Use of Data Analytics and Artificial Intelligence by Luxembourg companies

Where do we stand?

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Table of contents

Executive summary

Introduction

AI, as a true agent of change, is coming, and in many ways, its early rumblings are already being felt. It is clear that some companies will be early adopters while others will wait until their business model is obsolete. Many start-ups have created data-driven cultures from their inception, which is a key reason why large, established firms fear disruption from them.

PwC Luxembourg has conducted a study to better understand where Luxembourg companies stand in terms of Data Analytics and Artificial Intelligence (AI). The questions were aimed at understanding what types of strategy they currently have in place to manage data, the types of technology they use, and how they are investing to adopt a data-driven culture. The detailed results are presented in the following pages.

Key points to keep in mind:

- Luxembourg companies are still facing many hurdles in terms of data quality, coherence of systems, data processes, and data governance.
- Adopting a true data-driven strategy means that data matters should not be left to a few experts who are in charge of producing reports; instead, companies should ensure data visualisation tools[1] are widely spread throughout the company and used by employees at all levels of the organisation.

- The route to AI will be long and full of stumbling blocks. But Luxembourg companies should already embrace R&D in the area and start thinking about what they can do with the data they are collecting on a daily basis, instead of waiting for the headquarters to take ownership of this data[2].

1 While Excel, PowerPoint and Word remain the most commonly used office software applications, companies should massively promote the use of more advanced business intelligence and data visualisation tools such as QlikView, Tableau, Power BI, Klipfolio, Geckoboard, or Google Data Studio.
2 This remark especially applies to the investment fund industry, as Luxembourg is the world's second-largest investment fund domicile; as such, a significant amount of data on international clients is collected locally by Luxembourg management companies.

Understanding Data Analytics and Artificial Intelligence

The term Artificial Intelligence was first coined by John McCarthy in 1955 and, the following year, he held the first academic conference on the subject. The main advances over the past sixty years have been advances in computational and storage capacity coupled with the availability of a mounting amount of information.

Today, Data Analytics and AI projects have become more accessible, particularly given the new techniques for dealing with large volumes of fast-moving data. Therefore, traditional Data Analytics, Big Data, and AI actually are on a continuum.

Business Intelligence	Big Data	Advanced Analytics	Artificial Intelligence
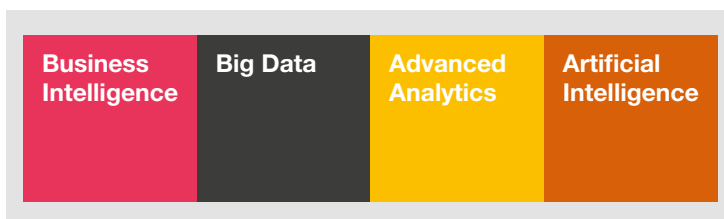
Terminology comes and goes, but the constant is a data explosion and the need to make sense of it.

Understanding the point of view of CEOs[3]

For the past ten years, PwC has measured the *information gap*, i.e. the gap between the data CEOs need to make informed decisions, and the data they actually get – in areas such as customers' preferences, financial forecast, brand & reputation, risks to the business, etc. This gap has not closed in the ten years the question has been asked.

One could argue that expectations have risen as technology has advanced, which is why the *information gap* is not closing. But CEOs recognise that it is not a lack of data – indeed the volume of data has expanded exponentially – they simply do not have the in-house capability to use the data collected to make optimised decisions.

3 PwC's 22nd Annual Global CEO Survey; the report titled "CEOs' curbed confidence spells caution" is available on the PwC website (www.pwc.com).

An important and continuing issue is the slow speed with which established firms make the shift to a data-driven culture. Clearly, they need more intensive programs to achieve data-related cultural change. As a matter of fact, very few firms in our sample (28%) have a clear and defined strategy for managing data. As many start-ups have created data-driven cultures from their inception, large and established firms fear disruption from them.

According to our study, Luxembourg companies primarily collect data for **operational efficiency** as well as **client knowledge and experience**. Besides, the financial industry considers AI primarily for **compliance and risk management purposes**. On the other hand, few collect data for innovation purposes.

One main issue remains the understanding of the concepts themselves. Answers show that respondents have very different perceptions and a very different understanding of the technologies that form part of AI. About half the respondents cited **machine learning and predictive statistics as the AI-related concepts with the greatest potential impact** on their business. On the other hand, more than half cited RPA[4] and process optimisation as the concepts that they believe will bring most value to their business – ones that we can argue are not advanced uses of AI capabilities.

In summary, Luxembourg companies are aware of the revolution taking place in the field of data, but still lack maturity in their overall data strategy, from having the right systems in place to exploiting the more advanced concepts of AI.

26%
of respondents consider their company to be mature with regard to data architecture

28%
of respondents say there is a clear and defined strategy for managing data within their company

A few quotes from our clients

Data is not easily accessible and we do not have clear communication on what we can access and for which purpose.

We have plenty of data, but no one sees the big picture or knows where data is stored.

*We don't have the right tools and teams to make the most of our data.*

4 RPA (Robotic Process Automation) allows for the automation of repetitive tasks such as moving files and folders, copying and pasting data, filling in forms, extracting structured and semi-structured data from documents, etc.

Facing hurdles in the deployment of AI

In Luxembourg, only 23% of companies are currently using AI. **The human factor is by far the biggest hurdle**: our respondents cited in particular the lack of knowledge about AI, the lack of team training and internal resistance to change.

The financial factor is the second-largest obstacle: a lack of visibility concerning the return on investment and a lack of financial resources were cited by more than one in four respondents as reasons for not deploying AI in their company.

Main reasons for not deploying AI in Luxembourg (full results available p.24)
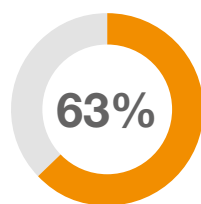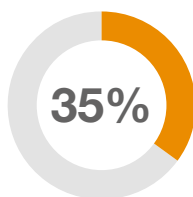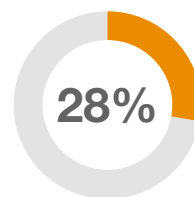
63%

Lack of knowledge about AI

35%

Lack of team training

28%

Lack of visibility concerning the return on investment

26%

Lack of financial resources

21%
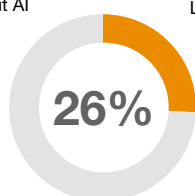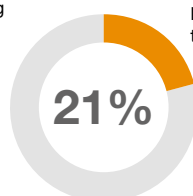
Internal resistance to change

> *The AI journey starts with your people. The capacity of employees, especially younger generations, to embrace the AI revolution is underestimated. Organisations should upskill their employees – all of them – and trust them to innovate.*
>
> Thierry Kremser, Data & AI Leader, PwC Luxembourg

Invest in people

One of the approaches that firms have established to deal with data-driven disruption and change is to establish new management roles. However, there is still a lack of clarity about how different data-oriented roles relate to each other.

In Luxembourg, like in the rest of the world, we observe the **emergence of new roles such as Data Engineer.** By far **the most widespread role is that of Data Protection Officer**, as this is a requirement from the 2018 General Data Protection Regulation (GDPR) for specific organisations or for processing certain types of data. On the other hand, **the Data Scientist, who is the true essence of AI, is still missing** in most Luxembourg firms.

Data-processing positions in place within Luxembourg companies (full results available p.15)

70% Data Protection Officer

47% Data Analyst

40% Business Intelligence Manager

28% Data Architect

21% Data Engineer

14% Data Scientist
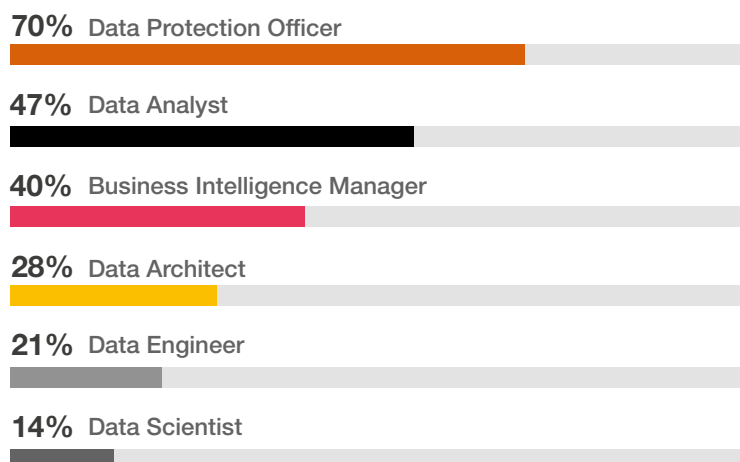
A few quotes from our clients

"

We created a new dedicated data department in January 2019. The team is composed of 5 persons with 3 new positions!

"

Amazing experience of coming from a small team of people working on analyses and proofs of concept to a large team of 23 people implementing solutions for our business lines.

Conclusion

The study reveals that Luxembourg companies understand the need to embrace the data revolution. Our findings are the following:

- companies have made efforts in recent years to embrace data-privacy rules and have reached suitable maturity in that area;
- however, maturity remains lower in the areas of data analysis and data architecture, which are the fundamentals of AI;
- many companies continue to cope with data-related issues internally and use internal data-cloud solutions;
- the use of AI remains on the fringe (less than 25% of participating companies) – reasons for this low level of deployment are clearly identified and stem mainly from the human factor.

The continuing rise in the importance of data analytics and AI is one of the most striking features of today's economy and society. The keys to success are to determine how your firm should respond, assign clear responsibilities for data strategy, and then move ahead to execute the required changes systematically and effectively.

We recommend that organisations take action by upskilling people, setting up a clear governance framework, and investing in expert people to build skilled teams. Most importantly, they should not be afraid to launch initiatives and to test and fail.

Who will play a leading role in the future of AI?[5]

AI is a gigantic opportunity, and many governments are working to make sure that their countries get a big piece of the pie. To date, more than 20 countries, including Canada, China, France, Germany, India, Japan, Kenya, Mexico, New Zealand, Russia, South Korea, the UAE, and the UK, have released AI strategy documents.

Overall, these new policies outline how governments plan to foster AI development to encourage domestic companies to develop solutions that will boost GDP and offer a host of societal benefits. At the same time, they tackle questions about security, privacy, transparency, and ethics.

Given the potential for AI to have disruptive social and environmental effects, the development of sophisticated national and international governance structures will become increasingly critical. Perhaps no other emerging technology has inspired such scrutiny and discussion.
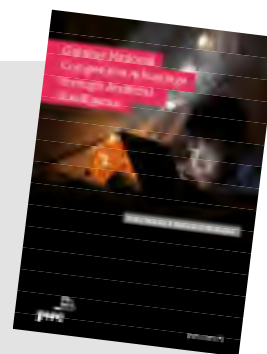
5 Please consult our PwC white paper titled "Gaining National Competitive Advantage through Artificial Intelligence: Policy Making & National AI Strategies, May 2019".

Survey results

Data governance and strategy

On a scale of 1 to 10, how would you rate your company in terms of maturity with regards to…

…data privacy	…data analysis	…data architecture
70%	**28%**	**26%**
of respondents consider their company to be mature (attributed note of 7 to 10)	of respondents consider their company to be mature (attributed note of 7 to 10)	of respondents consider their company to be mature (attributed note of 7 to 10)
Average **6.9/10**	Average **5.3/10**	Average **4.9/10**
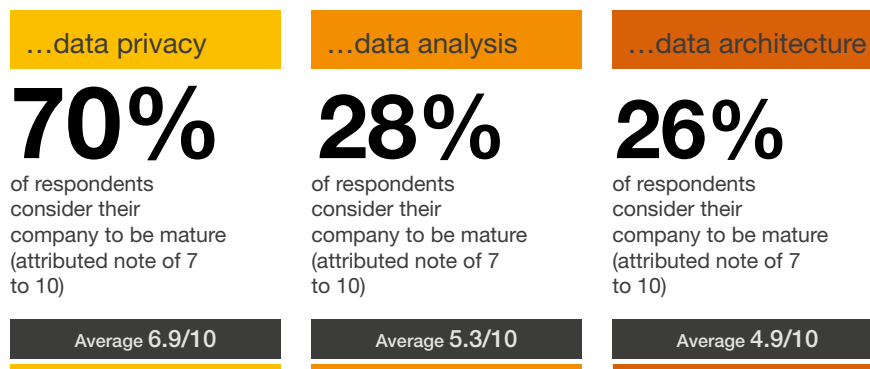
The main finding is that Luxembourg companies are well equipped to comply with the rules and regulations in place, in particular data privacy rules (driven by the latest GDPR regulations). However, there is room for improvement with regards to data analysis and data architecture.

Do you have a clear and defined strategy for managing data within your company?

No, **19%**

In progress, **53%**

Yes, **28%**
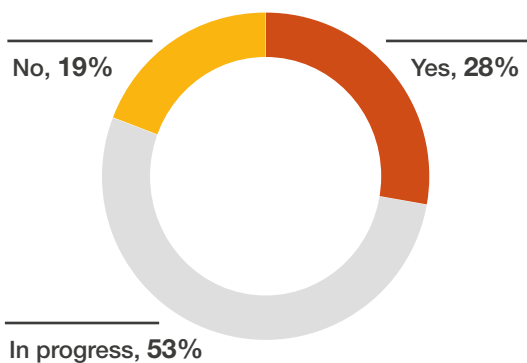
Only a minority of Luxembourg companies have a clear strategy in place for data management.

Base: 43 respondents / Single choice question

Do you manage all data-related issues internally?

No, only some of them, **39%**

Yes, all of them, **61%**
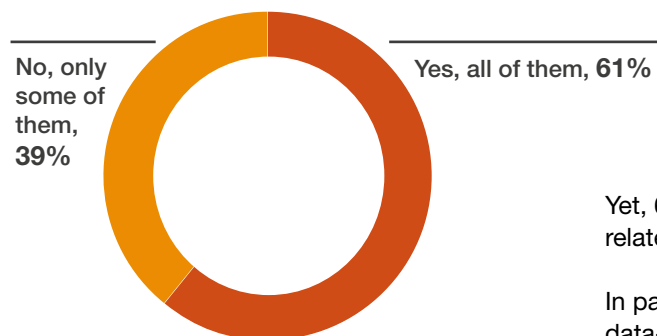
Yet, 61% of them manage all data-related issues internally.

In particular, SMEs tend to manage data-related issues internally instead of seeking experience and capability from external advisors.

Base: 41 respondents / Single choice question

"

Properly governed and managed data is at the heart of any digital project. Data is what fuels data analytics, machine learning and AI, thus proper and trusted data governance is a key condition to success.

Christophe Daudrix, Risk Assurance Director, PwC Luxembourg

Which data-processing positions are there in your company?

New Data Protection Officer — 70%

Data Analyst — 47%
64% of non-financial companies employ a Data Analyst

Business Intelligence Manager — 40%
60% of large companies employ a Business Intelligence Manager

Data Architect — 28%

New Data Engineer — 21%

Master Data Manager — 19%

Data Steward — 16%

Internal Auditor with data expertise — 14%

Data Designer — 14%

New Data Scientist / Chief Data Scientist — 14%

Data Miner — 9%

New Chief Analytics Officer — 5%

Chief Operating Officer — 2%

None — 9%

Don't know — 5%

New New types of positions on the market

Base: 43 respondents / Multiple choice question

Irrespective of size and sector, most companies have a Data Protection Officer (driven by GDPR requirements). Other new positions are also emerging, such as Data Engineers, Data Scientists and Chief Analytics Officers; their mission is to help the business analyse the data in innovative manners.

However, the roles bringing true innovation to AI (such as Data Scientists) are still under-represented.

Data collection and use

What are your main reasons for collecting data?

Reason	Percentage
Operational efficiency	81%
Client knowledge and experience	74%
Compliance and risk management[6]	70%
Fraud detection	35%
HR management	33%
Innovation	28%
Other	5%
Don't know	2%

86% of financial companies collect data primarily for compliance and risk management purposes

41% of non-financial companies collect data primarily for innovation purposes

6 Including the control and audit functions
Base: 43 respondents / Multiple choice question

Luxembourg companies primarily collect data for operational efficiency, client knowledge and compliance reasons.

On the other hand, few collect data for innovation.

> **"**
>
> *The regulatory agenda has always been a key driver for the transformation of the financial industry in Luxembourg. But I am pleasantly surprised that 74% of clients already use data for client knowledge and experience. I am convinced that Luxembourg overall can become a frontrunner in the Data & AI competition.*
>
> Thierry Kremser, Data & AI Leader, PwC Luxembourg

Cloud

Which big-data cloud(s) do you use?

Internal solution only 49%

Don't know 2%

None 9%

Internal solution +
3rd - party solutions 5%

3rd-party solutions only 35%

Google	47%
Azure	41%
Amazon Web Serives (AWS)	35%
Mobile Recording (POST)	6%
Workday	6%
IBM Cloud	6%
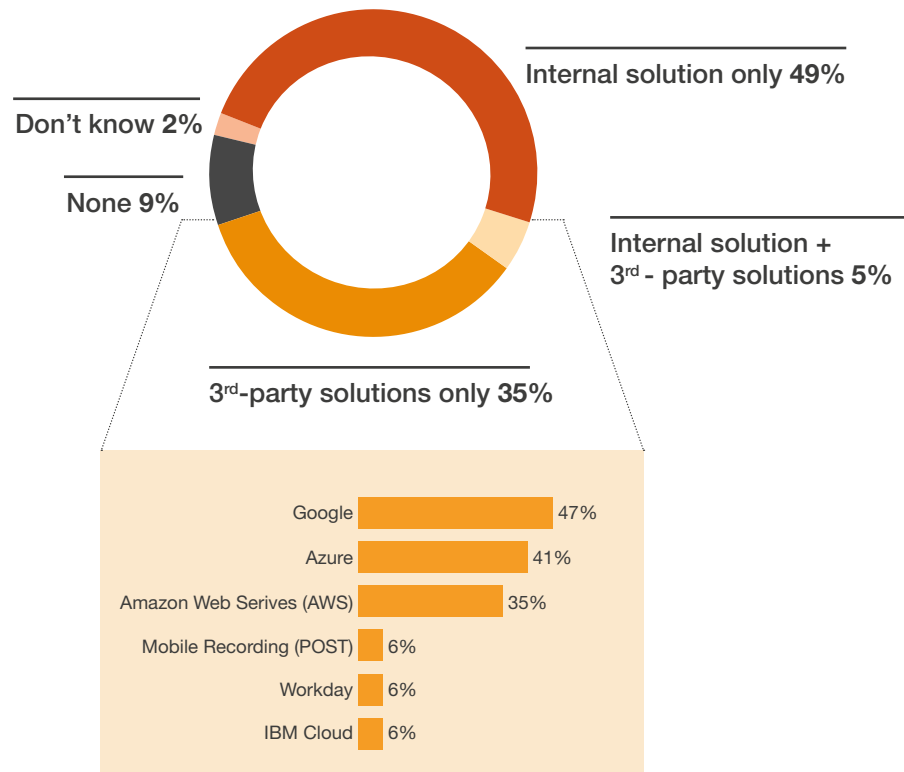
Luxembourg companies still predominantly use internal cloud solutions. However, recent regulations in the financial sector[7] are slowly changing the playing field and we should see a bigger uptake of third-party cloud solutions over the next few years.

7 In May 2017, Luxembourg's supervisory authority of the financial sector, the CSSF, published the CSSF Circular 17/654 addressing IT outsourcing based on a cloud computing infrastructure

Base: 43 respondents / Single choice question

Visualisation

Which visualisation tool(s) do you use?

Excel only 23%

Don't know 2%

Other tools only 33%

Excel + others 42%

Tool	Percentage
PowerBi	41%
Tableau	16%
SAS	16%
SAP Business Objects	9%
Qlik	9%
Visio	3%
Spotfire	3%
SAP Lumira	3%
Python tools	3%
IBM Cognos	3%
GLIMS	3%
Don't know	3%
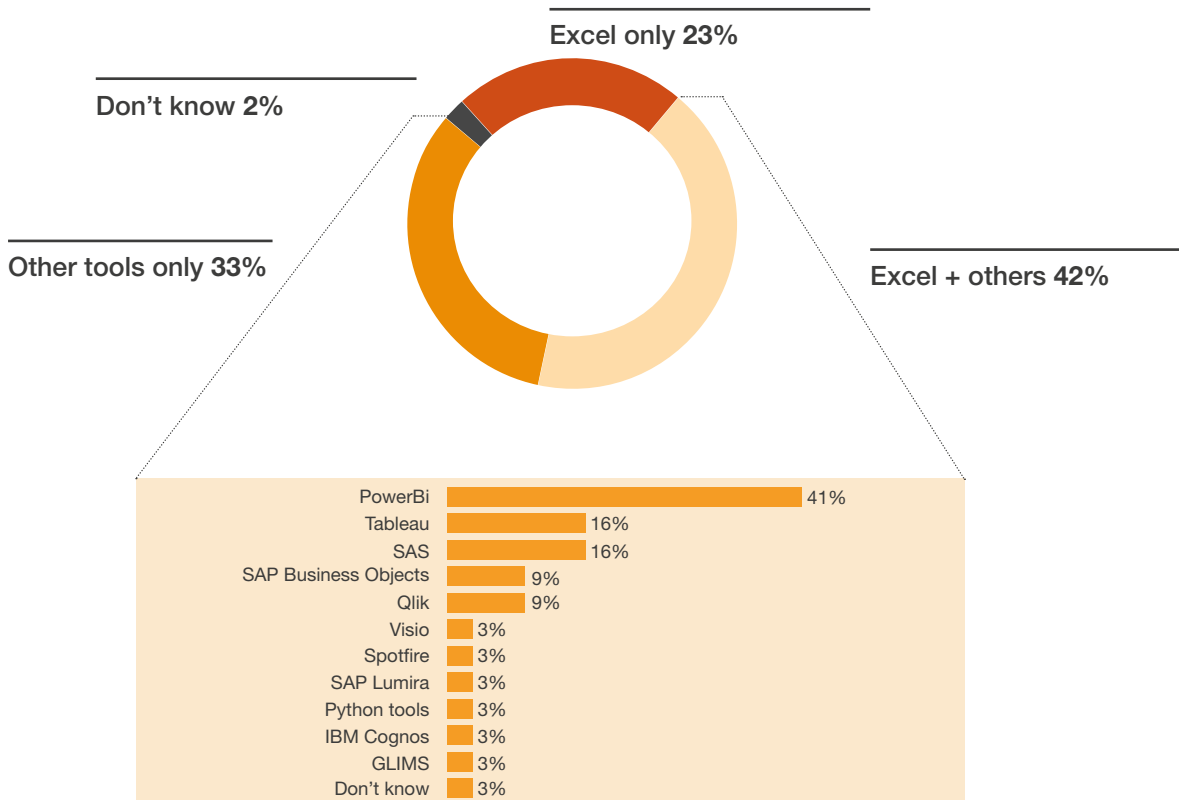
Luxembourg companies still largely use Microsoft Excel as a visualisation tool, either alone or complemented by another tool. In this latter case, they mainly leverage on PowerBI, followed by Tableau and SAS.

Base: 43 respondents / Single choice question

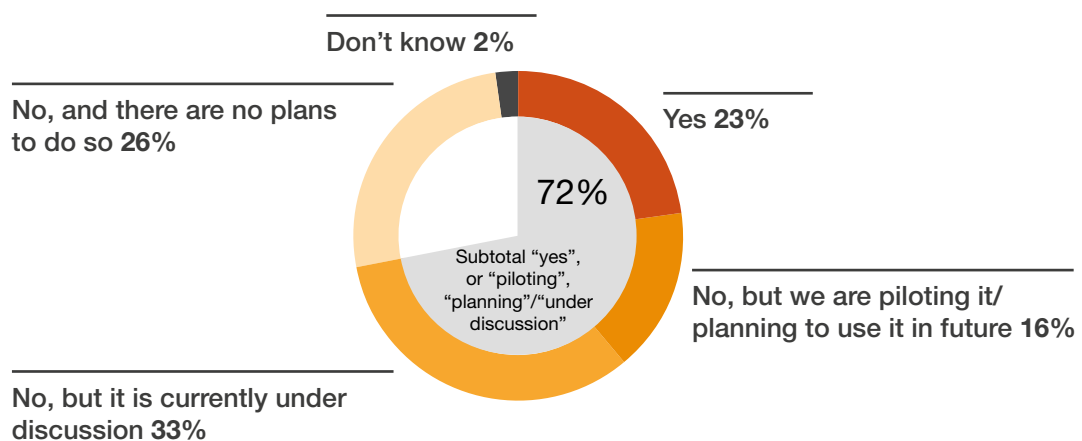*Data visualisation tools are easy to use and accessible to everyone. An upskilling program can enable everyone to understand their data and have quick insights.*

Grégory Blachut, Data Analytics Director, PwC Luxembourg

Artificial Intelligence

Are you currently using AI in your company?

Don't know **2%**

No, and there are no plans to do so **26%**

72%

Subtotal "yes", or "piloting", "planning"/"under discussion"

Yes **23%**

No, but we are piloting it/ planning to use it in future **16%**

No, but it is currently under discussion **33%**

A minority of Luxembourg companies are currently using Artificial Intelligence. However, close to half are in the early stages of implementing it or are talking about it.

We note that SMEs lag behind large companies, as none of them are currently using AI and 44% are not planning to do so either.

Base: 43 respondents / Single choice question
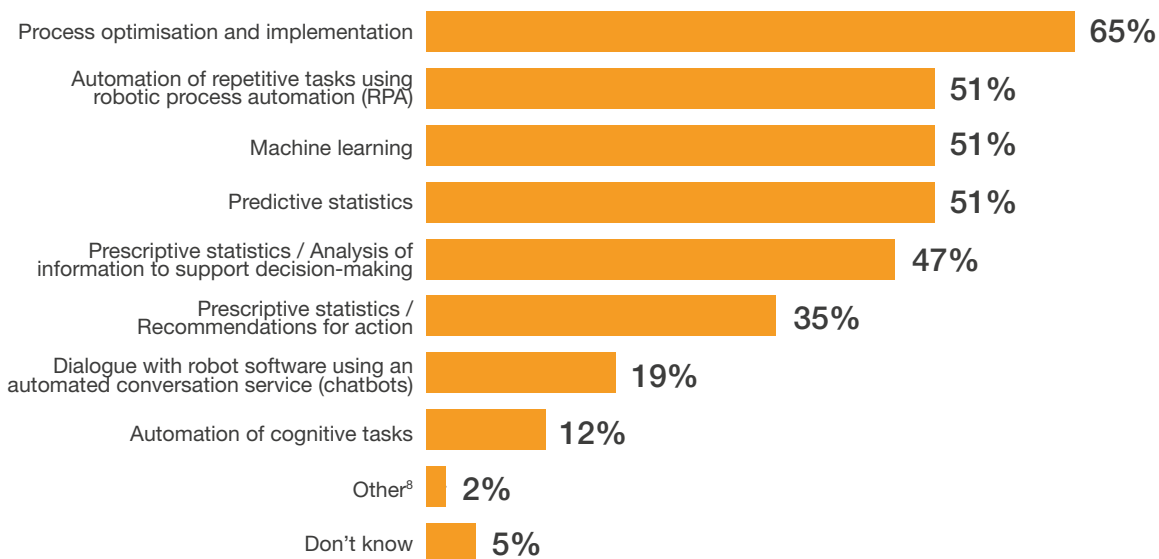
> "
> *Not surprisingly, AI is on the agendas of most companies in Luxembourg. It represents great opportunities for improvement but also poses risks that need to be addressed. Bias inclusion, black boxes and traceability of data are just some of the things that need to be considered in order to deploy a responsible AI.*
>
> Julie Batsch, Risk Assurance Partner, PwC Luxembourg

Business impact

Which AI-related concepts do you think have or would have the greatest impact on your business?

Process optimisation and implementation	65%
Automation of repetitive tasks using robotic process automation (RPA)	51%
Machine learning	51%
Predictive statistics	51%
Prescriptive statistics / Analysis of information to support decision-making	47%
Prescriptive statistics / Recommendations for action	35%
Dialogue with robot software using an automated conversation service (chatbots)	19%
Automation of cognitive tasks	12%
Other[8]	2%
Don't know	5%

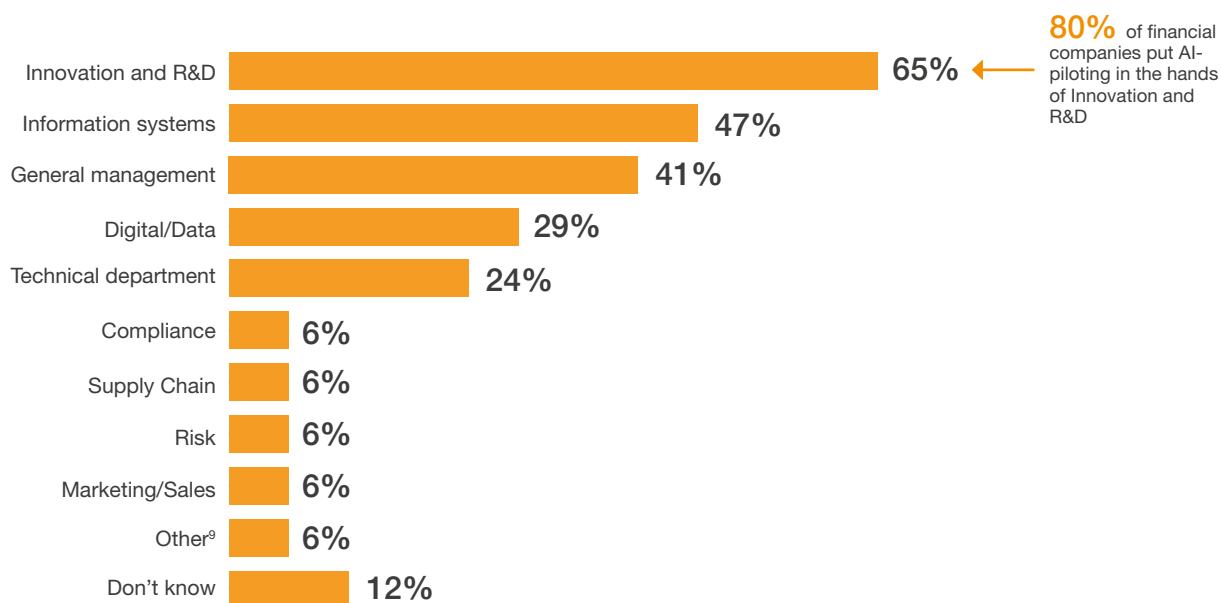8 Natural language processing

Base: 43 respondents / Multiple choice question

More than half the respondents see value in process optimisation and RPA, though these are arguably basic uses of AI.

However, the value of more advanced uses of AI is not yet recognised by Luxembourg companies, perhaps due to the leap in maturity that needs to happen before integrating them into the business model.

Teams

Who is/are responsible for piloting AI-related projects within your company?

80% of financial companies put AI-piloting in the hands of Innovation and R&D

Category	Value
Innovation and R&D	65%
Information systems	47%
General management	41%
Digital/Data	29%
Technical department	24%
Compliance	6%
Supply Chain	6%
Risk	6%
Marketing/Sales	6%
Other[9]	6%
Don't know	12%

9 Operational area

Base: 17 respondents using AI or piloting/planning its use in the future / Multiple choice question

In a majority of companies, AI remains under innovation or data functions; only a minority have chosen to put AI under general management or business functions.
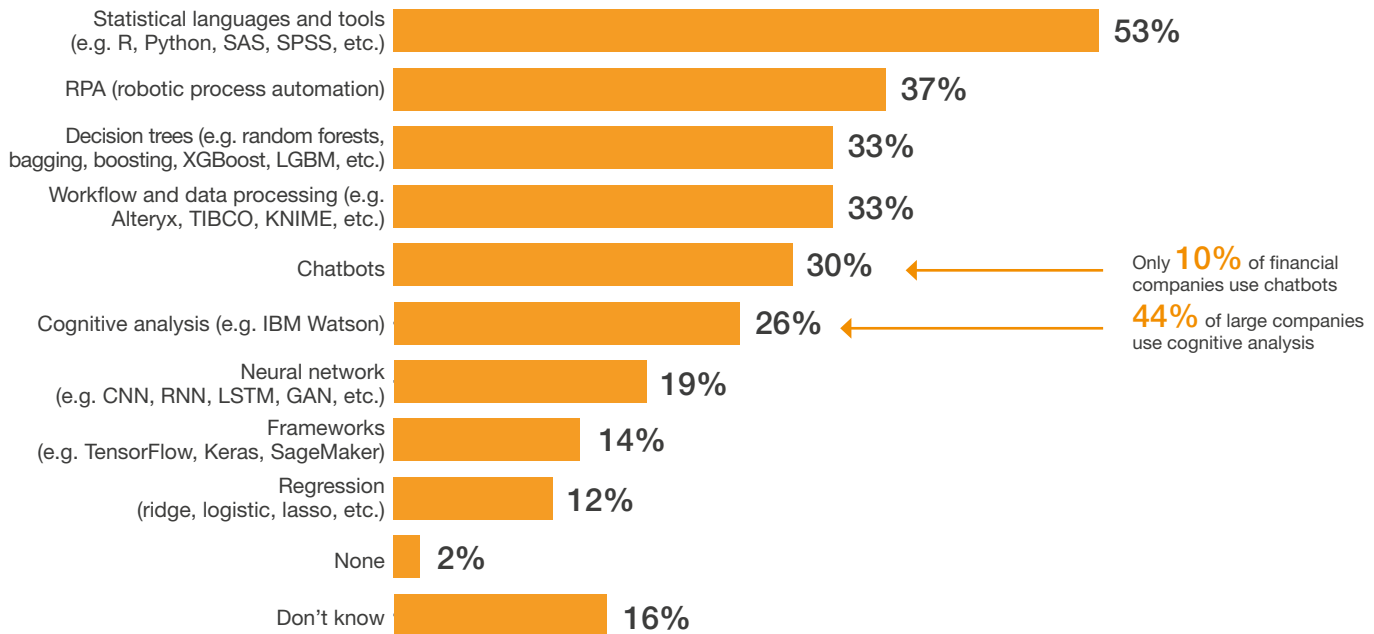
"

Building an AI model not only requires technical skills but also domain knowledge. That's why a diverse and open-minded team is a must to smoothly integrate the model to production.

Grégory Blachut, Data Analytics Director, PwC Luxembourg

Technologies and techniques

Which AI technologies are you using or would you like to use?

Technology	%
Statistical languages and tools (e.g. R, Python, SAS, SPSS, etc.)	53%
RPA (robotic process automation)	37%
Decision trees (e.g. random forests, bagging, boosting, XGBoost, LGBM, etc.)	33%
Workflow and data processing (e.g. Alteryx, TIBCO, KNIME, etc.)	33%
Chatbots	30%
Cognitive analysis (e.g. IBM Watson)	26%
Neural network (e.g. CNN, RNN, LSTM, GAN, etc.)	19%
Frameworks (e.g. TensorFlow, Keras, SageMaker)	14%
Regression (ridge, logistic, lasso, etc.)	12%
None	2%
Don't know	16%

Only **10%** of financial companies use chatbots

44% of large companies use cognitive analysis

Base: 43 respondents / Multiple choice question

The more advanced AI technologies require companies to have matured in the area of data. However statistical languages such as R and Python are the first building blocks in harnessing data.
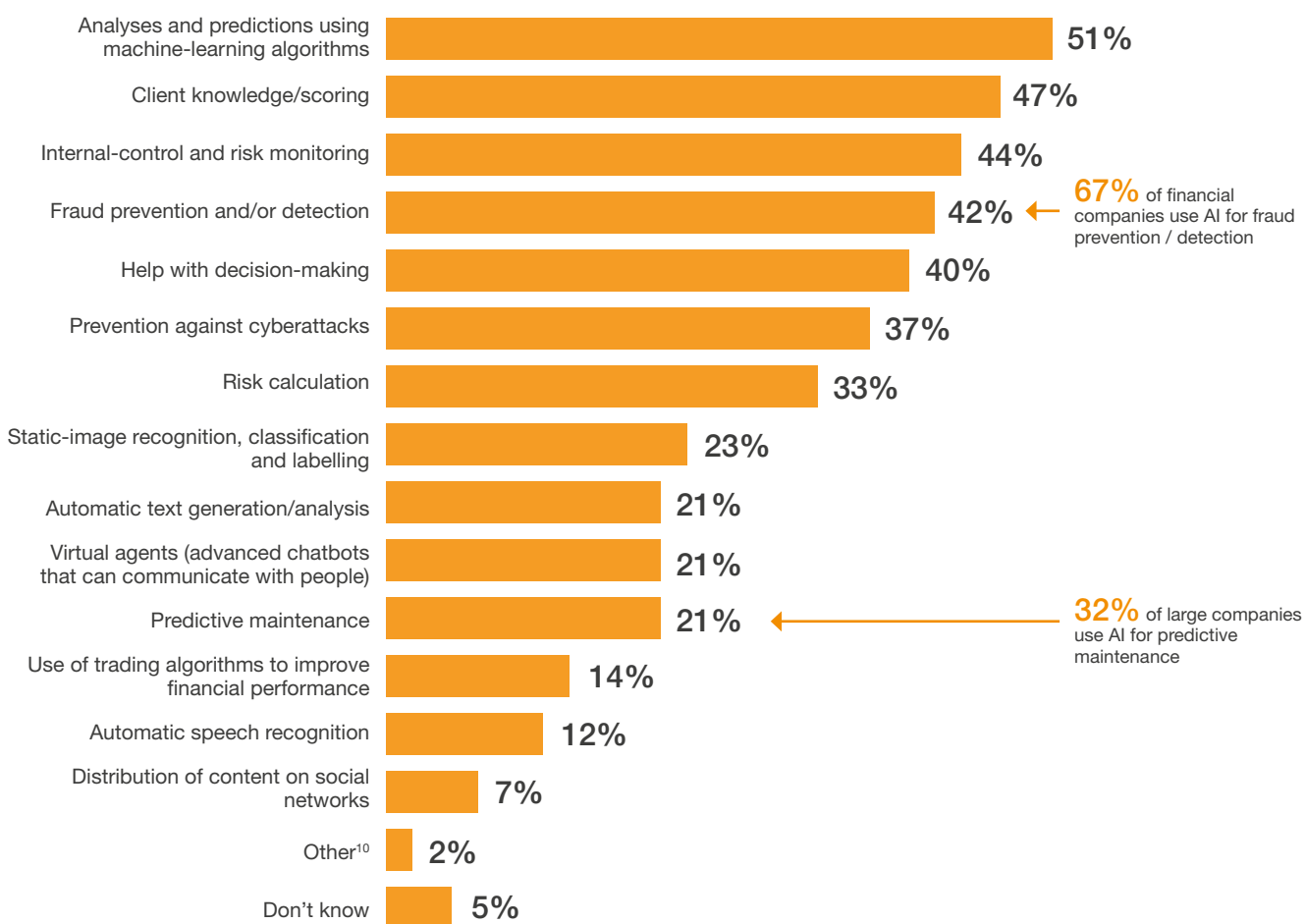
> "
> *Statistical languages such as R and Python are widespread. Schools and universities are increasingly teaching these subjects. It's a good entry door to AI.*
>
> Thierry Kremser, Data & AI Leader, PwC Luxembourg

Field applications

In which fields is AI used (or would be used) within your company?

Field	%
Analyses and predictions using machine-learning algorithms	51%
Client knowledge/scoring	47%
Internal-control and risk monitoring	44%
Fraud prevention and/or detection	42%
Help with decision-making	40%
Prevention against cyberattacks	37%
Risk calculation	33%
Static-image recognition, classification and labelling	23%
Automatic text generation/analysis	21%
Virtual agents (advanced chatbots that can communicate with people)	21%
Predictive maintenance	21%
Use of trading algorithms to improve financial performance	14%
Automatic speech recognition	12%
Distribution of content on social networks	7%
Other[10]	2%
Don't know	5%

67% of financial companies use AI for fraud prevention / detection

32% of large companies use AI for predictive maintenance
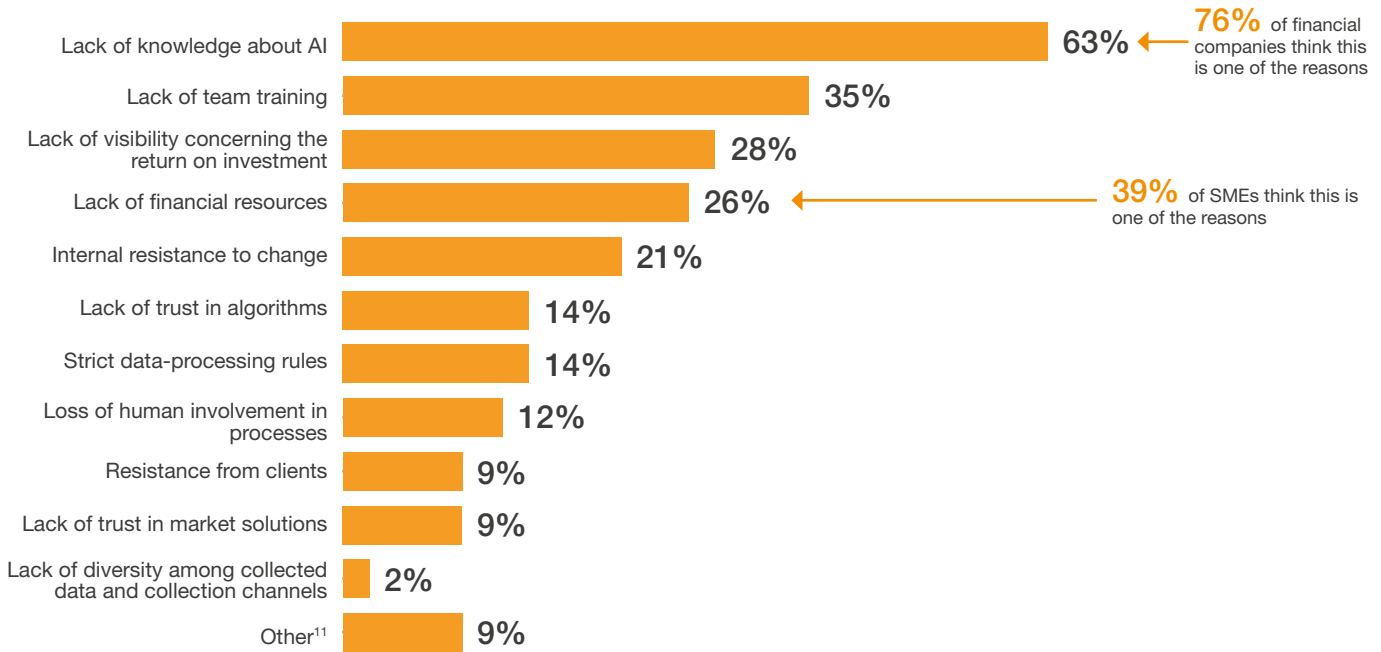
10 Machine learning

Base: 43 respondents / Multiple choice question

The use of AI within Luxembourg companies spans various fields. While predictions and client knowledge come first overall, in the financial sector AI is mostly used for risk monitoring and fraud prevention purposes.

Facing hurdles

## What do you think are the reasons for not deploying AI?

Reason	Percentage
Lack of knowledge about AI	63%
Lack of team training	35%
Lack of visibility concerning the return on investment	28%
Lack of financial resources	26%
Internal resistance to change	21%
Lack of trust in algorithms	14%
Strict data-processing rules	14%
Loss of human involvement in processes	12%
Resistance from clients	9%
Lack of trust in market solutions	9%
Lack of diversity among collected data and collection channels	2%
Other[11]	9%

76% of financial companies think this is one of the reasons

39% of SMEs think this is one of the reasons

11 Lack of time; lack of a facilitating legal and technical framework; lack of vision

Base: 43 respondents / Multiple choice question

Regardless of size and industry, the human factor is by far the biggest hurdle: our respondents cited in particular the lack of knowledge about AI, the lack of team training and internal resistance to change.

Deployment monitoring

Do you have follow-up indicators to measure the impact of deploying AI in your company's field of business?

Yes 9%

No, but we intend to do so in the short/medium term 9%

Don't know 19%

No 63%
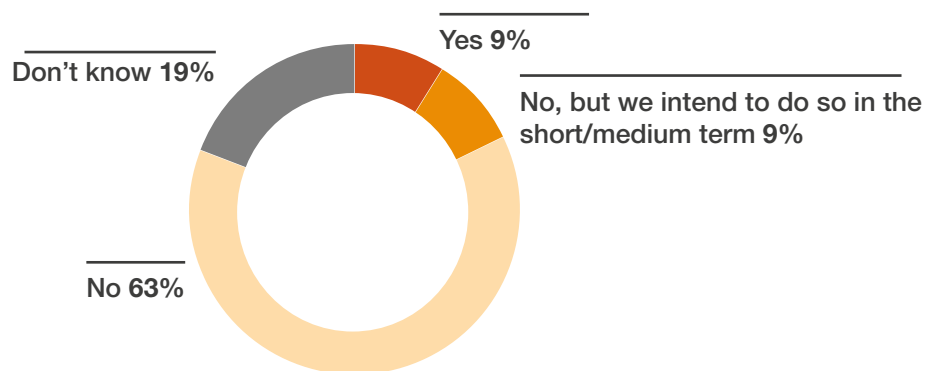
Base: 43 respondents / Single choice question

A majority of Luxembourg companies do not measure the impact that artificial intelligence has on their business, despite the significant transformation it could bring.
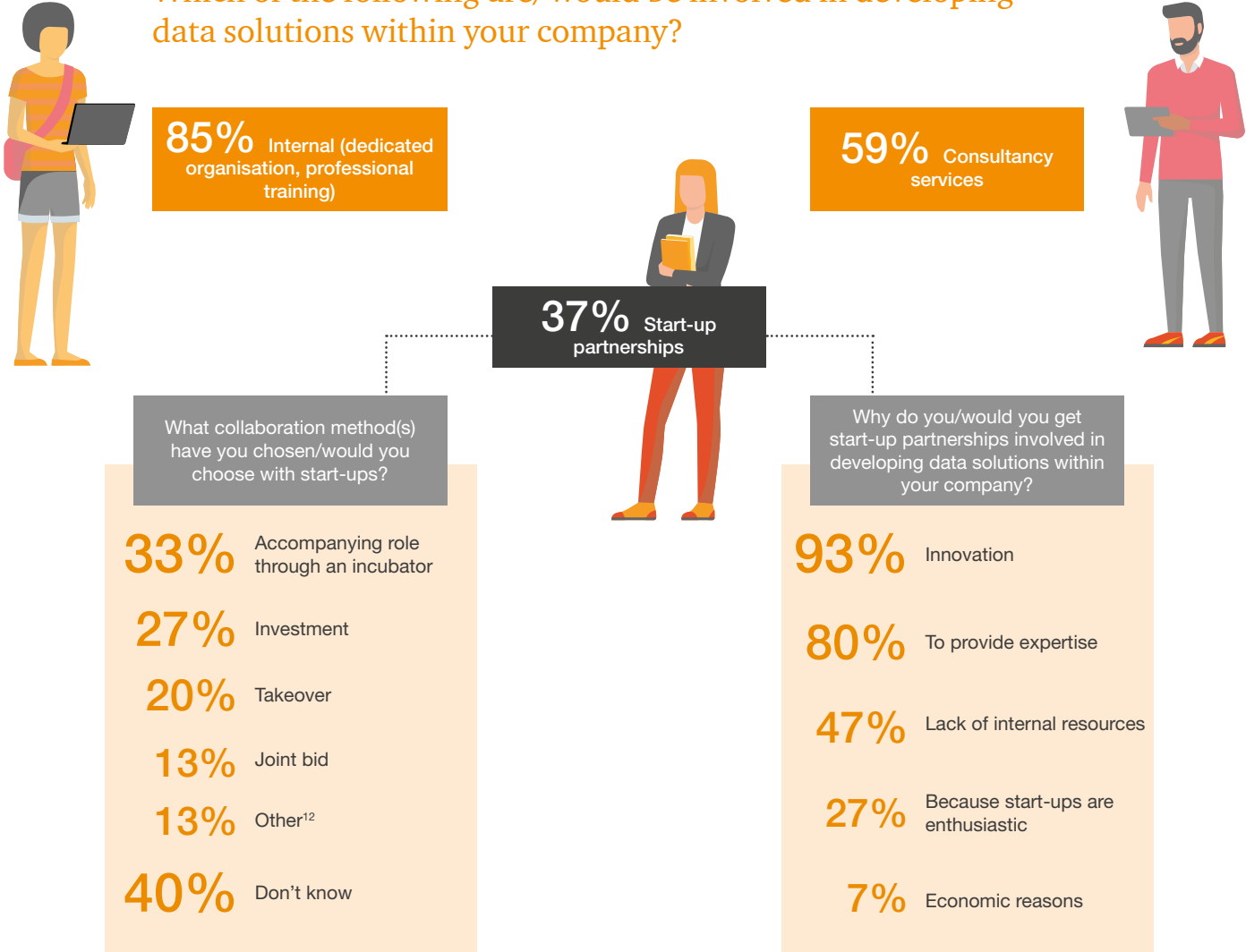
> "
>
> *After adopting digital transformation, local banks are starting to embrace Big Data and AI transformation. For example, some banks are implementing real-time transactions and measuring their impact through customer experience and retention metrics.*
>
> Grégory Blachut, Data Analytics Director, PwC Luxembourg

Collaboration

Which of the following are/would be involved in developing data solutions within your company?

85% Internal (dedicated organisation, professional training)

59% Consultancy services

37% Start-up partnerships

What collaboration method(s) have you chosen/would you choose with start-ups?

33% Accompanying role through an incubator

27% Investment

20% Takeover

13% Joint bid

13% Other[12]

40% Don't know

Why do you/would you get start-up partnerships involved in developing data solutions within your company?

93% Innovation

80% To provide expertise

47% Lack of internal resources

27% Because start-ups are enthusiastic

7% Economic reasons

12 Subcontracting; contracting

Base: 43 respondents / Multiple choice question

If internal resources are firstly involved in developing data solutions, they are generally accompanied by consultancy services, subcontracting or start-up partnerships. Companies collaborating with start-ups do so mainly via an incubator or they invest in them, for innovation purposes and/or so that they can provide expertise.
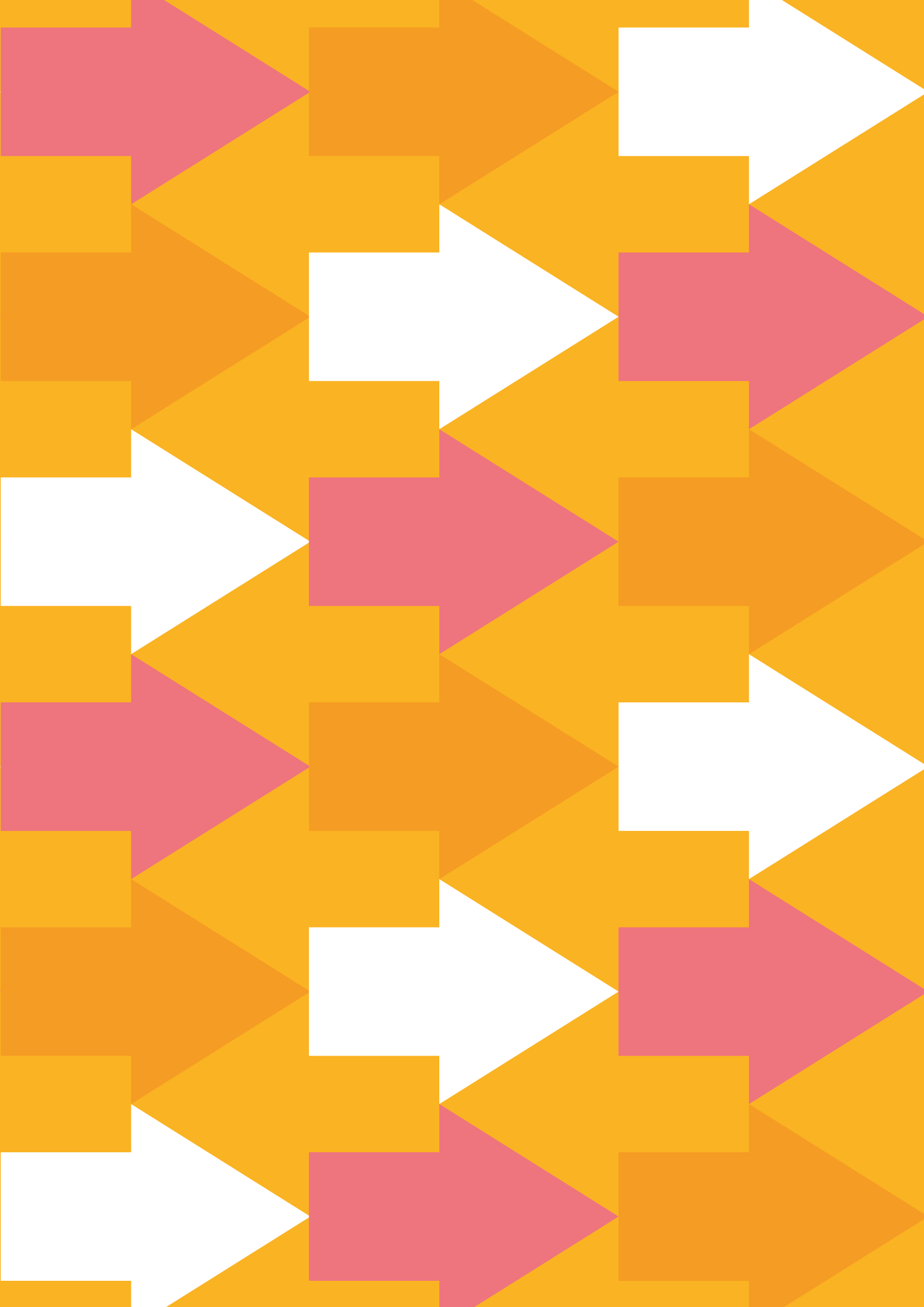
Methodology

Survey methodology

Questionnaire

This survey was conducted on-line by PwC Luxembourg through a self-administered questionnaire. It is based on a set of questions originally developed by PwC France and Usine Digitale[13].

Data collection period

During the month of March 2019.

Sample size

43 respondents in total, answering in their capacities as Head of IT, Operations, Risks, Data or Digital among others. Despite the limited number of respondents, we believe that the survey results paint an informative picture of the situation in Luxembourg.

Company profiles

The companies in the sample are based in Luxembourg and come from a wide range of sectors. About half operate in the financial industry while the other half operate in the public sector, in manufacturing and in the service industry.

These companies are of all sizes: about 44% employ more than 1,000 employees while 42% are SMEs.

13 Results from the survey conducted in France are available on www.pwc.fr under the title "Du Big Data à l'Intelligence Artificielle : le défi des entreprises françaises, Novembre 2018".

Respondents' profiles

Job title

Head of IT	23%
Head of Operations	19%
Head of Risk	14%
Head of HR	12%
Head of Data	5%
Head of Digital	5%
Head of Transformation	2%
Head of Corporate Management	2%
Head of Fund administration	2%
Other	16%

Line of business

Information systems	21%
Finance	14%
Innovation and R&D	12%
HR	12%
General management	12%
Risk	9%
Technical department	5%
Marketing/Sales	5%
Data	5%
Transformation	2%
Other	4%
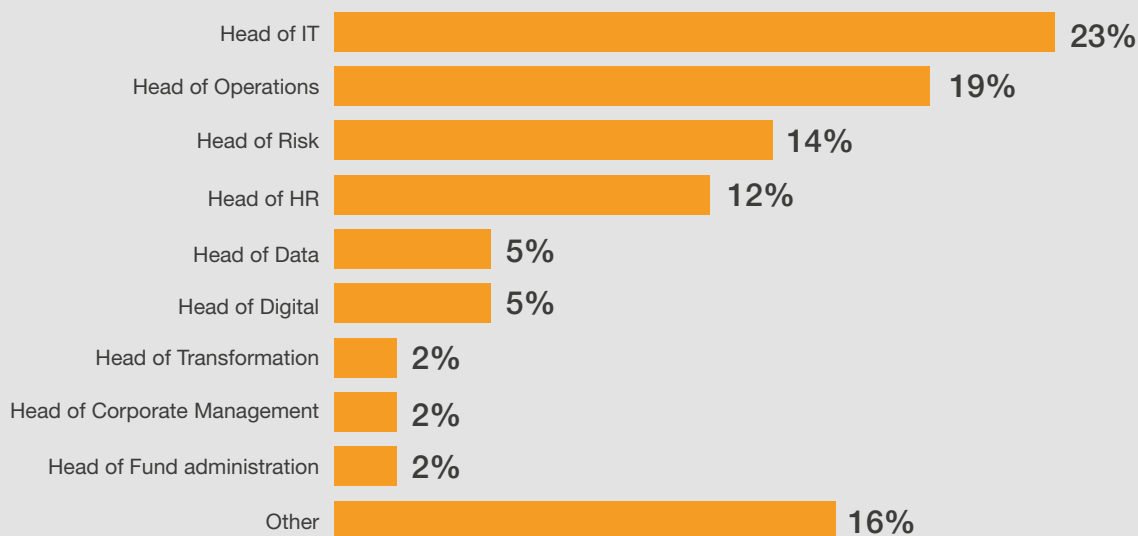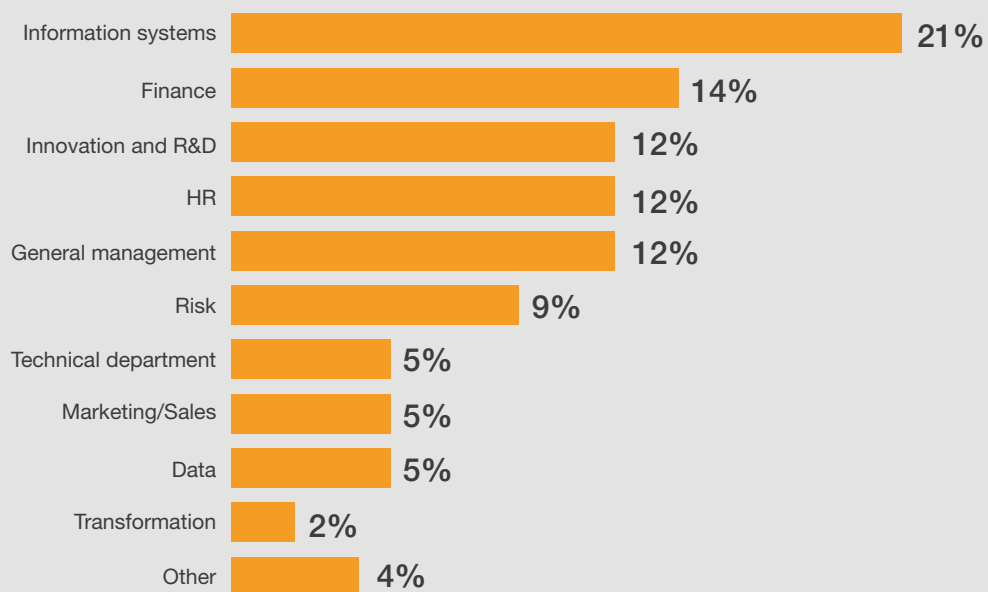
Company profiles

Business sector

44.2%

Non-financial
Operational Companies
Healthcare
Transport & Logistics
Consulting
Food
ICT
Automotive
Construction
Utilities
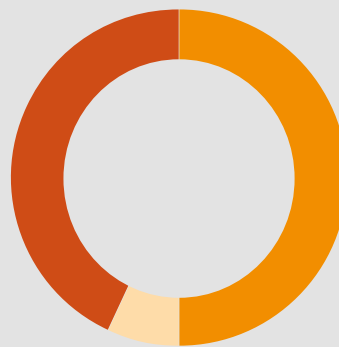
48.8%

Financial
Banking
Asset & Wealth Management
Insurance
Payment Services
Financial Technology

7%

Public Sector

Number of employees

12%
1-50 employees

7%
51-100 employees

44%
1,000+ employees

23%
101-250 employees

SMEs

2%
251-500 employees

12%
501-1,000 employees

Notes
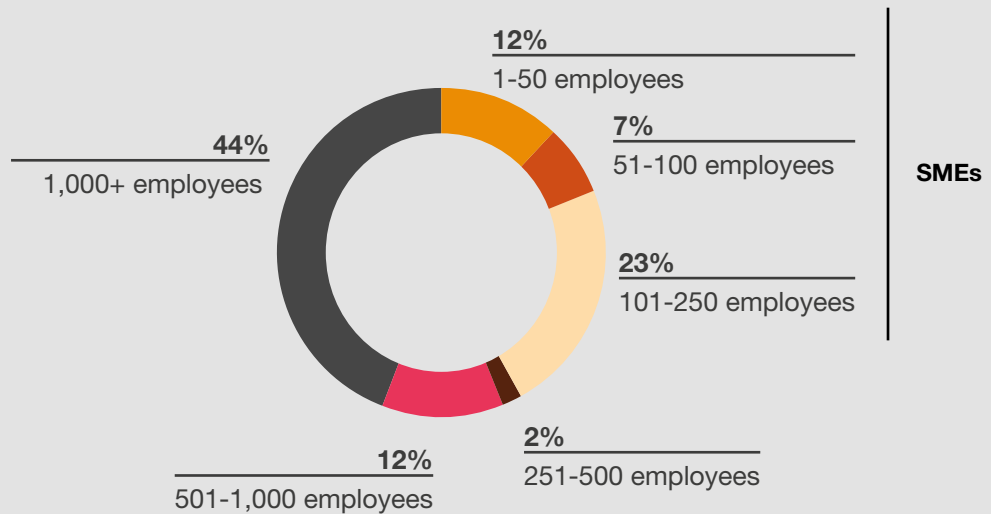
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