TRUST & AI

RESEARCH REPORT

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taiste

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Artificial intelligence (AI) is a computer or a software capable of analysing complex data sets, and making deductions or suggestions based on it.

In other words, AI is performing tasks that are considered as intelligent.

In this research report, we provide insights on how trust and context can affect attitudes towards artificial intelligence.

We hope that it will give you new perspectives on the interplay between AI and the users who interact with the services utilising these new possibilities.

CONTEXTS OF TRUST

AI – WHY CONTEXT MATTERS

Futurist Gerd Leonhard has stated that human life will change more in the upcoming 20 years that it has changed in the past 300 years. Scholars believe that all areas of human life will be affected by the use of artificial intelligence – but it remains to be seen what this will mean in practice. During the past few years, discussions around AI have been either about its supposedly endless capacity to drive business, or visions of our societies turning into the dystopian nightmares familiar from science fiction novels.

AI has already been utilised in both private and public sectors for some time. In the last couple of years, it has become a buzzword. Why is it such a huge thing now? For starters, it has a huge potential in replacing practices and processes that have previously required tedious manual labor and/or extensive amounts of time and resources.

AI has proven useful in logistics automation, public and private sector decision making, healthcare, finance, predictions and data analysis, marketing and politics. In its simplest form, AI can be a chat bot that works in customer service, guiding your purchasing decisions at online stores by suggesting products. The more complicated AIs, on the other hand, can analyse big data sets and create suggestions and predictions that guide the business decisions of massive global enterprises.

What are we talking about when talking about AI?

Artificial intelligence refers to computer systems performing tasks that are normally attributed to human intelligence, such as visual perception, speech recognition, decision-making and language translation.

Unlike humans however, machines are able to analyse and take into account massive amounts of data, and provide predictions and suggestions quickly and effectively. And unlike "regular" computer programs, AI is able to learn and adapt based on the information it is given.

Of course, this raises the question of what happens when AI is being used for automated decision making without a human mediator. It is no wonder that as a topic, ethics of AI has gained massive public and private interest. This has already resulted in various projects seeking to create guidelines for using AI in the most ethically sound ways possible.[1] Despite these efforts, no binding international legislation currently exists. This makes AI a bit of a Wild West. For example, privacy policies are often a legally unclear area when it comes to how these technologies can be utilised.

Biased AI has been another concern. What happens when AI is taught (or it learns) to appropriate human biases, the very ones that make our world so problematic? AI can only be as smart (and biased) as the data sets it is fed. In order to create insights and suggestions, AI would need to understand the messy contexts that affect human biases on a daily basis.

Before the algorithms do their magic, the data might, in many cases, need human intervention before it can be fed into autonomous systems. This might mean anything from cleaning up the data to building algorithms that are taught to avoid biased analysis. However, it is impossible to totally avoid bias. Sometimes, this means that humans have to define it case by case – and see if it can be countered so that the data produced is still valid for the purpose. This,

too, is rooted in cultural concepts of moral and ethics, which are often not universal.

As an example, automated recruiting programs could end up only suggesting applicants that fit the same mould as the people who have gotten hired before. When aiming for diversity and inclusivity, this type of automation can obviously be dangerous.

At Taiste, we believe in creating a better world through design, development and human insight. This inspired us to create this research report: to better understand the environment where our own and our clients businesses, services and technologies exist – and share what we've learned.

Moreover, AI being a hot topic, we wanted to shed light into an area that is currently not discussed as broadly: how the general public actually perceives AI and its trustworthiness.

After all, general population's level of trust (and mistrust) towards technology has an effect on how companies might want to design their services in the future.
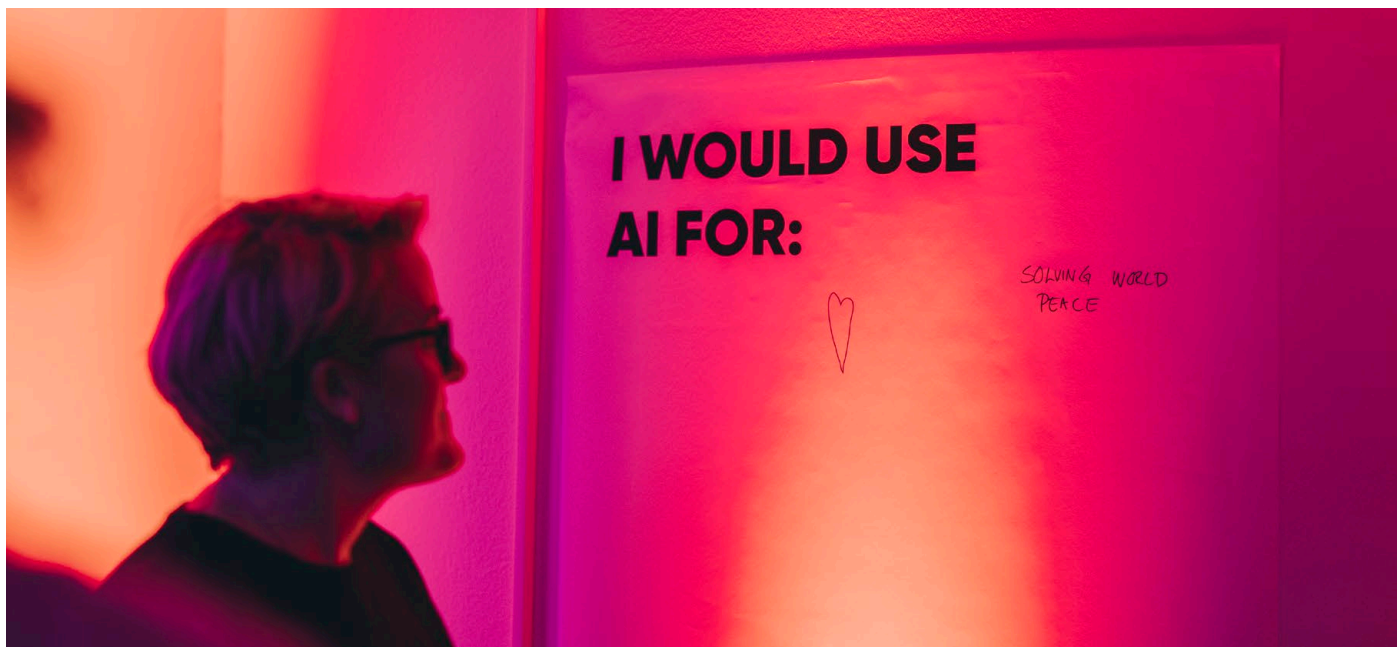
TRUSTING AI IS A "LEAP OF FAITH" — OR IS IT?

What if AI could become more intelligent and even morally "better" than humans if we teach it to avoid human biases? Would it be more human than us humans? We have our history, our legacies, emotions, social connections, hierarchies and dependencies that often defy logic. What if future AI was capable of making decisions and judgments based on moral values and cultural beliefs, and could help us navigate in this messy human world (as researcher Timo Honkela suggests in his 2018 book titled "Rauhankone")?

Big international tech companies, such as Facebook, Twitter, Google or Apple have failed to foster a culture of trust during the past years. Information leaks, political influencing, distribution of hate speech, fake news and data breaches have resulted a world of uncertainty, a world without trust.

Trust is crucial wherever risk, uncertainty, or interdependence exist, and the future couldn't be more uncertain. Our impact on the environment is unquestionable and we need rapid solutions in order to cut back the carbon dioxide emissions. But how can we change our societies, politics, economics and culture in order to keep up with the speed of technological development? Can we trust that change? Bahmanziari, Pearson & Crosby describe this type of trust towards technology as a "leap of faith".[2]

If we need faith to trust AI, what are the measures we need to form a basis for that faith? In early 2019, Google announced they will form an ethics board for the development of AI at Google. However, merely a week later, Google decided to cancel the board because of the outcry from the public. Over two thousand Google employees signed a petition calling for the removal of one board member, Heritage Foundation president Kay Coles James. The petition was based on her comments about trans people and her organisation's skepticism of climate change. Also, the inclusion of another board member Dyan Gibbens, the CEO of a drone company, divided the employees in terms of using Google AI for applications.

> " Trust is crucial wherever risk, uncertainty, or interdepence exist, and the future couldn't be more uncertain.

These types of liability problems are unfortunate, but excellent examples of how we need to be able to trust the people and organisations behind the regulations and administrations trying to form the ethical backbone for the development of AI.

AI ETHICS AS THE CURRENT HOT TOPIC

Currently, there are many ongoing debates about the ethical use and ethics of AI.[3] In addition to legally binding regulations, there are some general goals that are most often repeated in the discussions:

AI SHOULD BE...

ALLIGNED WITH HUMAN VALUES

Without shared values, there is a risk that algorithms create deductions and results that are not aligned with our societies and cultures.

EXPLAINABLE

The processes of AI deductions and data processing should be made clear in order to understand how the algorithm came to certain conclusions. The use of AI should be explained as clearly as possible to all affected parties.

ROBUST

Attacks on AI-powered systems should be prepared for: everything from data preach, polluting and affecting initial data, as well as stealing algorithms based on output models.

INCLUSIVE

Our world is inherently biased, but AI should not create more biases.

TRANSPARENT

Transparency does not only refer to the design, testing, development and use of AI-solutions, but also documenting deployments and maintenance in order to create an audit-friendly systems.

ACCOUNTABLE

Companies are eligible for GDPR compliance, but without transparent and explainable AI it is impossible to hold AI-solutions accountable.

> "Even if we do not share the same ethical framework, we need to speak the same language in AI Ethics. For example — what exactly does it mean to "trust" AI?
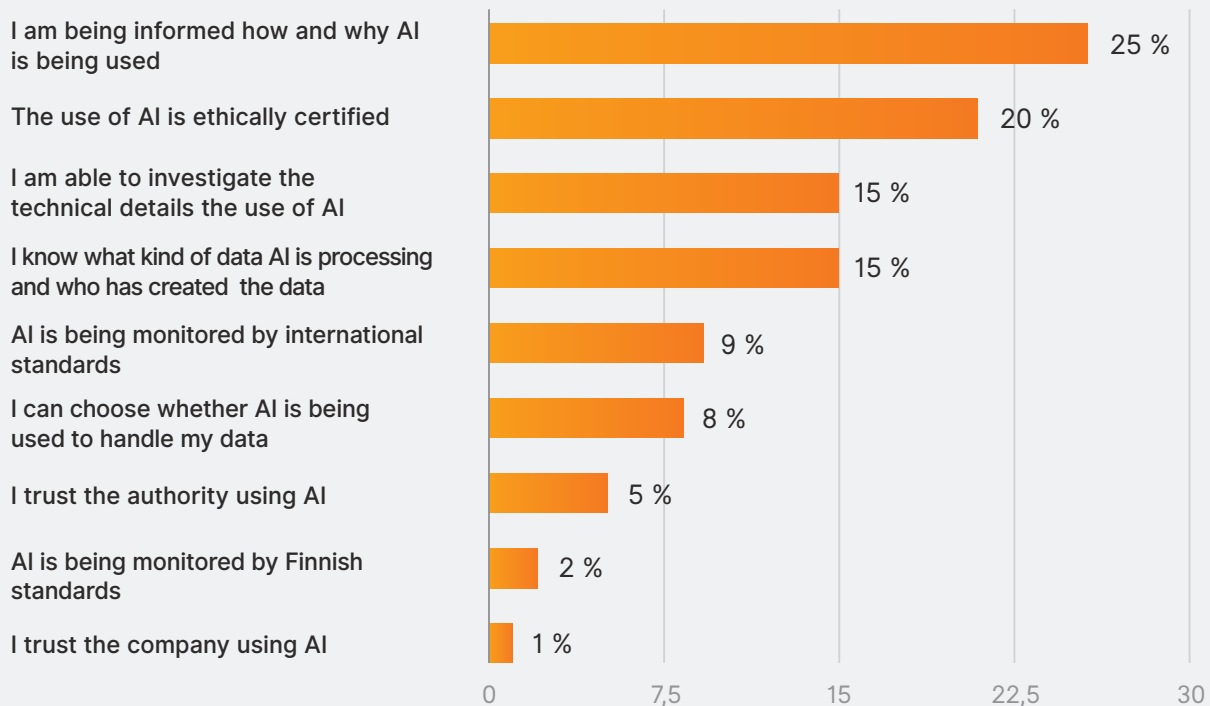>
> **-Catalina Butnaru**

In our study, we found that the top two important factors increasing trust towards AI would be 1) being informed why and how AI is used (25%) and 2) that the use of AI has been ethically certified (20%).

AI and technology scholar Joanna Bryson has noted that AI itself shouldn't be trusted at all, since it is merely a software performing tasks. Instead, we need to trust the organisations and regulators that enable the existence, development and deployment of AI.[4] Moreover, we need to be able to trust the people behind the ethics boards[5], and business, design and development teams responsible of creating the AI solutions.

Which of the following options would increase your trust towards AI?

Option	Percentage
I am being informed how and why AI is being used	25 %
The use of AI is ethically certified	20 %
I am able to investigate the technical details the use of AI	15 %
I know what kind of data AI is processing and who has created the data	15 %
AI is being monitored by international standards	9 %
I can choose whether AI is being used to handle my data	8 %
I trust the authority using AI	5 %
AI is being monitored by Finnish standards	2 %
I trust the company using AI	1 %

"NOT ALL ROBOTS" – MEDIA ROBOTISES AI

In media, AI often has a strong connotation with robotics. This is especially evident when looking at the illustrations, stock photos and other visualisations used in media and marketing that promote or discuss the use of AI. AI is not the easiest concept (nor solutions dependent on it) to market or visualise, but using robots is extremely problematic in terms of context-dependent memory.

The human brain responds and processes visual data much better than any other type of data. Scholars have found that the human brain can actually process images 60,000 times faster than text, and 90% of all data processed by our brains is visual (6). When using robots as a visual symbol for AI, we are dangerously misleading the context-dependent memory of the public: people begin to associate AI with robotics or human-like features. According to our study, public media has a major effect (49%) on people's experience of trust towards AI.

Anthropomorphism is the human tendency to attribute human tendencies to non-human entities. It is an especially useful concept when discussing AI.

As UX professionals, we are also responsible in creating delightful user-experiences that turn the experience of interacting with complicated technologies and systems into something mo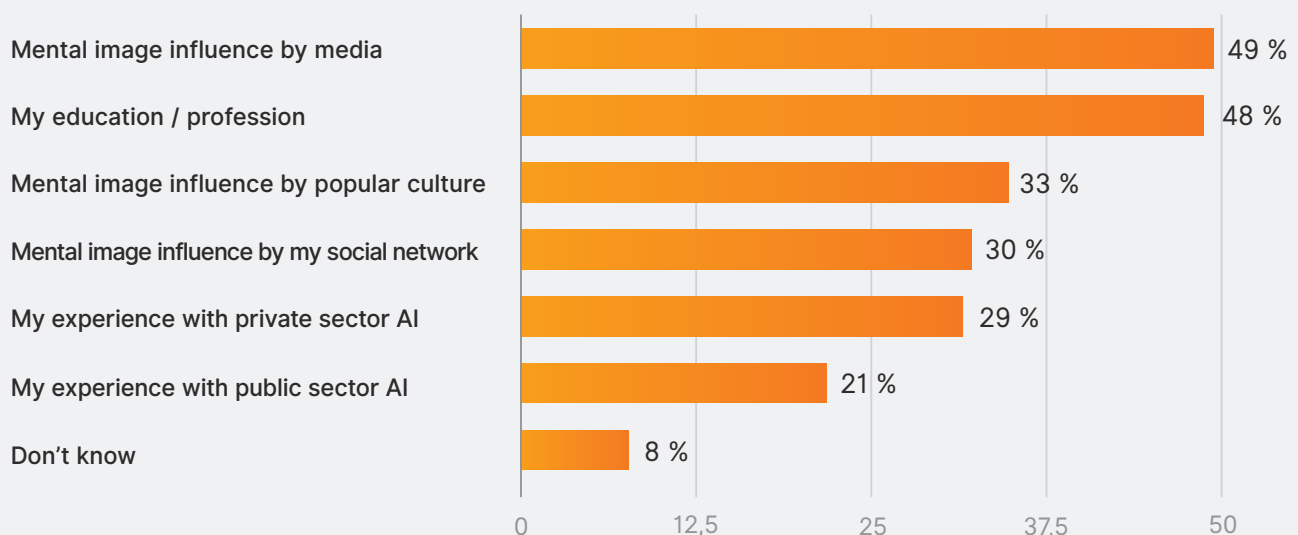re tangible. However, designing AI solutions that appear as and communicate as humans may also, in many cases, be misleading – it might make the user trust their decisions and suggestions too easily.

> "
> Trust is very fickle and in limited supply. Once broken, it will affect all players in the tech ecosystem, not just one.
>
> **- Catalina Butnaru**

Regarding this, MIT professor Sherry Turkle has presented the notion of "alive enough". It refers to being more conscious of the ways we design user interfaces for tech solutions – they should only be made to feel "alive enough" for the purpose they need to fill. While it may be reasonable to design elderly care robots to have human-like appearances and voices, the non-human qualities of the AI should probably be a bit more transparent when it comes to many other applications.[6] Finding a balance between an uncannily[7] human-like servant and a cold machine overlord is an important part of creating the tone of voice or visual appearance for an artificial intelligence.

Which of the following affect your **feeling of trust** towards AI?

Category	Percentage
Mental image influence by media	49 %
My education / profession	48 %
Mental image influence by popular culture	33 %
Mental image influence by my social network	30 %
My experience with private sector AI	29 %
My experience with public sector AI	21 %
Don't know	8 %

IMPACT ON HUMAN RELATIONSHIPS

Technology changes human behaviour and human behaviour changes technology. It is never a separate nor even a linear process, but both sides of the story are deeply affected by each other. Since current AI applications often need a human mediator, we were inspired to examine the attitudes towards AI becoming more of a companion than a tool. To what extent would people be willing to accept AI as an individual or a person?

In October 2017, Sophia the Robot was the first robot to receive citizenship of a country. A month later, the United Nations Development Programme also nominated Sophia as the first ever Innovation Champion – also making it the first non-human to be given a United Nations title.

"COULD AI MAKE US LESS PRODUCTIVE AND ETHICAL?"

"In yet another experiment, this one designed to explore how AI might affect the "tragedy of the commons"—the notion that individuals' self-centred actions may collectively damage their common interests—we gave several thousand subjects money to use over multiple rounds of an online game. In each round, subjects were told that they could either keep their money or donate some or all of it to their neighbours. If they made a donation, we would match it, doubling the money their neighbours received. Early in the game, two-thirds of players acted altruistically. After all, they realized that being generous to their neighbours in one round might prompt their neighbours to be generous to them in the next one, establishing a norm of reciprocity.

From a selfish and short-term point of view, however, the best outcome would be to keep your own money and receive money from your neighbours. In this experiment, we found that by adding just a few bots

(posing as human players) that behaved in a selfish, free-riding way, we could drive the group to behave similarly. Eventually, the human players ceased cooperating altogether. The bots thus converted a group of generous people into selfish jerks.

All of this could end up transforming human society in unintended ways that we need to reckon with as a polity. Do we want machines to affect whether and how children are kind? Do we want machines to affect how adults have sex?"
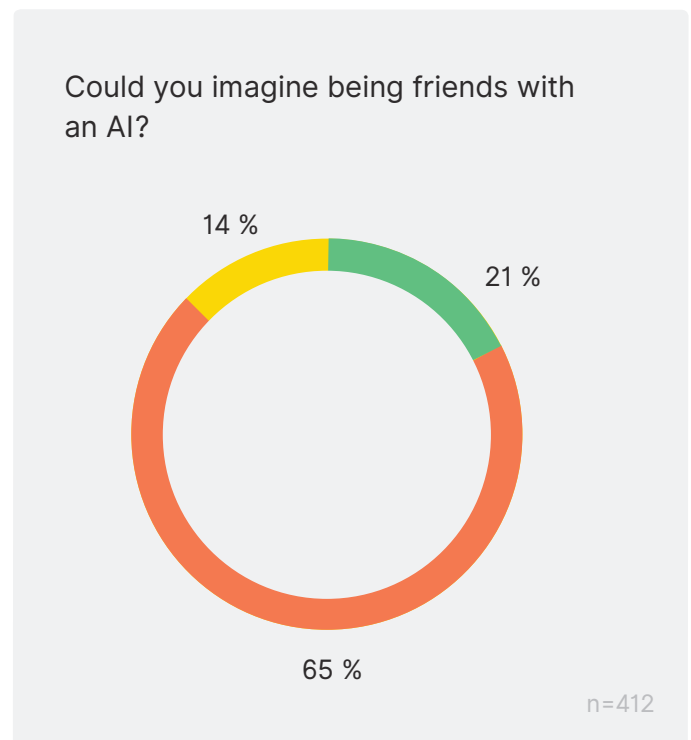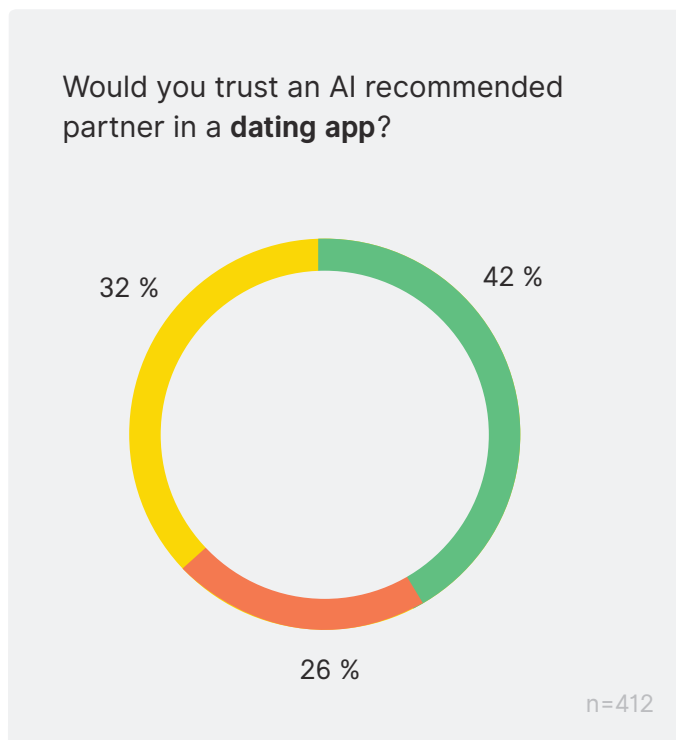
- Nicholas A. Christakis, The Atlantic

https://www.theatlantic.com/magazine/archive/2019/04/robots-human-relationships/583204/

When asked whether they could imagine becoming friends with or having a romantic relationship with an AI, 42% of our respondents said they would trust a dating app to recommend a partner, but 65% of them still couldn't see themselves befriending an artificial intelligence. 91% of the respondents in our study could not imagine becoming romantically involved with an AI. That being said, a broader research report by Havanas from 2017 declares that actually 27% of millennials would consider dating a robot.[8] We might not be that far away from the realities of scifi movies such as "Her" (2013) and television series such as "Westworld" (2016–), after all.

However, our results need to be placed in cultural context. In Japan, for example, the use of dating simulations has been popular since the 1980s, despite the controver-

siality in terms of their effects on alienated and marginalised individuals who already have difficulties maintaining and creating human relationships.[9]

A similar "alienation" discourse has been used in Finnish elderly care, where remote video access has been one of the most popular solutions to increase the opportunities to live at your own home as long as possible, as well as to cut back the expenses of nurse home visits.[10]

Would you trust an AI recommended partner in a **dating app**?

42 %

32 %

26 %

n=412

Could you imagine being friends with an AI?

14 %

21 %

65 %

n=412

● Yes   ● No   ● I don't know

FINALLY, CAN WE TRUST AI?

Despite the qualitative limits of the survey, we were excited to find that majority of the respondents felt optimistic about AI (57%). Understandably, there was also doubt (56%), but also excitement (53%). This can be interpreted so that the respondents of our survey see AI as a positive opportunity, and are realistic about its opportunities.

As social animals, we need trust. Trust is the basis of all human interaction, but in a world run by technology, we need to also be able to trust the technologies we use.

We need to trust that banks keep our money safe and the transactions are successful. We need to trust that our messages really get sent, that our working hours get recorded, that our files really get downloaded & uploaded, that our devices perform the tasks we expect of them, without unexpected failures.

Moreover, we need to trust that the people who build the technology we use are trustworthy, despite the fact that technology has also led to wars, misery and pain. Technology is a two-edged sword, able to do both good and bad, depending on the intentions of the people creating and using it.

As Ethics Designer Minna Mustakallio puts it: "Data doesn't do anything. We need to stop talking about data having an agency. It is always people-driven, despite the algorithms behind the process."

The same statement holds true for AI.
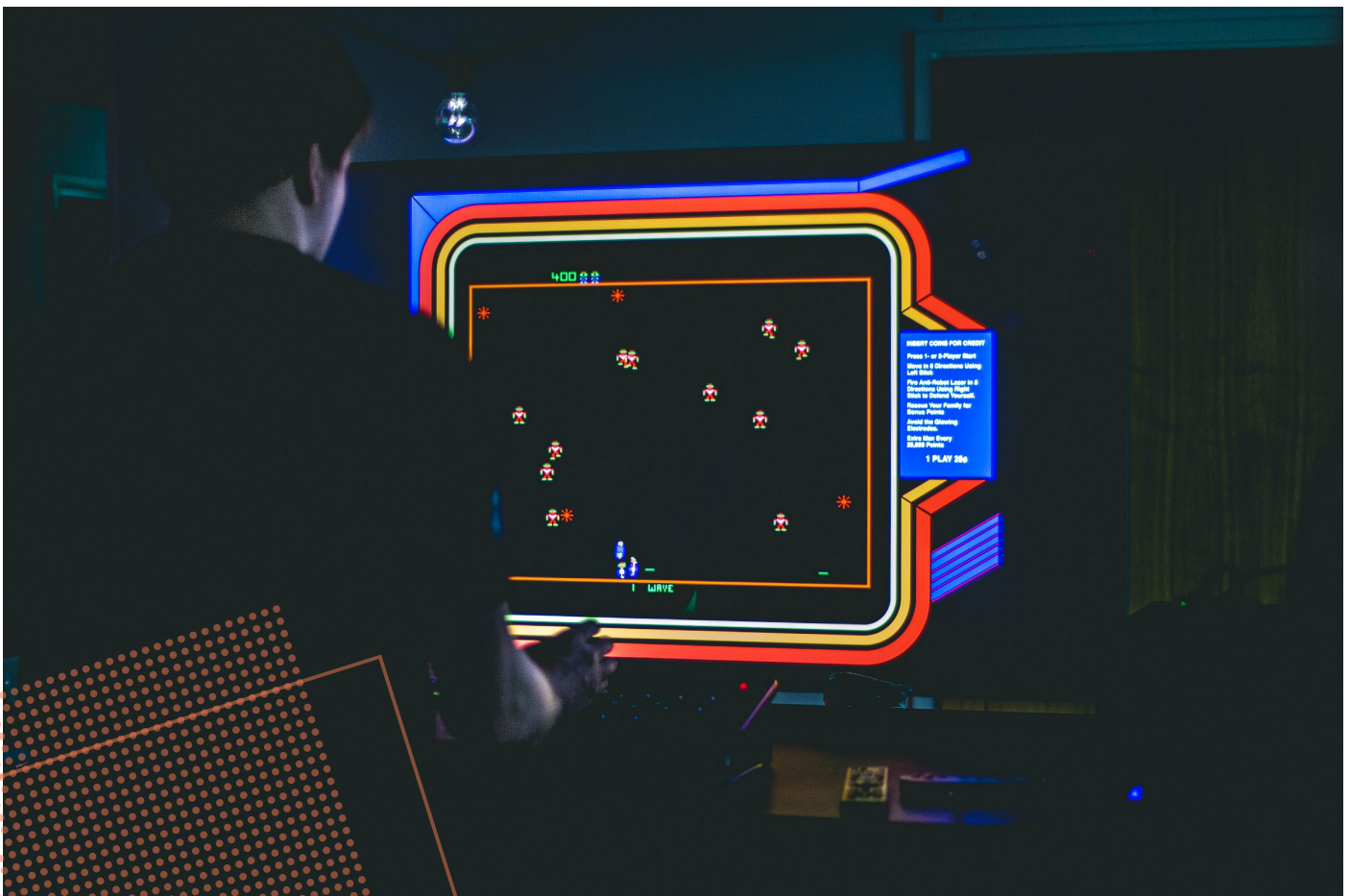
HOW TO READ THIS REPORT

Technology is not born in a vacuum, and nor was this report. In order to better understand how people trust and don't trust AI, we launched online surveys in spring 2019. The total amount of respondents in our study was 411 individuals, consisting mostly of people living in the major cities of Southern Finland. Almost three quarters of the respondents were women (71%). The age distribution of the respondents was dominated by young adults: the majority were between ages 25–44 (68%). 40% of the respondents were graduates or had a vocational qualification and 32% had a bachelor's degree. 19% had an undergraduate degree from a university.

In order to provide some context for the statistical data, we combined the results with other research reports and literature on the subject, and we hope this has resulted a research report that can help you make sense of the ways in which general public understand and trust AI in public and private contexts. Especially now, when the AI hype train is running at maximum speed.

In terms of who might benefit from the results, we had at least two groups in mind: firstly, the people working in organisations and companies who are currently jumping on the AI wagon. Secondly, people working on AI-solutions from perspectives of design, development, research and business.

On the other hand, the results should prove insightful to just about anyone interested in the topic of how context and culture affect trust.

What do you think?

Did this report help you to understand the contextuality of AI better? Do you have something to add or further questions? Please let us know and send your thoughts by emailing us:

anna.haverinen@taiste.com
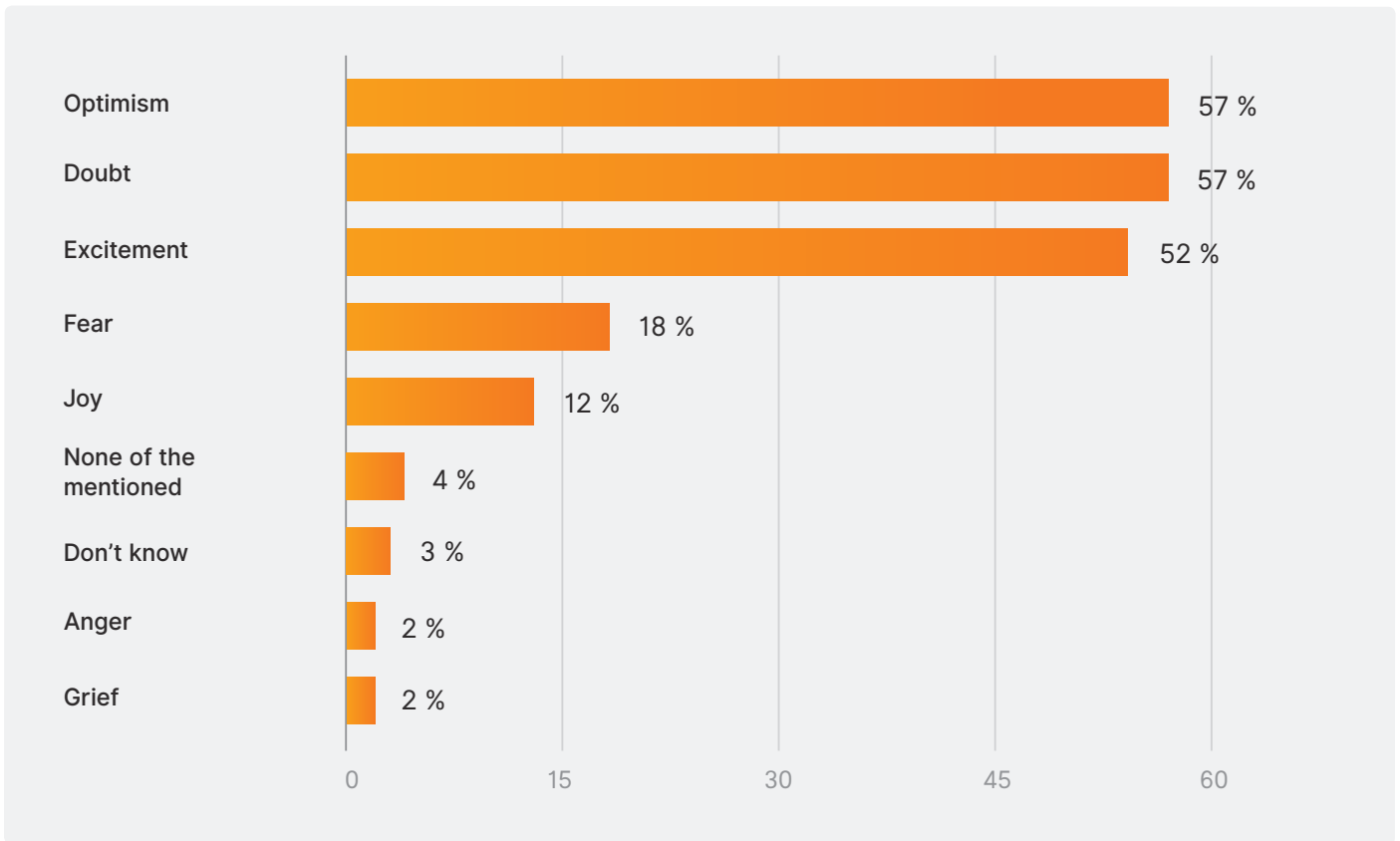suvi.kava@taiste.com

RESULTS

GENERAL

TOP 3 EMOTIONS

The top three emotions triggered by AI were **optimism** (57 %), **doubt** (57 %) and **excitement** (52 %).

Emotion	Percentage
Optimism	57 %
Doubt	57 %
Excitement	52 %
Fear	18 %
Joy	12 %
None of the mentioned	4 %
Don't know	3 %
Anger	2 %
Grief	2 %

CURRENT TRUST

Current trust towards AI was mostly rated **7** or **6** (48% of answers) in a scale from 0 to 10.

How would you rate your trust towards AI currently in a scale from 0 to 10?

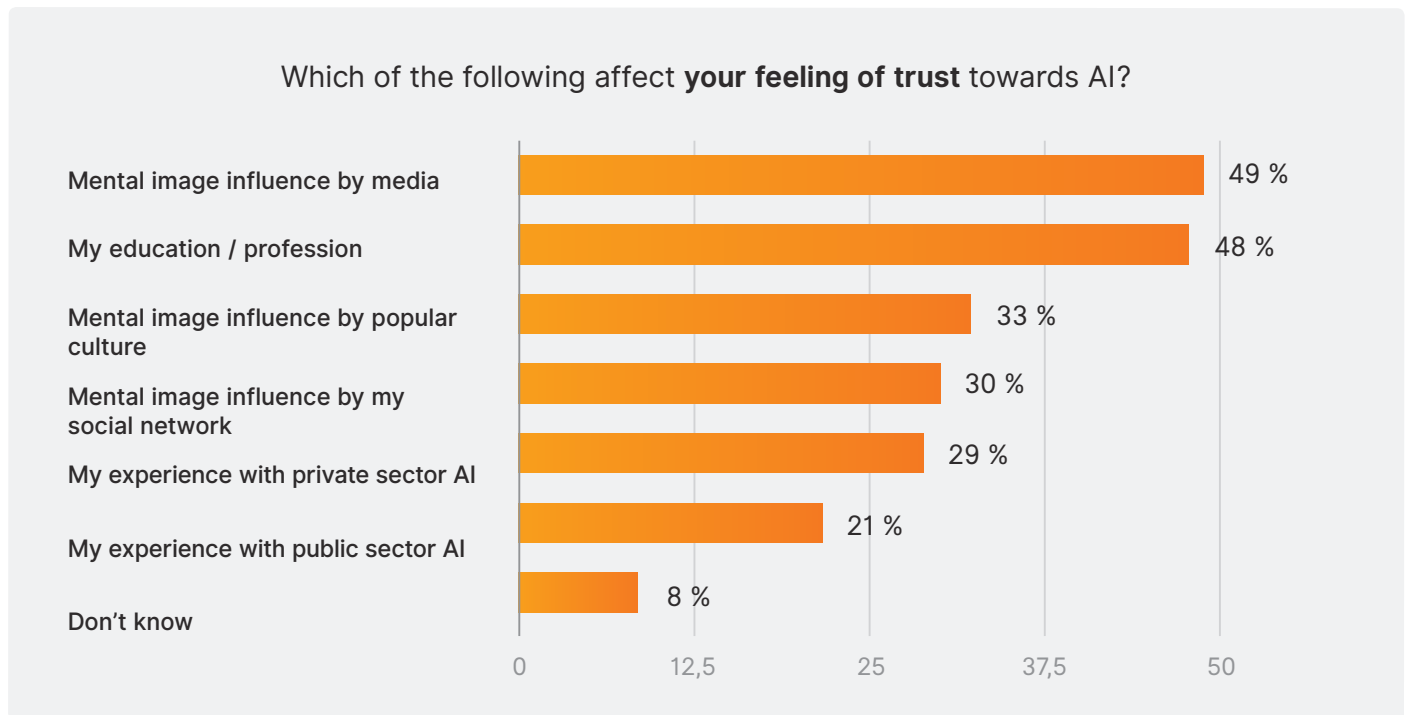| Rating	Percentage
0	1 %
1	1 %
2	4 %
3	7 %
4	6 %
5	13 %
6	23 %
7	25 %
8	14 %
9	3 %
10	2 %
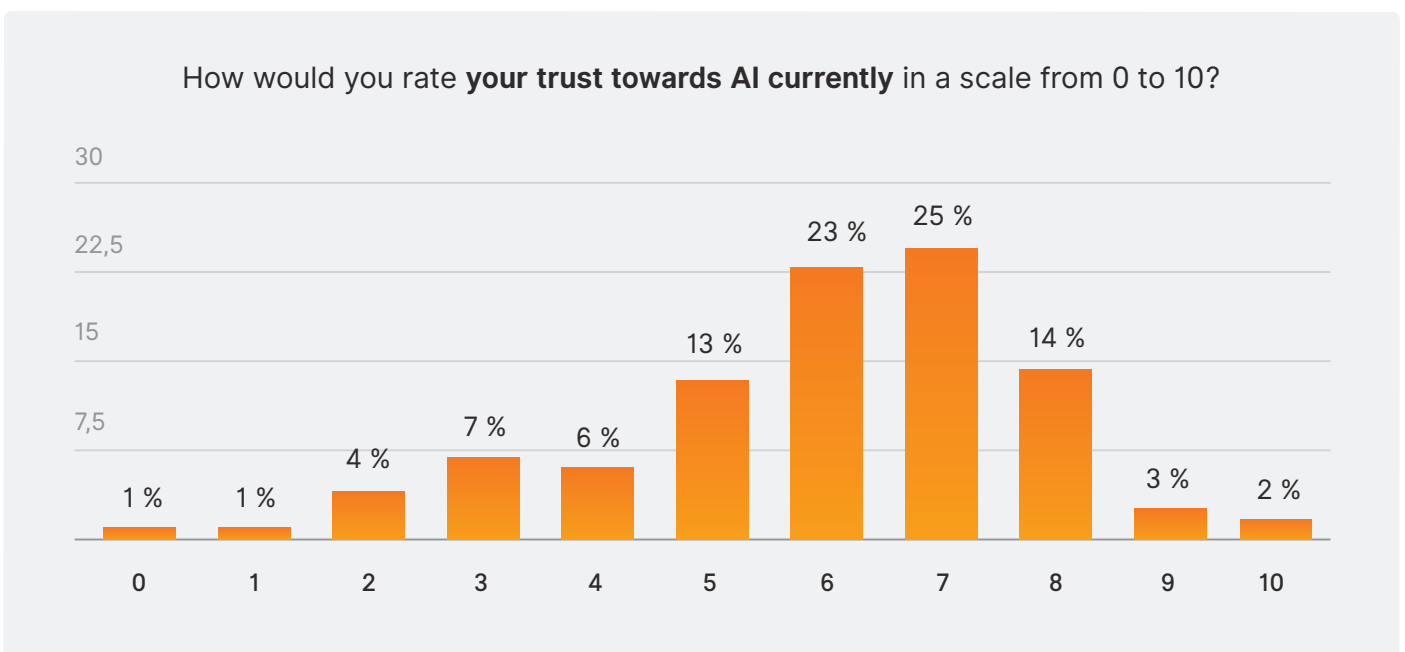
MEDIA AFFECTS THE WAY PEOPLE TRUST AI

Top three factors affecting the feeling of trust towards AI were **mental image influences by media** (49%), **education or profession** (48%), and **popular culture** (33%).
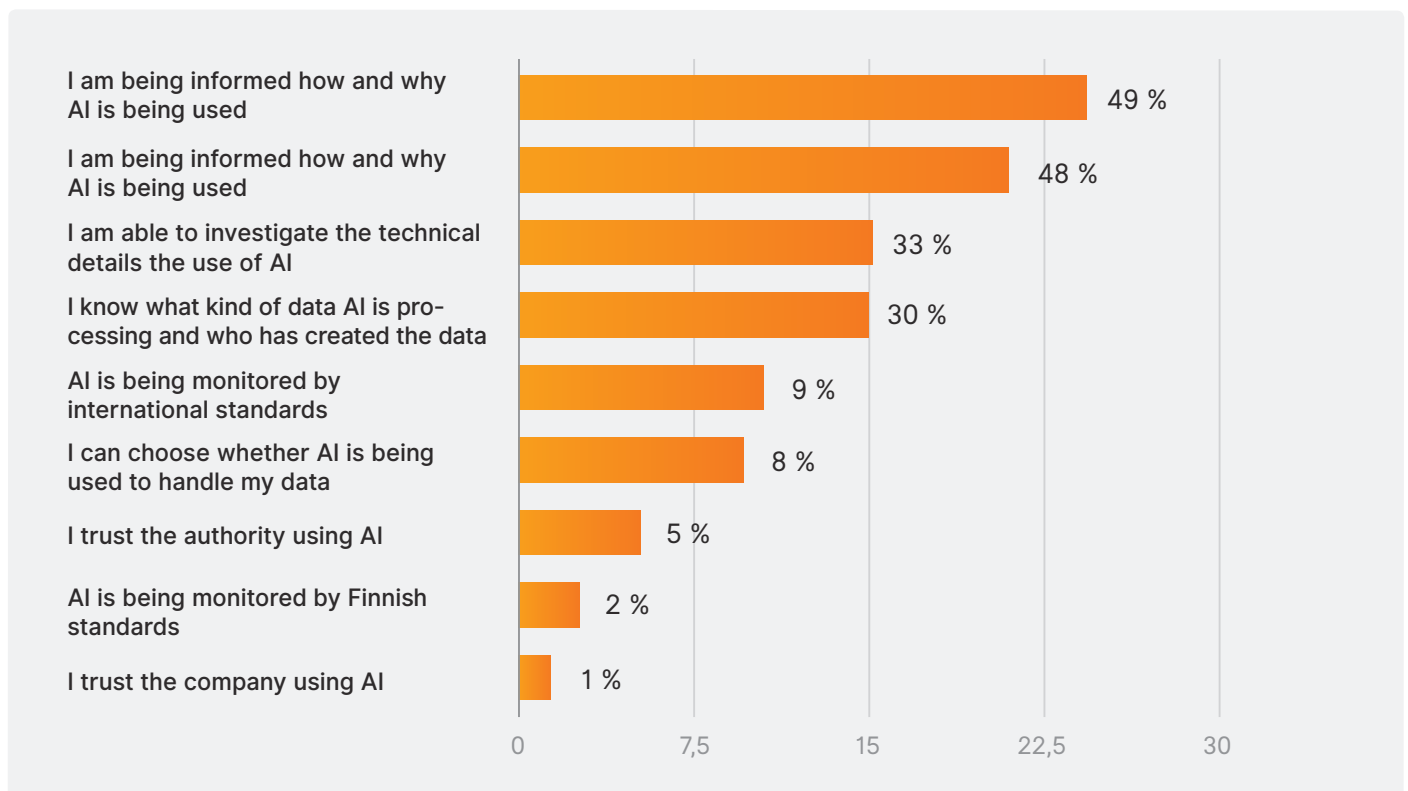
Which of the following affect **your feeling of trust** towards AI?

Mental image influence by media	49 %
My education / profession	48 %
Mental image influence by popular culture	33 %
Mental image influence by my social network	30 %
My experience with private sector AI	29 %
My experience with public sector AI	21 %
Don't know	8 %

TRUST IN AI

The most important factors that would increase trust towards AI would be 1) **being informed why and how AI is used** (25%) and 2) **that the use of AI has been ethically certified** (20%).

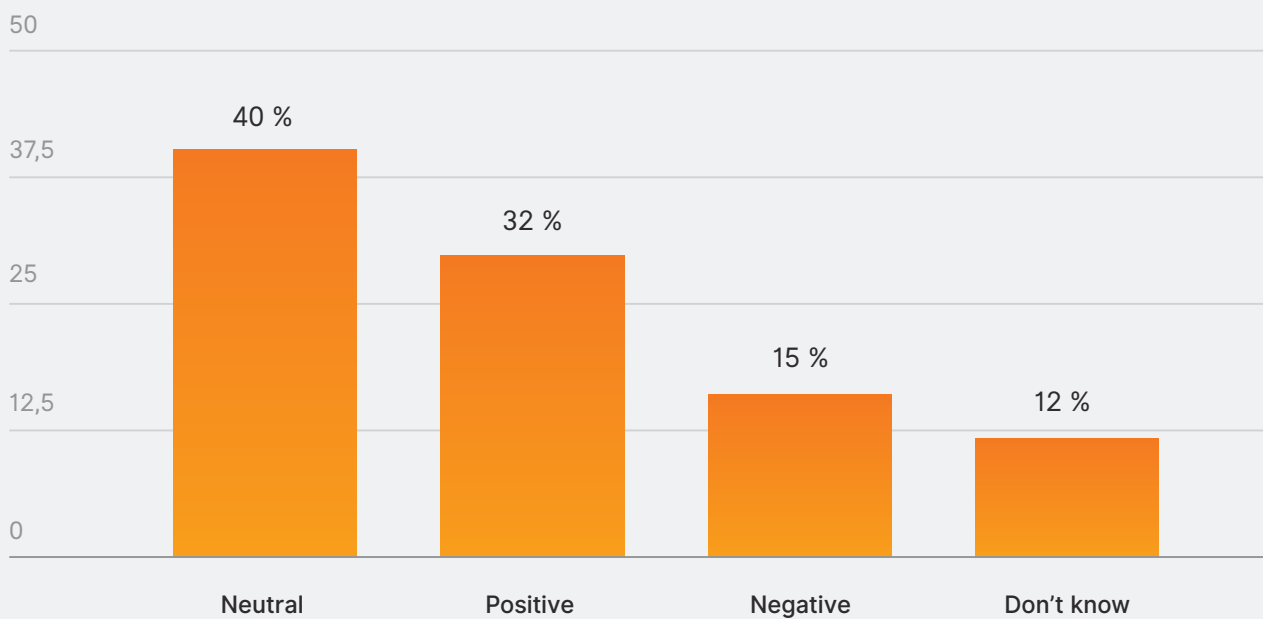|	
I am being informed how and why AI is being used	49 %
I am being informed how and why AI is being used	48 %
I am able to investigate the technical details the use of AI	33 %
I know what kind of data AI is processing and who has created the data	30 %
AI is being monitored by international standards	9 %
I can choose whether AI is being used to handle my data	8 %
I trust the authority using AI	5 %
AI is being monitored by Finnish standards	2 %
I trust the company using AI	1 %

BOTH PRIVATE & PUBLIC SECTOR ARE TRUSTED TO USE AI

n=410

How do you feel about **public sector** applying AI in their decision making processes?

	Neutral	Positive	Negative	Don't know
%	40 %	29 %	17 %	14 %
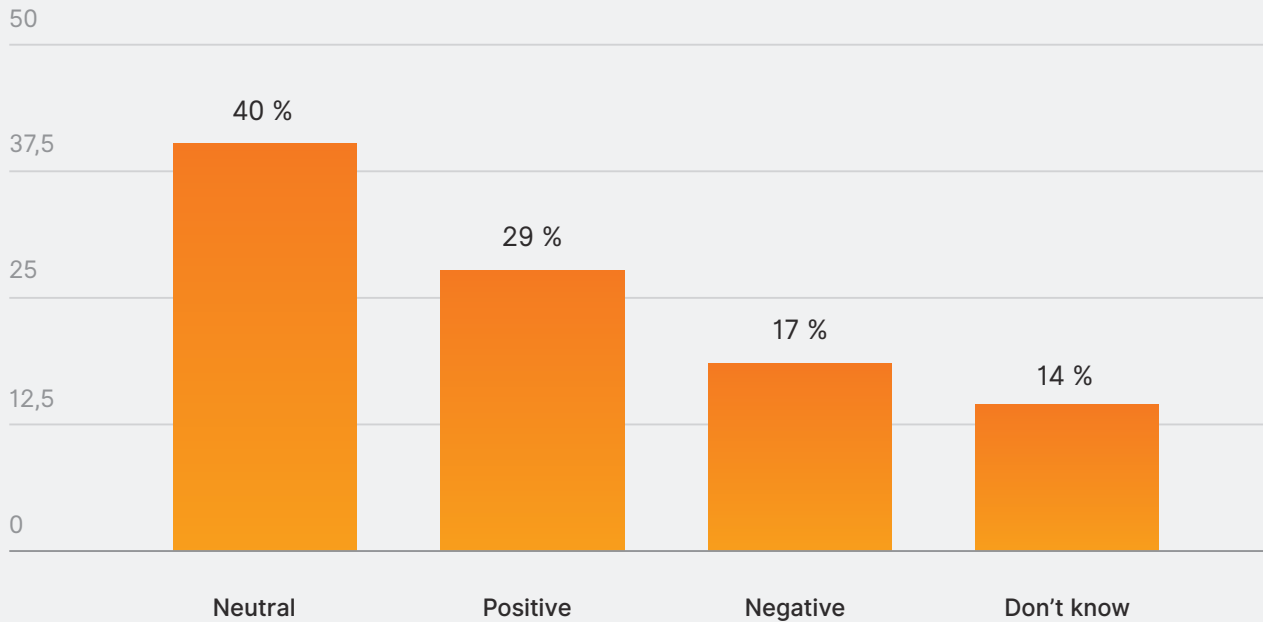
How do you feel about **private sector** applying AI in their decision making processes?

	Neutral	Positive	Negative	Don't know
%	40 %	32 %	15 %	12 %

n=411

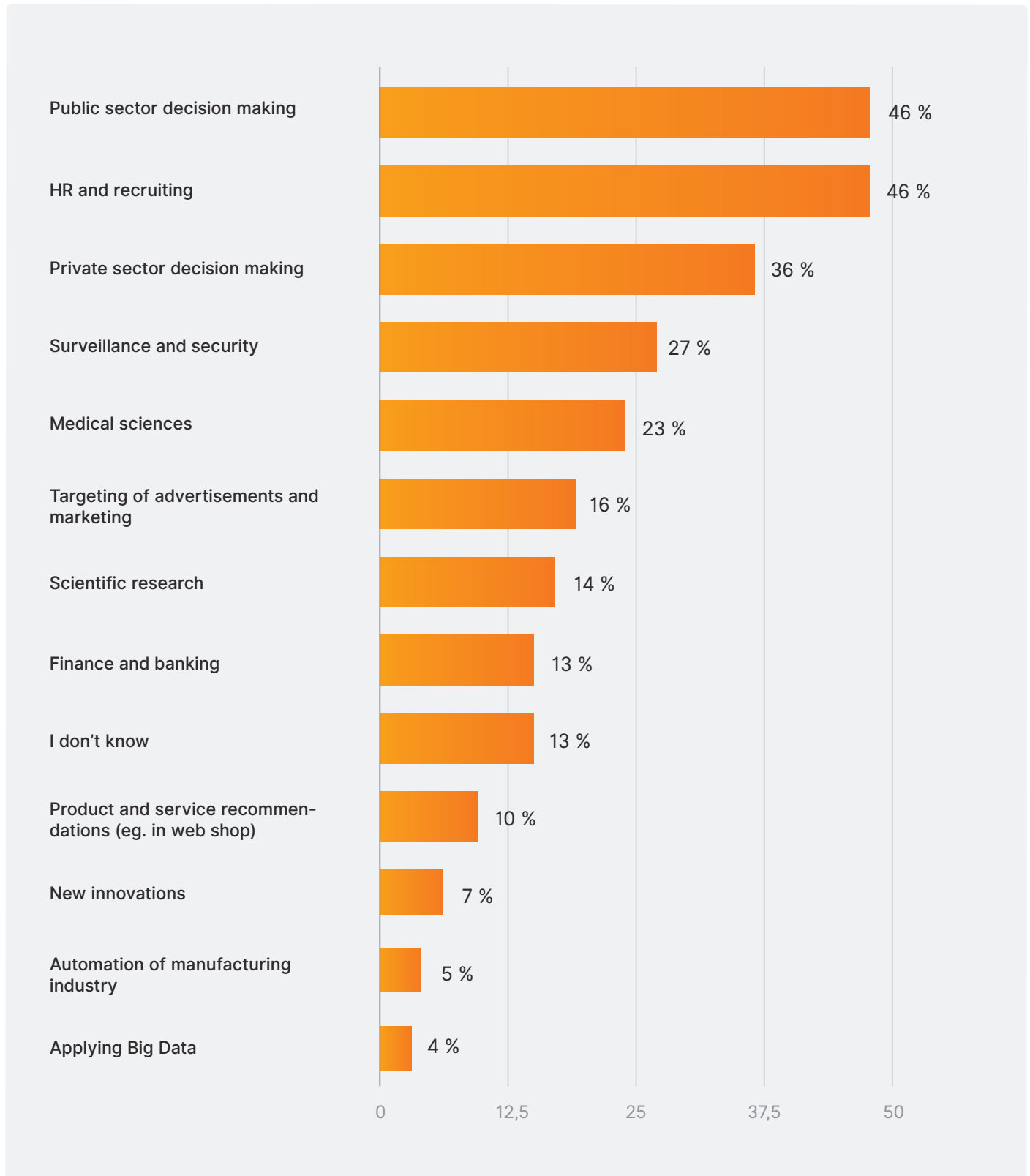# BIG DATA IS THE MOST TRUSTED AREA FOR THE USE OF AI

Big data applications (68 %), **automation of manufacturing industry** (56%), and **new innovations** (52%) were considered as the best areas for applying AI technologies.

Area	%
Applying Big Data	68 %
Automation of manufacturing industry	56 %
New innovations	52 %
Product and service recommendations (eg. in web shops)	50 %
Surveillance and security	44 %
Medical sciences	42 %
Scientific research	41 %
Targeting of advertisements and marketing	39 %
Finance and banking	27 %
Public sector decision making	15 %
Private sector decision making	12 %
HR and recruiting	9 %
I don't know	4 %

n=412

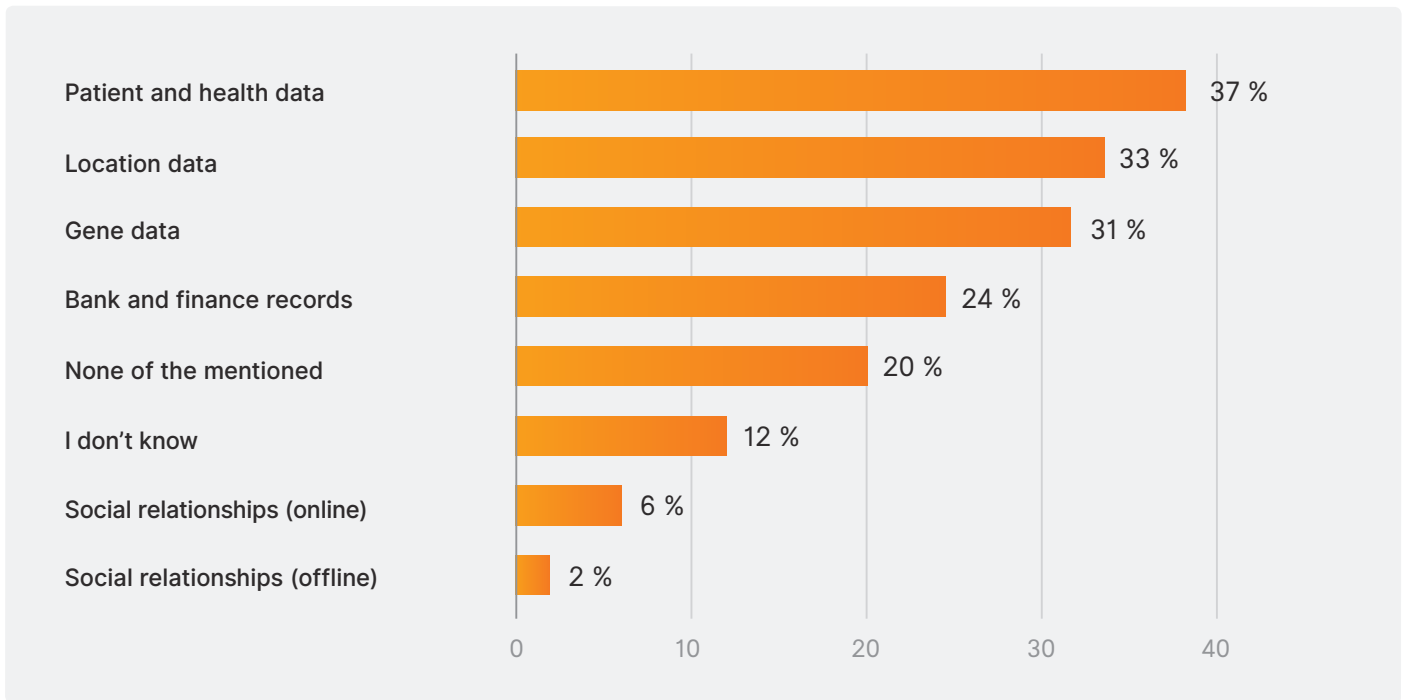# USING AI IN PUBLIC SECTOR DECISION MAKING AND HR GIVES PEOPLE DOUBTS

Public sector decision making (46%), **HR and recruitments** (46%), and **decision making on private sector** (36%) were considered as the worst areas for applying AI technologies.

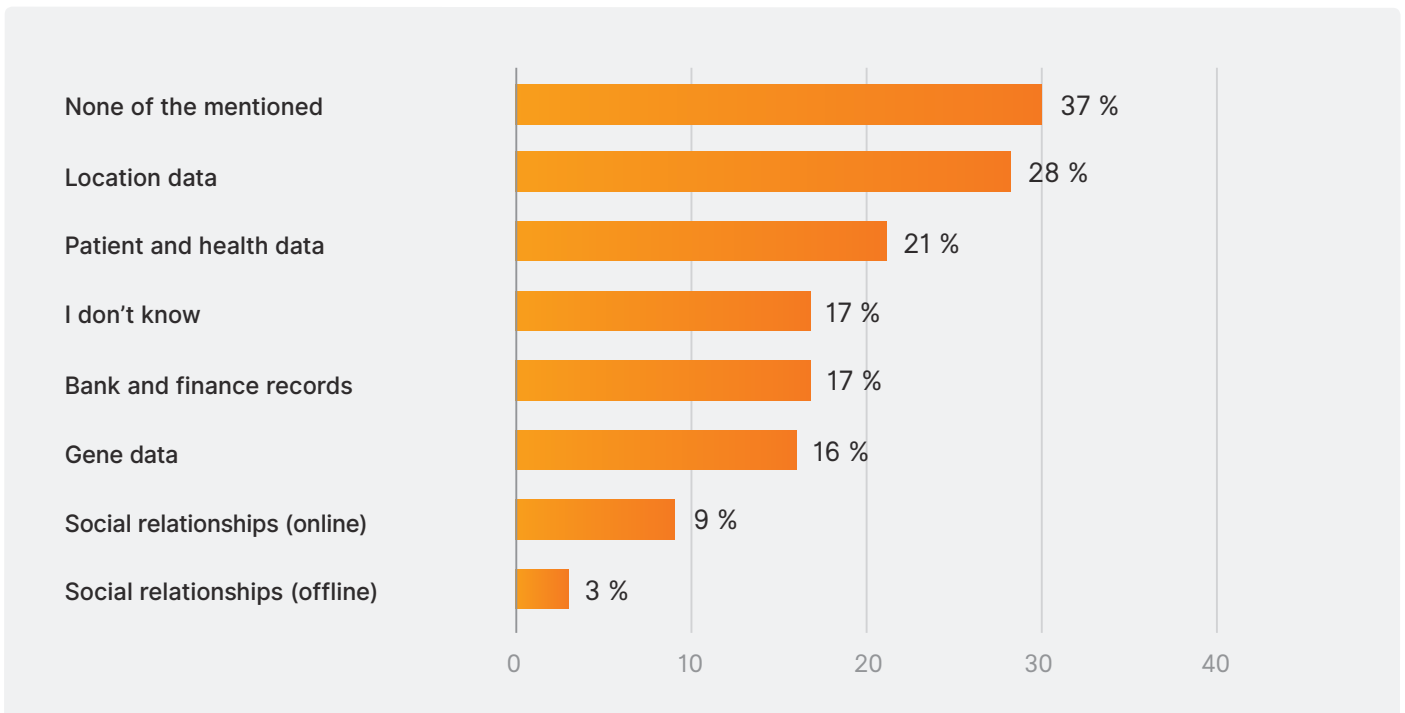| Area	Percentage
Public sector decision making	46 %
HR and recruiting	46 %
Private sector decision making	36 %
Surveillance and security	27 %
Medical sciences	23 %
Targeting of advertisements and marketing	16 %
Scientific research	14 %
Finance and banking	13 %
I don't know	13 %
Product and service recommendations (eg. in web shop)	10 %
New innovations	7 %
Automation of manufacturing industry	5 %
Applying Big Data	4 %

n=409

AI IN PUBLIC SECTOR DECISION MAKING

The data sets that the respondents would allow an AI to process for public sector decision making include **patient and health data** (37%), **location** (33%), and **genome data** (31%).

Category	Percentage
Patient and health data	37 %
Location data	33 %
Gene data	31 %
Bank and finance records	24 %
None of the mentioned	20 %
I don't know	12 %
Social relationships (online)	6 %
Social relationships (offline)	2 %

n=411

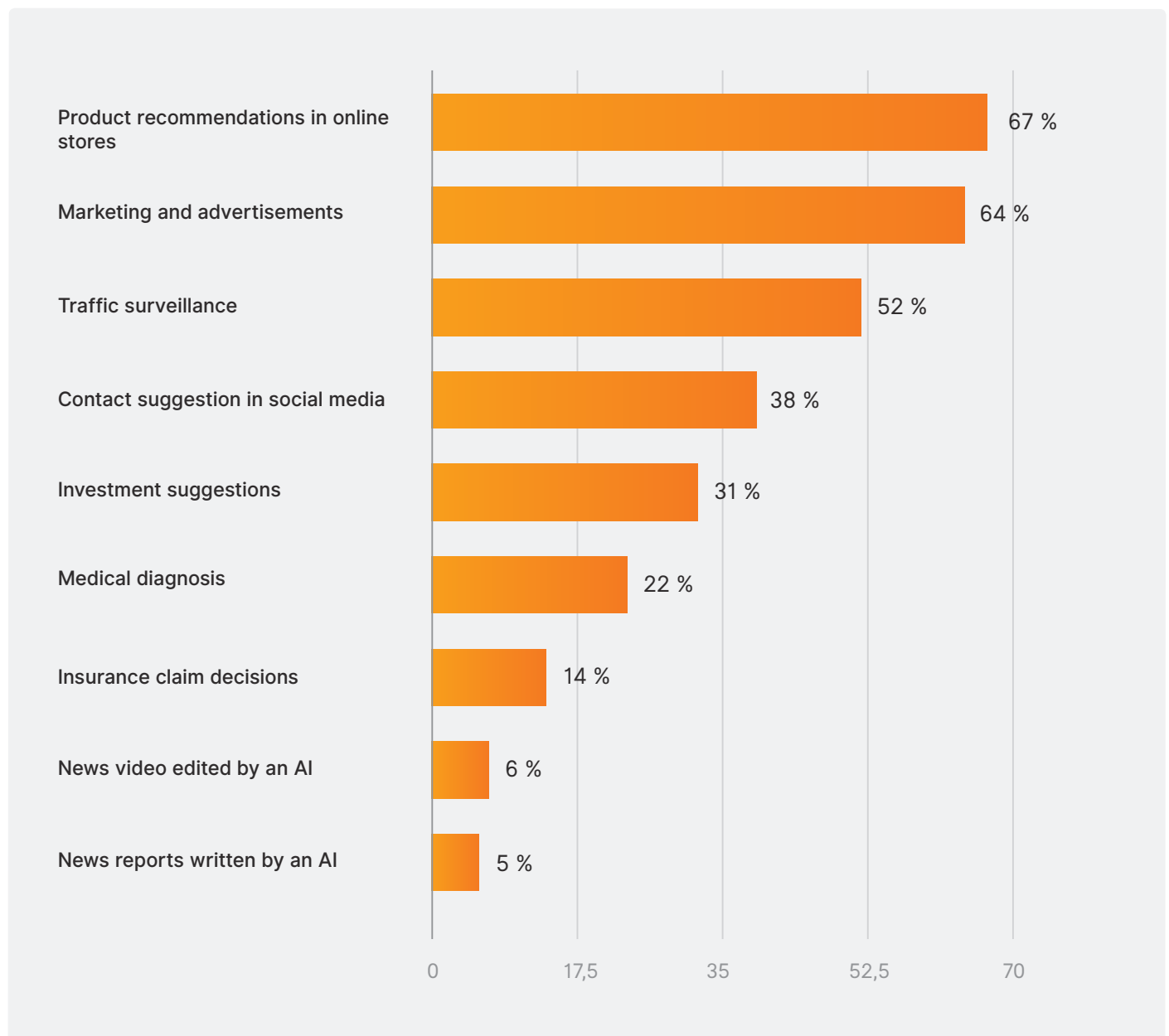# AI IN PRIVATE SECTOR DECISION MAKING

30% of the respondents wouldn't let an AI to process any of the mentioned data sets for private sector decision making. However, 28% would let the AI to process location data and 21% health data.

Category	Percentage
None of the mentioned	37 %
Location data	28 %
Patient and health data	21 %
I don't know	17 %
Bank and finance records	17 %
Gene data	16 %
Social relationships (online)	9 %
Social relationships (offline)	3 %

n=411

THE MOST RELIABLE APPLICATION AREAS OF AI

AI-powered product recommendations in online stores (67%), **marketing and advertisement** (64%), and **traffic surveillance** (52%) were considered as the most reliable application areas for AI.

| Application area	Percentage
Product recommendations in online stores	67 %
Marketing and advertisements	64 %
Traffic surveillance	52 %
Contact suggestion in social media	38 %
Investment suggestions	31 %
Medical diagnosis	22 %
Insurance claim decisions	14 %
News video edited by an AI	6 %
News reports written by an AI	5 %

n=411

RESULTS

RELATIONSHIPS

AI CAN BE A MATCH MAKER

42% of the respondents would trust the recommendation given by AI in a dating app, while 32% were unsure.

Would you trust an AI recommended partner in a **dating app**?

32 %   42 %

26 %

n=412
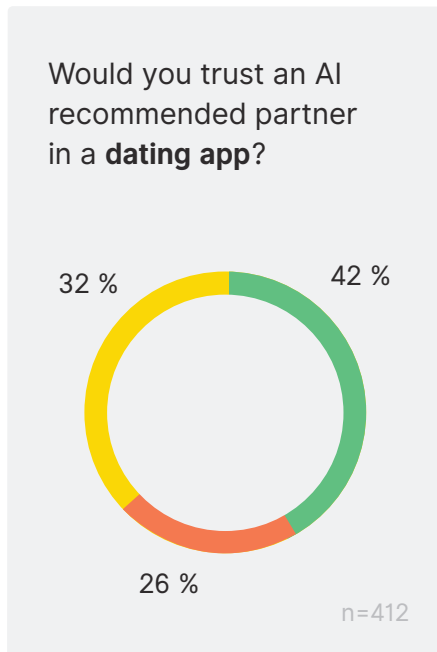
PEOPLE WOULDN'T BE FRIENDS WITH AN AI

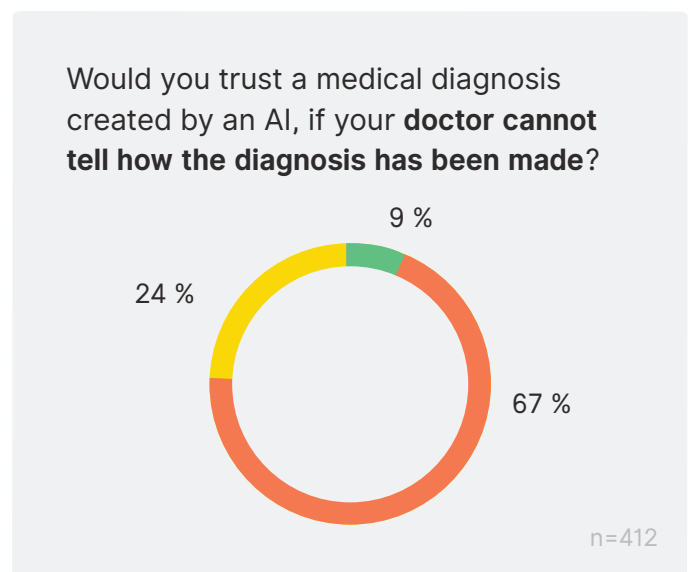65% of the respondents stated that they couldn't imagine befriending with AI, while only 21 % would.

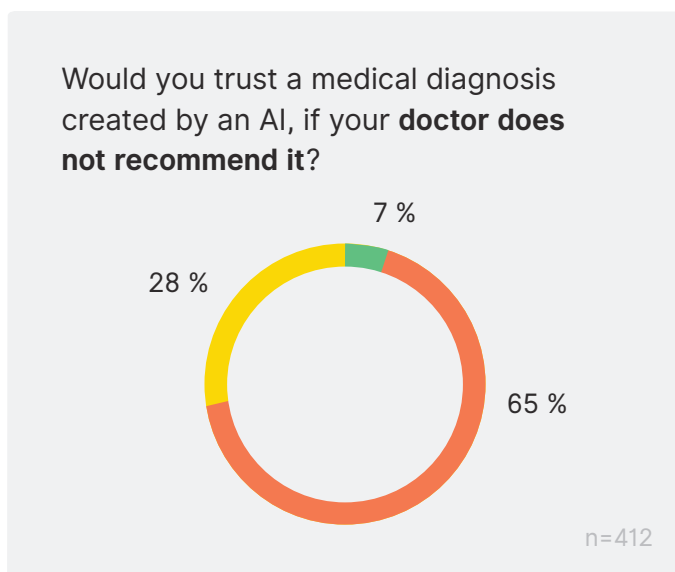## Could you imagine being friends with an AI?

14 %   21 %

65 %

n=412
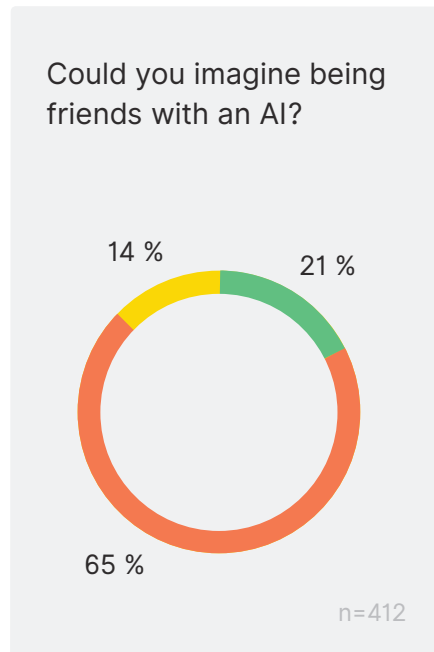
NO ROMANCE OPPURTUNITIES

Majority of the respondents (91%) could not imagine themselves being romantically involved with an AI.

Could you imagine being **romantically involved** with an AI?

6 %   1 %

91 %

n=412
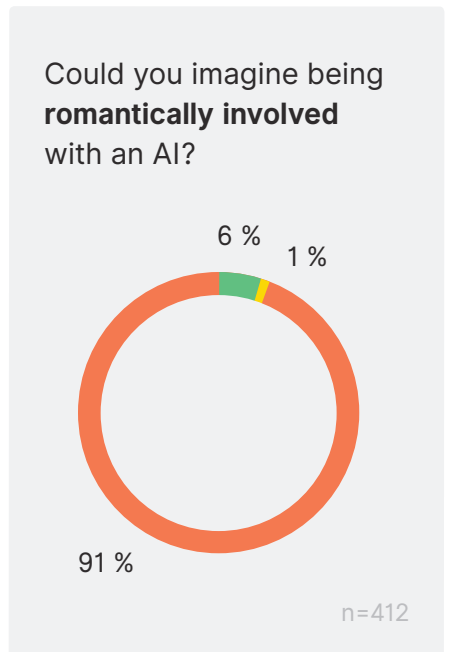
MEDICAL EXPERTISE IS NEEDED WITH AN AI

7% would trust a medical diagnosis created by an AI even if their doctor disagrees with it.
65 % wouldn't trust a medical diagnosis created by an AI if their doctor doesn't recommend it.
67% wouldn't trust a medical diagnosis created by an AI if their doctor couldn't tell how it has been created.
There needs to be a human mediator.

Would you trust a medical diagnosis created by an AI, if your **doctor does not recommend it**?

7 %

28 %

65 %

n=412

Would you trust a medical diagnosis created by an AI, if your **doctor cannot tell how the diagnosis has been made**?

9 %

24 %

67 %

n=412

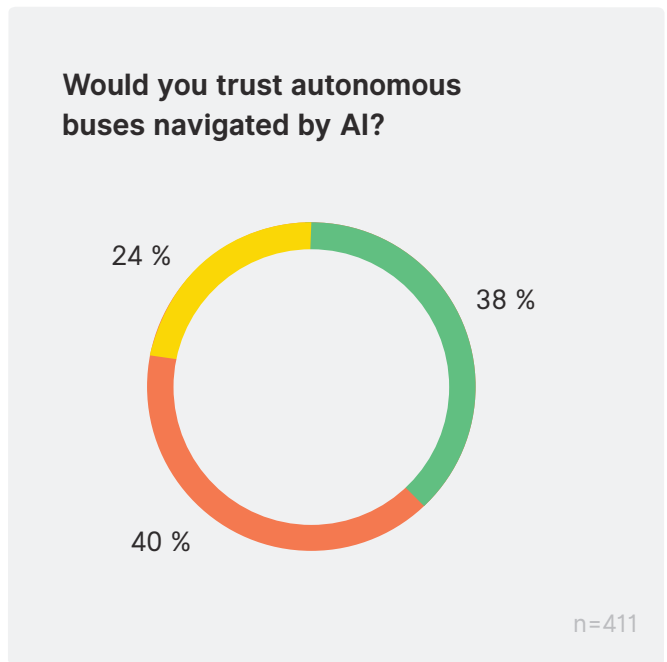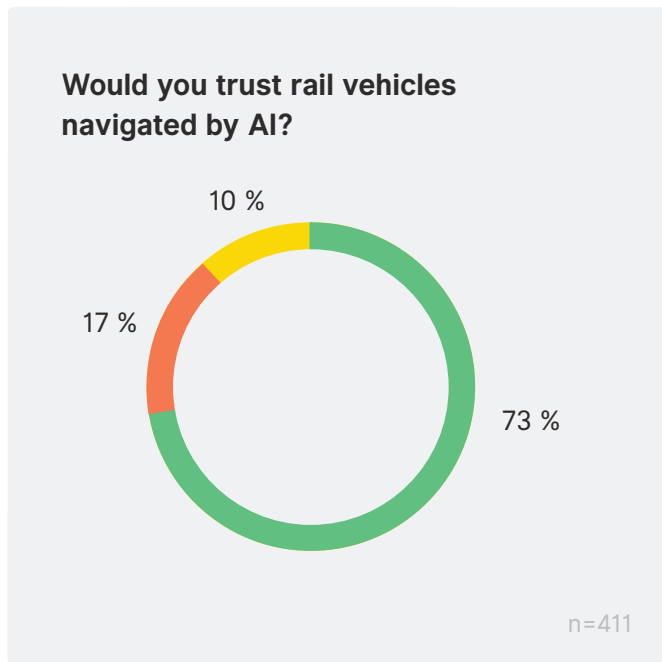● Yes   ● No   ● I don't know

RESULTS

TRAFFIC AND TRANSPORTATION

VEHICLES ON RAILS MORE TRUSTWORTHY

40% would trust an autonomous car navigated by an AI while 38% wouldn't.
68% would trust traffic control operated by an AI.

Would you trust autonomous cars navigated by AI?

22 %

40 %

38 %

n=411

Would you trust traffic control operated by AI?

17 %

68 %

15 %

n=411
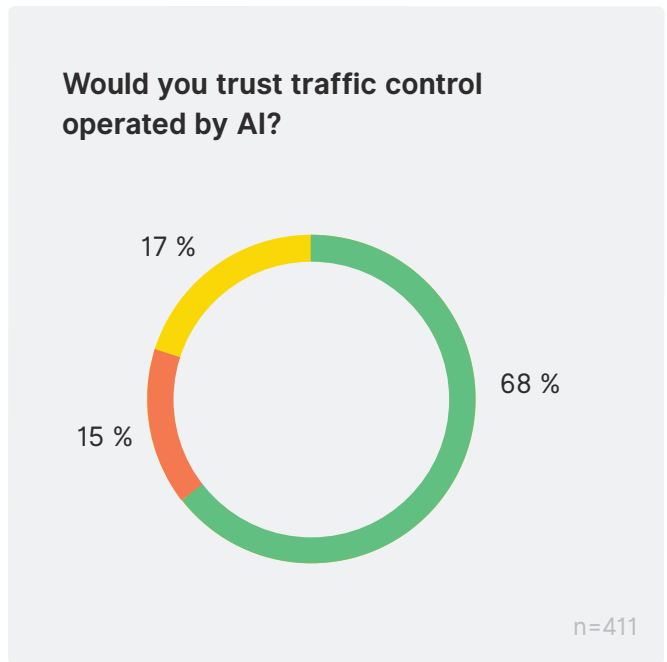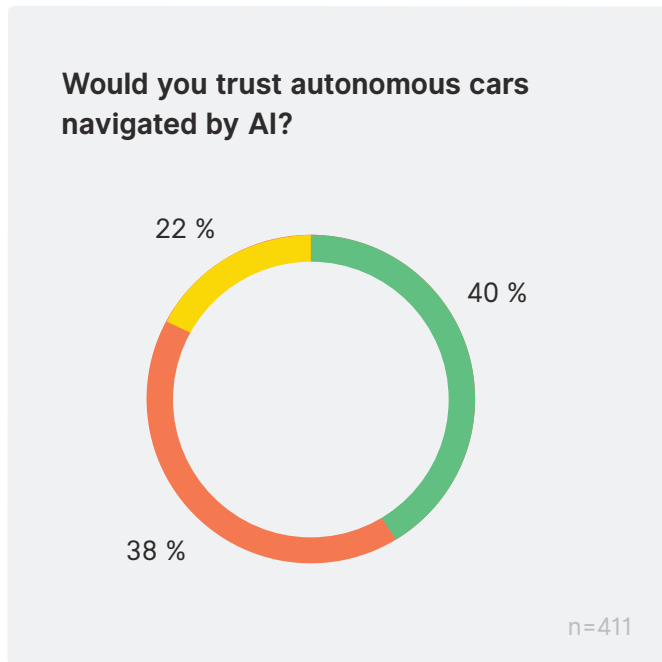
Vehicles on rails are considered as more trustworthy. 73% would trust an autonomous railway vehicle
(ie. metro, tain, tram) navigated by an AI. Autonomous buses navigated by an AI divide opinions: 38% would trust them,
40% wouldn't do so.

Would you trust rail vehicles navigated by AI?

10 %

17 %

73 %

n=411

Would you trust autonomous buses navigated by AI?

24 %

38 %

40 %

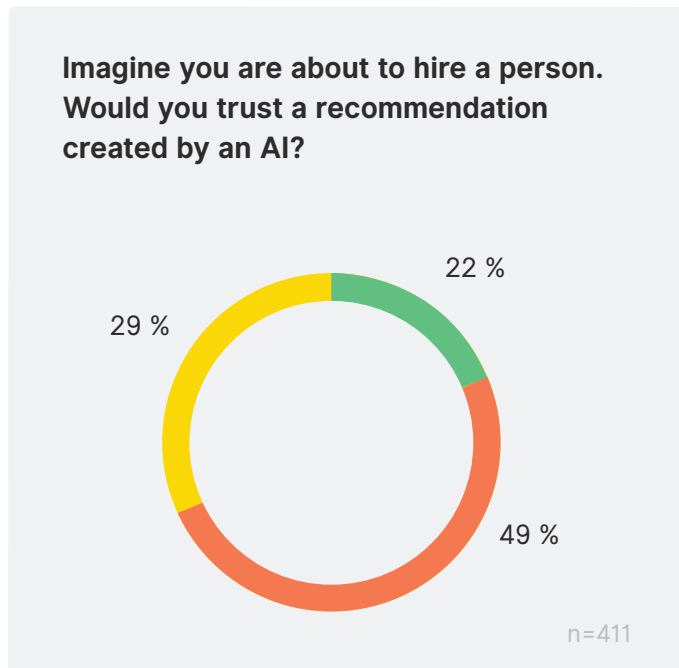n=411

● Yes ● No ● I don't know

27

RESULTS

HR & RECRUITING

AI AND RECRUITMENTS

While making recruitment decisions, 49% wouldn't trust a recommendation made by an AI. When applying for a job, 51% wouldn't trust the fairness of the recruitment process if they knew that the applications would be processed by an AI.

Imagine you are about to hire a person. Would you trust a recommendation created by an AI?

22 %
29 %
49 %

n=411

Imagine you are applying for a job. Would you trust the recruiting process to be fair if you knew your application will be processed by an AI?

14 %
35 %
51 %

n=411

AI POWERED CUSTOMER SERVICE

53% would trust an online customer service operated by an AI.

Would you trust an online customer service operated by an AI?

15 %
53 %
32 %

n=411
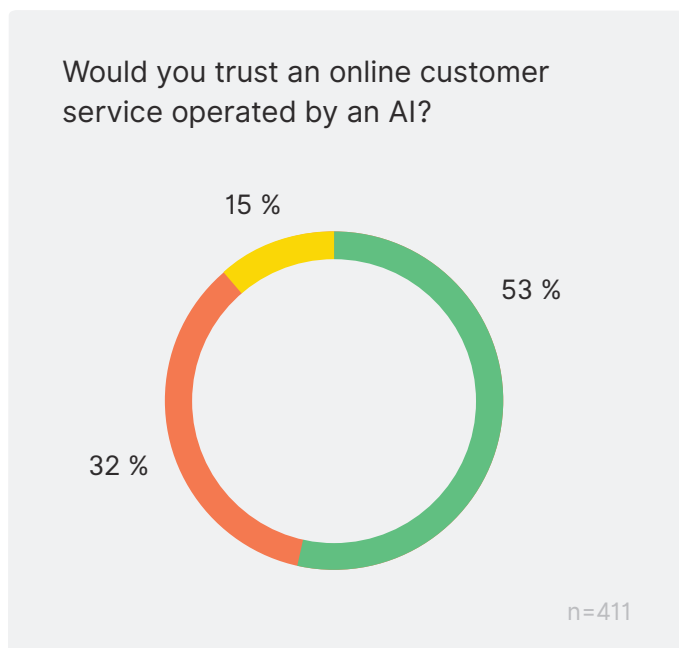
DATA SECURITY AND AI IS TRUSTWORTHY

As entrepreneurs, 51% would trust an AI operated data security system.

Imagine you **owned a company**. Would you trust an AI-operated **information security system**?

24 %
59 %
26 %
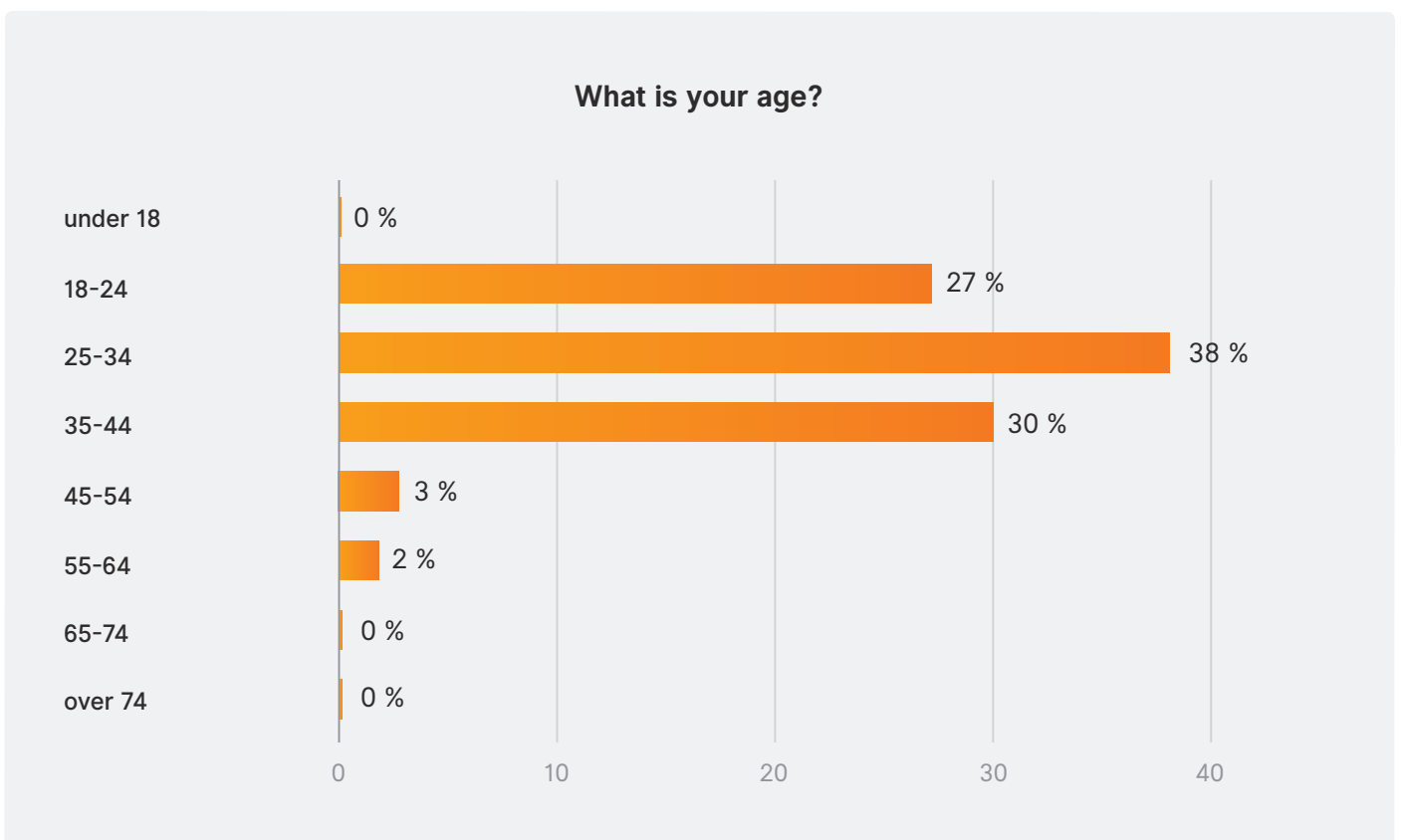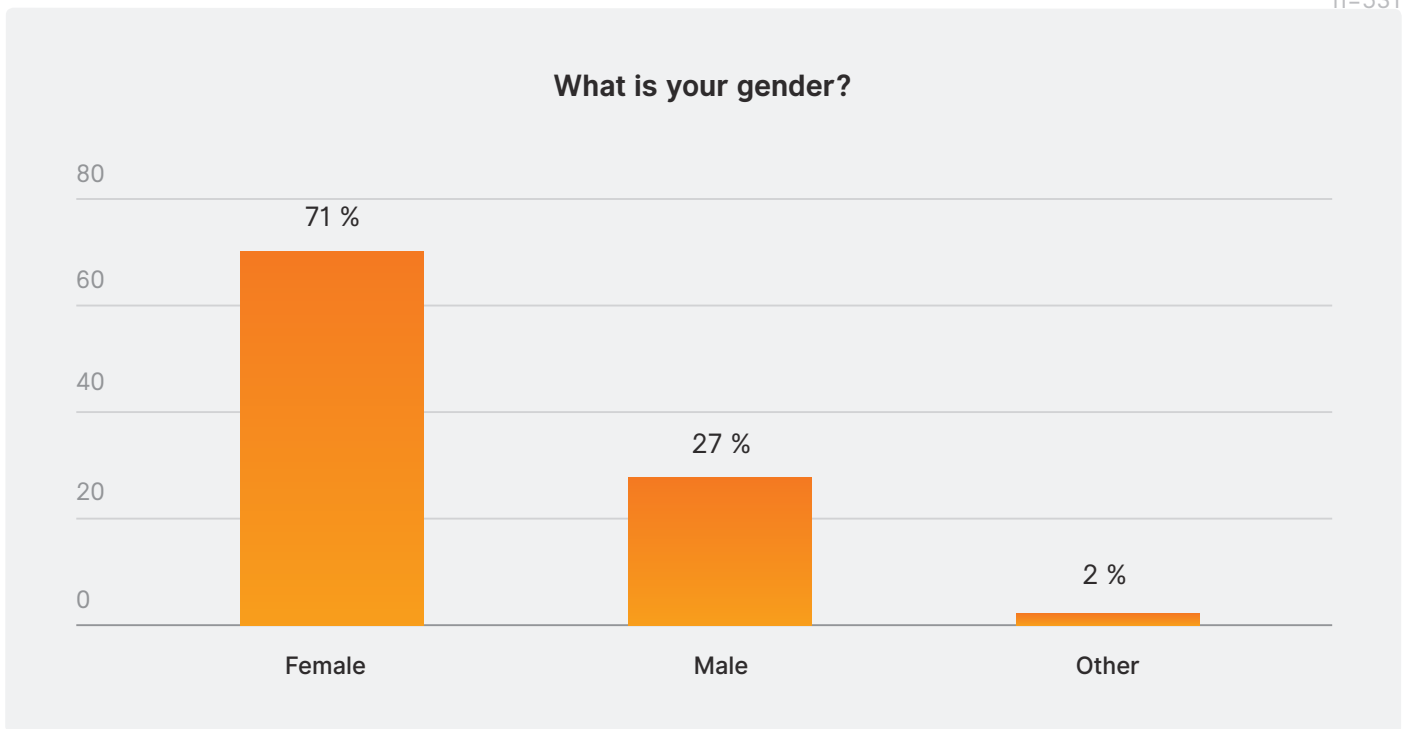
n=411
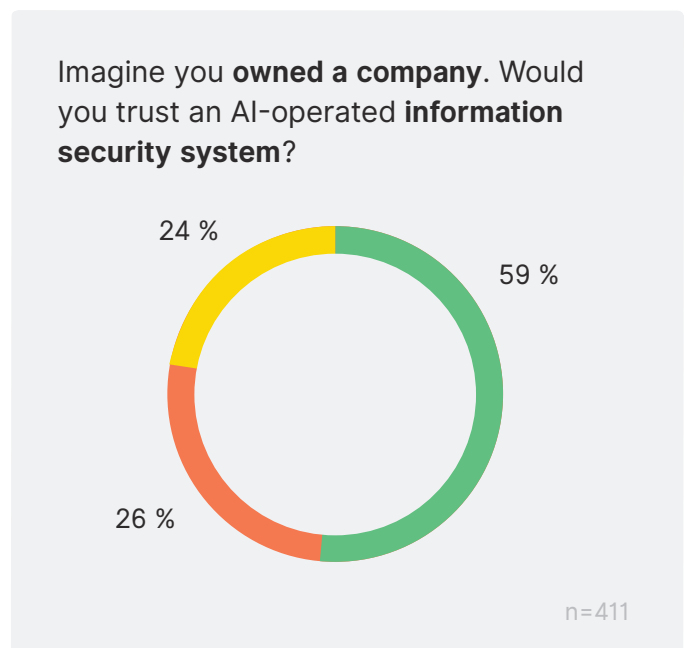
● Yes   ● No   ● I don't know

DEMOGRAPHICS OF THE SURVEY

GENDER AND AGE

Almost three quarters of the respondents were women (71%). The age distribution of the respondents was dominated by young adults, the majority were aged between 25–44 (68%).
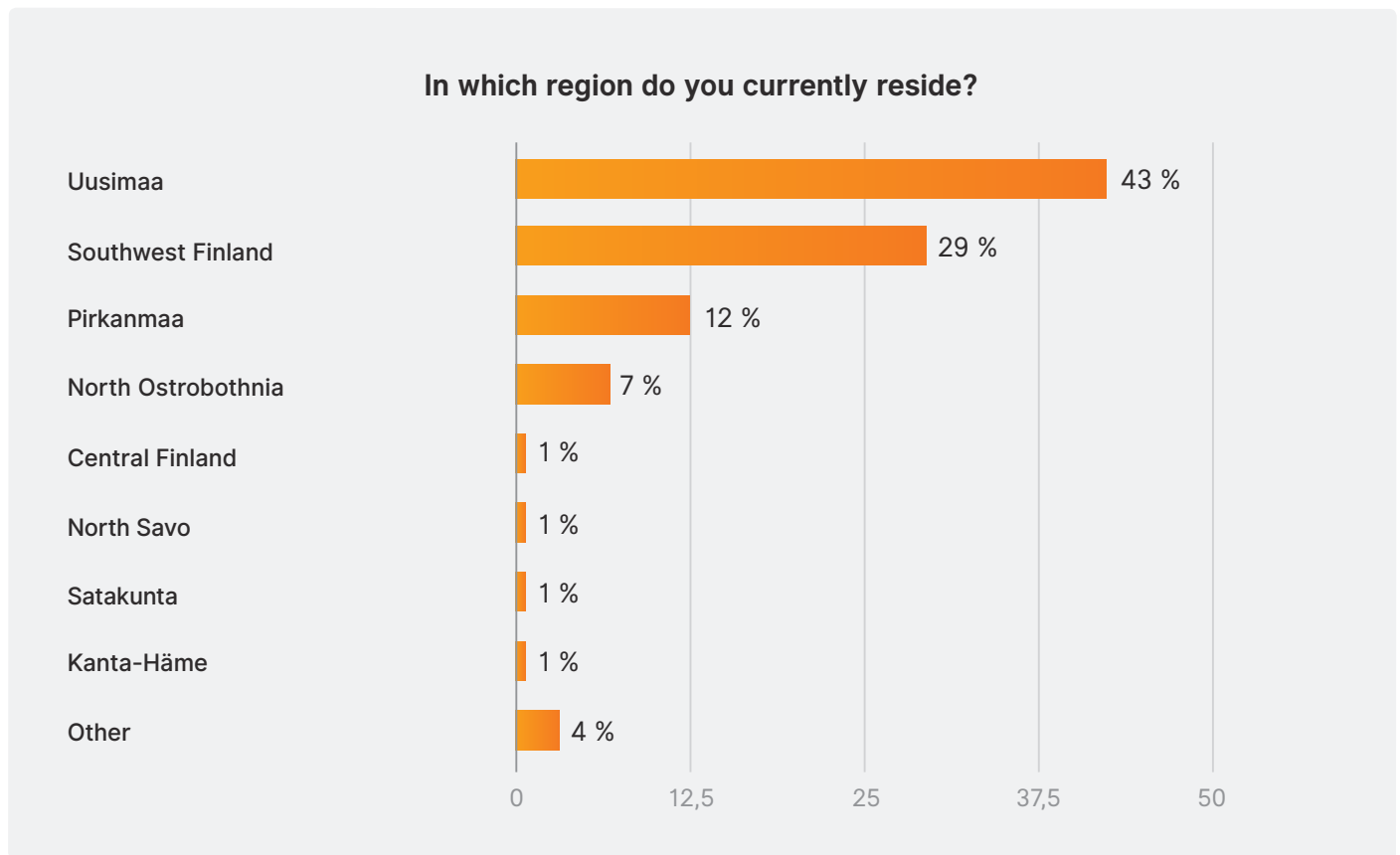
What is your gender?

Gender	Percentage
Female	71 %
Male	27 %
Other	2 %

What is your age?

Age	Percentage
under 18	0 %
18-24	27 %
25-34	38 %
35-44	30 %
45-54	3 %
55-64	2 %
65-74	0 %
over 74	0 %

RESIDENCE

The majority of the respondents were from Southern Finland; Uusimaa 43%, and Southwest Finland 30%.

In which region do you currently reside?

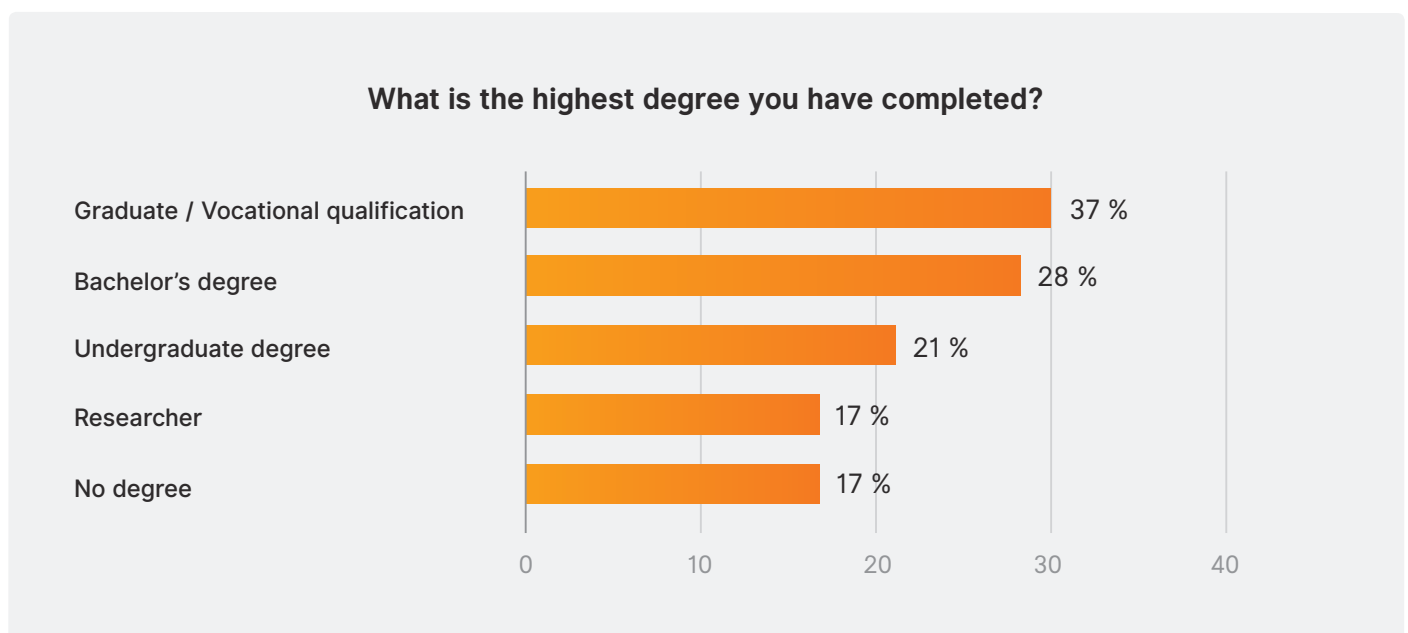| Region	Percentage
Uusimaa	43 %
Southwest Finland	29 %
Pirkanmaa	12 %
North Ostrobothnia	7 %
Central Finland	1 %
North Savo	1 %
Satakunta	1 %
Kanta-Häme	1 %
Other	4 %

n=531

LEVEL OF EDUCATION

40% of the respondents were graduates or had a vocational qualification and also 32% had a bachelor's degree. 19% had an undergraduate degree from a university.

n=502

What is the highest degree you have completed?

Degree	Percentage
Graduate / Vocational qualification	37 %
Bachelor's degree	28 %
Undergraduate degree	21 %
Researcher	17 %
No degree	17 %

CONTRIBUTORS, SOURCES & FURTHER READING

CONTRIBUTORS

ANNA HAVERINEN
DESIGN ANTHROPOLOGIST

A Design Anthropologist with a PhD in Digital Culture Research, Anna has a solid background in both academic and private sector research. For her, service design is about understanding people and contexts behind the services themselves. In her free time, she enjoys renovation, creative writing and cyclocross.

SUVI KAVA
UX ANALYST

Suvi's goal is to make the Internet better: easier to use, more beautiful and useful – in a result-driven way. During her career, her weapons of choice have become SEO, UX and analysing customer paths. She draws inspiration and energy from doing sports, learning new things and dreaming of bicycle trips.

TUOMAS JALAMO
COMMUNICATIONS MANAGER

A Swiss Army knife of all things content strategy and digital marketing, Tuomas knows what makes brand communications tick – and how to take yours to the next level.

Our warmest thanks to Data & AI ethicist **Minna Mustakallio** for comments and contribution.

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We create digital products and solutions.

Applications for mobile and web environments are our main focus. Our award-winning team combines service design, technology and business expertise.

You can entrust us with independent project responsibility, or have us working as a part of your team – in all phases of development, from idea to launch.

SOURCES

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BOOKS ON AI

- **Artifcial Ingellifence — foundations of computational agents -** Book about the science of artificial intelligence (AI). It presents artificial intelligence as the study of the design of intelligent computational agents.
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- **Bostrom, Nick: Superintelligence: Paths, Dangers, Strategies**
  https://www.amazon.com/Superintelligence-Dangers-Strategies-Nick-Bostrom/dp/0198739834/ref=zg_bs_3887_3

- **Bourg, David M.: AI for Game Developers**
  amazon.com/gp/product/0596005555?ie=UTF8&tag=jefork-20&linkCode=as2&camp=1789&creative=9325&creativeASIN=0596005555

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- **Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms (Pre-order)**
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- **Russell & Norvig: Artificial Intelligence: A Modern Approach**
  https://www.amazon.com/Artificial-Intelligence-Approach-Russell-Norvig/dp/9332543518/ref=sr_1_2?s=books&ie=UT-F8&qid=1462026033&sr=1-2&keywords=norvig+artificial+intelligence

- **Winston: Artificial Intelligence**
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- **Wood, Gaby: Edison's Eve: A Magical History of the Quest for Mechanical Life**
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OTHER MATERIAL

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- **Dreamscope app** – Tool for creating neural net images
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- **Monica's Mind**
  http://monicasmind.com/

- **The AI Revolution: The Road to Superintelligence**
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