to treatment. However, even today, access to budgets can be granted even without a specific line of reimbursement, like Trerapixel has done in breast cancer and Gleamer in our field of activity.

Which company do you find particularly inspiring?

In our space, I would say **AiDoc.** It is a company that develops computer-aided detection system for CT Scan, based on AI. They are fast in their deployment and have an interesting products quality.

What are your most important lessons learned from your past experience in the area ?

You need to work in **close relationship with doctors**. We have partnered with radiologists, 37 of them have invested in the company.
You have to manage **data quality** thanks to rigorous internal processes.
The regulatory part should be carefully taken care of, taking into consideration the differences between EU and US processes.

If you had one piece of advice for someone willing to engage in AI for health, what would it be?

Working as close as possible to doctors is necessary to decode the way they work.

Interview realized on October, 14th 2020

OWKIN | **Owkin**

Victor Dillard

Commercial Operations Director

> Do not underestimate the importance of accessing quality data!

Learnings from leaders

What do you see as main opportunities and risks in AI for health in the next 3 years?

I see opportunities around **decision support for doctors** (improving diagnosis, prognosis, prediction of response to treatment) as well as the possibility of **optimize Pharma R&D processes**. I also see a huge opportunity in scaling AI with **federated learning**. We need to be careful around AI perception: it should not be perceived as a threat to health care professionals – AI will not replace their skill and expertise - but rather as **a new tool, a means of augmenting their capabilities** and improving the delivery of health care.

What is your main challenge today to accelerate the data/AI trajectory within your organization?

Today, we are working on expanding **our footprint within European and North American hospitals**. We are scaling up our access to data so we can federate unique datasets and continue developing cutting edge models.
In addition to that, we need to accelerate our **discussions with the regulatory authorities**, both in EU and USA.

Can you cite use cases you are particularly proud of?

Malignant Mesothelioma (cancer prognosis: 8 to 36 months): development of a DL algorithm to better predict patient prognosis. 3000 data points from the Mesopath data center have been gathered. The algorithm performed better than the panel of experts and identified a new biomarker with strong correlation to prognosis.

HE2RNA: prediction of gene expression from histology slide images. It helps pathologists predict the presence of genes involved in cancer development and predict tumor status and response to therapies directly from digital pathology. It proves we can predict molecular features simply from an image captured on a microscope.

Which company do you find particularly inspiring?

The way 23andMe has dared and pushed the boundaries is inspiring. They have catalyzed a new era in the generation and sharing of medical data. Tempus Labs is another company that inspires me to keep advancing AI in healthcare.

What are your most important lessons learnt from your past experience in the area?

Across healthcare, bringing new technologies to the market requires more than solid, quality data. Collaboration is integral to innovation, and creating a collaborative ecosystem internally but also externally, with customers and other stakeholders, is critical for success.

If you had one piece of advice for someone willing to engage in AI for health, what would it be?
Go for it! But do not underestimate the **importance of accessing quality data**! Data is the lifeblood of any AI company. Should you want to develop an activity, ask yourself early-on in the process whether you want to go to market on your own or not and if yes, go beyond science and work on your business plan.

Interview realized on October, 22th 2020

CEAtech

Emilie Viasnoff

Programs and corporate projects Director

> When trusted and embedded, AI is a strong support and comfort for patients

Learnings from leaders

What do you see as main opportunities and risks in AI for health in the next 3 years?

'**For the patient, data and AI pave the way for personalized, predictive and precise medicine** and an optimized patient journey. For health professionals, this will result in better coordination, information sharing, decision support. For the hospital, this means efficiencies with more time for patient care. **On the risk side,** I would mention **data management** (fragmentation, heterogeneity, availability, security) and the level of **trust** that patients should place in AI for it to work.'

What is your main challenge today to accelerate the data/AI trajectory within your organization ?

'**Embedding AI in medical devices**: in order to avoid to pour all data in the cloud, a move to Edge computing for most devices would be beneficial (e.g: blood pressure cuff). The learning can still be done in the cloud, but inference is close to patient.
Confidence: AI must be trustable, explainable, almost responsible in a sense and to do so certified (not necessarily from a regulatory standpoint)'

Can you cite use cases you are particularly proud of ?

'**AI for diabetes**, in partnership with DIABELOOP, a self-learning algorithm to automate the treatment of T1 diabetes
AI for medical imagery: close work with OEM in order to improve image pre-treatments and to cross heterogeneous images
AI for neurology: Brain-computer interface project, decoding cortex activity to help patients with severe motor dysfunction
AI in the hospital to classify medical information: many NLP projects to classify information on patients / cohorts'

Which company do you find particularly inspiring?

'**INSERM**, **Pasteur**: players that are very strong in healthcare, but beginners in AI
At the opposite, **Atos**, **INRIA** are well positioned in AI but are beginners in the healthcare space
Some **university hospitals** are also very innovative in AI (e.g: Radboud, Maastricht…): they succeed in crossing skills of both worlds (healthcare and AI)

What are your most important lessons learned from your past experience in the area ?

'When **trusted and embedded AI will be a strong** support and comfort for patients. At the same time, for **all AI R&D projects to be successful** and for AI to develop at a good pace, it will be critical to ensure the **quality of the data and the robustness of the infrastructure**. '

If you had one piece of advice for someone willing to engage in AI for health, what would it be?

'Start from the patient's need and the **potential added value of AI initiatives** in healthcare!'
Start thinking from the beginning **how to build confidence** on the tooling you are developing.'

Interview realized on October, 9th 2020

Learnings from leaders

Institut Curie

Pr. F. Reyal
Pr. In Oncology,
Head of Breast, Gynecologic Cancer and Reconstructive Surgery Unit

> I prefer to think about AI opportunities rather than its risks

What do you see as main opportunities and risks in AI for health in the next 3 years?

'AI for health can significantly improve the **patient pathways**, at all levels. I prefer to think about AI opportunities rather than its risks. The **privacy issue** that has been raised is now obsolete and irrelevant.

What is your main challenge today to accelerate the data/AI trajectory within your organization ?

'According to me, the main challenge we are facing in our AI initiatives is the **human factor** and the associated **change management** that has to accompany its development and implementation within the organizations.

Can you cite use cases you are particularly proud of ?

'Curie worked on a network **map of innate immune response in cancer** reveals cell heterogeneity signatures. This meta-map contains 1,466 chemical species as nodes connected by 1,084 biochemical reactions, and it is supported by information from 820 articles (www.nature.com/articles/s41467-019-12270-x)'

Which company do you find particularly inspiring?

'**Dana Faber Institute**, as the world leader in adult and pediatric cancer treatment and research. Also, **Capgemini**, with whom we have a scientific partnership on breast cancer around a better understanding of patient pathways using leveraging AI.'

What are your most important lessons learned from your past experience in the area ?

'It is important to **anticipate** prior to launching an AI project, especially roadmap and budget. We discovered at Curie Institute that **agile methodologies** are particularly well suited to implement AI .'

If you had one piece of advice for someone willing to engage in AI for health, what would it be?

'To perform AI, you need to have access to **data** and **technologies**.'

Interview realized on October, 9th 2020

INSTITUT PASTEUR | **Institut Pasteur**

Jean Baptiste Masson
Principal Investigator of the Decision and Bayesian Computation lab (G5)

> It takes patience and time to achieve meaningful results.

Learnings from leaders

What do you see as main opportunities and risks in AI for health in the next 3 years?

'First, with **diagnosis** in hospitals, through a better utilization rate of scanners and MRI. More broadly, AI can definitely improve the **quantitative monitoring of hospitals**. Also, large scale **epidemiology** and **drug pharmacovigilance** have become accessible. On the risk side, we have to **manage expectations** of AI, especially because we are hitting a **wall of performance in models**, new type of models should now be invented to go beyond. We also need to be careful of the **'black box effect'** in AI-powered decision making.'

What is your main challenge today to accelerate the data/AI trajectory within your organization ?

'The main challenge today is focused on the **ever-growing storage and computation needs**. So far, we can deal with it, but for sure we are not at the scale of big tech player (e.g: Amazon) so we will reach a limit at some point. In addition, attracting **talents that are truly interested** by the healthcare field is a topic we are working on.'

Can you cite use cases you are particularly proud of ?

'We managed to **map receptor dynamics in synapses at the single receptor scale** based on applications of Bayesian approaches.

Another use case is based on designing and applying algorithm **to mimic insect search strategies for olfactory cues.**

We are also designing a software (DIVA) **mixing data treatment and visualization in virtual reality.**'

Which company do you find particularly inspiring?

'**The Janelia Research Campus** for their contribution to scientific research and their capacity to develop state-of-the-art machine learning for neuroscience and microscopy imaging applications. Also, **the Allen Institute** for their combined use of machine learning and big data for biological research. Finally, **the OpenAI organization** for their commitment to both research and safe use of AI.'

What are your most important lessons learned from your past experience in the area ?

'The main lesson learned when implementing AI in healthcare **is to accept that it takes time**, we are working long term here. We also may be surprised by what AI can bring to the table. When **subject matter expertise meets AI**, meaningful results can be expected.

If you had one piece of advice for someone willing to engage in AI for health, what would it be?
'It is necessary to have a **proper knowledge of the subject** when building algorithms. Moreover, you should be patient in this endeavor since it can take time to get meaningful results.'

Interview realized on October, 13th 2020

Table of content

Conclusion

AI is a strategic stake for CEOs and C-level executives for 87% of the panel (77% if we exclude startups). The budget dedicated to AI ranges from EUR5–EUR20 million, with use case development and IT enablers consuming most of it.

Overall, organizations in healthcare use AI as a lever to **deliver better care for patients** (68%), **improve customer satisfaction** (53% - key for major companies) and **reduce the cost of care** (51% - key for insurance and hospitals). Three major areas emerge:

- **AI for managing innovation and post-market cycles**: disruptive innovation before market authorization first then innovation to manage product LCM
- **AI to better manage the patient journey**: toward better diagnostic and a more preventive medicine
- **AI to manage risk**: patient stratification for more granular consideration of risk profiles.

The **'hype' phase of AI in healthcare is now behind us,** but the industry is still in its **infancy**. Although 60% of the panel consider their organizations to be mature in data and AI, there is some heterogeneity between players. The level of **satisfaction** of the panel with regards to AI initiatives is **high to very high** (69%), which is quite typical of the enthusiasm shared in early days. 81% of organizations have set up a department in charge of data, AI and innovation which is still too far from the ExCo. To hit the market, it will take **15 months** from ideation to first rollout and **12 months** from there to full scale, but timing will vary with the complexity (features, regulation, scope).

Conclusion

Departments are now well-equipped with expert profiles: **data scientists** (77%), **product owners** (68%) and **data engineers** (62%). A majority of companies will externalize to third parties tech players on a case by case basis.

Many organizations (68%) are working in an **open innovation model**, a scheme that has emerged as the new paradigm to drive value.

Data availability and quality is the main roadblock (74%) followed by **difficulties in adopting AI solutions** (47%), **lack of IT enablers** (45%), **lack of budget** (45%) and **privacy and ethics considerations** (45%). Privacy is now part of business as usual considerations whereas the other dimensions of AI ethics in healthcare (explainability, fairness, accountability) are far less watched out.

Cloud infrastructures have become the market standard, with most organizations (67%) currently developing their AI projects on these infrastructures. The **on premise** model is however still very present in healthcare especially for Research institutes and startups.

Data ingestion and **data cleansing** are perceived as weaknesses by more than half of the respondents and take up most of the investments. On the contrary, algorithms are perceived as a strength that needs to be consolidated, with startups driving this opinion.

Finally, the panel insists on the key role of the **human factor in AI**: technology should stay at the service of human-beings, be it patients, doctors or decision-makers, which is reassuring for the coming years.

AI for Health 2020

Cluster ID Cards

	'Learners'	'Transitionals'	'Experienced'
Sponsorship level	C-level or under C-level	C-level or CEO	CEO
Budget	Under EUR5M (major), early fundraising (start-up)	Between EUR5M and EURM€	Above 50M€, recent fundraising of €10M+ (start-up)
% of projects at POC stage (median)	71% of pipeline	67% of pipeline	51% of pipeline
# of projects in first roll out and full scale (median)	2 projects	7 projects	46 projects
Timing from ideation to first roll-out (average)	Few months (but simple use cases)	18 months	13 months
Timing from first roll-out to full scale (average)	*Not reached this level to date*	15-20 months	15-20 months
Satisfaction level	High to very high	High	Medium to high
Work in ecosystem	No specific pattern	Sometimes to often	Often
Main roadblock	Lack of skills (capability gap)	Lack of IT enablers	Data availability and quality
Ethics considerations	Focus on privacy	Privacy and emerging considerations for explainability, fairness, and accountability	Privacy and advanced considerations for explainability, fairness, and accountability

Acknowledgement

Capgemini and Startup Inside are very grateful to the following organizations and people we had the opportunity to interview during this study.

Major companies

Abbott
AstraZeneca
GE Healthcare
Janssen
Philips Healthcare
Novartis
Sanofi

Insurance

AXA
SCOR

Hospital and research labs

Cea Tech
Institut Curie
Institut Pasteur

Startups

Gleamer
Owkin
Paige

... and to the people who participated to our AI for Health online survey

Thank you to the Capgemini and Startup Inside staffs who have contributed to this report...

CAPGEMINI INVENT

Charlotte Pierron-Perlès
EVP AI and Data Services
Head of Insight Driven Enterprise

Barnabé Lecouteux
Principal

Sebastien Tourlet
Principal

Thomas Hedon
Manager

Alyzée Calmels
Consultant

Gert-Jan Schoppert
Global Marketing Lead Life Sciences

Isabelle Leveque
Marketing Lead

Myriam Chave
Marketing Manager

Roxane Guirauton
Digital Project Manager

STARTUP INSIDE

Damien Gromier
Co-Founder and CEO

Stephanie Trang
Managing Director AI for Health

Elora Pierre
Designer

Marie Charlemagne
Communication Manager

About Capgemini Invent
As the digital innovation, consulting and transformation brand of the Capgemini Group, Capgemini Invent helps CxOs envision and build what's next for their organizations. Located in more than 30 offices and 25 creative studios around the world, its 7,000+ strong team combines strategy, technology, data science and creative design with deep industry expertise and insights, to develop new digital solutions and business models of the future.

Capgemini Invent is an integral part of Capgemini, a global leader in consulting, digital transformation, technology, and engineering services. The Group is at the forefront of innovation to address the entire breadth of clients' opportunities in the evolving world of cloud, digital and platforms. Building on its strong 50-year heritage and deep industry-specific expertise, Capgemini enables organizations to realize their business ambitions through an array of services from strategy to operations. A responsible and multicultural company of 265,000 people in nearly 50 countries, Capgemini's purpose is to unleash human energy through technology for an inclusive and sustainable future. With Altran, the Group reported 2019 combined global revenues of €17 billion.

Visit us at www.capgemini.com/invent

About AI for Health and Startup Inside
AI for Health is the reference ecosystem collective that brings together more than 200 French and European players in AI for health: startups, research laboratories, hospitals, manufacturers and patient associations.
The initiative is led by the Startup Inside group, a major player in the transformation of large organizations through AI and entrepreneurial spirit. Startup Inside mobilizes French and European players in artificial intelligence by leading the AI for Health, AI for Finance, AI for Industry, and AI for Good ecosystem initiatives.
Press: damien.gromier@startupinside.com and stephanie.trang@startupinside.com
Follow us on Twitter @aiforhealthfr and on LinkedIn: @AIforhealthfr

Visit us at www.startupinside.com and www.aiforhealth.fr