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DATA PROTECTION IN THE SMART CITY

OF LISBON

FLANDERS INVESTMENT & TRADE MARKET SURVEY



DATA PROTECTION IN THE SMART CITY OF LISBON

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1. EXECUTIVE SUMMARY

By 2050, it is expected that 66% of the world's population will live in cities (133089, sd). This so-called phenomenon: urbanization, gives a lot of challenges towards city-governments. More people means a greater labour-force, but also more organizational needs and much more pollution. This challenges cities' governments.

Smart Cities are a solution for this problem. This concept tries to combine the needs of the growing population in the city (e.g. sense of security and safety) with the environmental aims (e.g. cleaner energy) in a way as efficiently as possible. To accomplish this, Smart Cities use data, which is generated by the technology of the city. The creation of this data is done in multiple ways, but the most important one is generated by the citizens, called: citizen data.

This sort of data is very sensitive because it contains very detailed information of all the civilians in the city. Different protection measures have been installed to make sure this is not exploited. Examples like security and information privacy are ones that do basic protection of this data and extra measures had to be put in place.

Therefore, the European Union introduced GDPR in 2018. A privacy law that makes it obligatory for businesses and entities that handle personal data of European citizens, to protect this data using the various principles of this law. But even though these several protection instruments are in place, leaks and hacks are still increasing.

For Smart Cities, the rising hacks and leaks of data is very troubling. The technology of the city is connected with each other and makes it possible for hackers to retrieve more data then originally anticipated, because of the interconnection of the technology in the city. If this happens, it could mean terrible things for the citizens of the city, with their private and sensitive information being accessed and stolen.

In order for this to be prevented and to secure the future of the Smart City concept in Lisbon, it can implement 3 ideas:

1. Have its own data protection authority to make sure that the municipality can manage and use the data of their own citizens, in that way they can make sure to fill the needs of these citizens and keep a close relationship with them.
2. Communicating better with its citizens to make sure that they are aware that their data is being used and what it is used for. This also relates to the fact that the citizens will feel a better relationship with the entities that use their data and feel integrated in the making and shaping of the future of Lisbon.
3. A reward-based system is the last idea that can be applied for Lisbon. As some municipalities use an app as a tool to give back to the people for using their private information, Lisbon could use this same method to try to gift citizens discounts or money for using their data.

All these ideas conclude the need for the citizens to be included in the governing of the city, which is something that clearly came out of the field research that was done.

2. INTRODUCTION

Lisbon is the capital of Portugal, a country that got struck hard in 2008 with the financial crisis. After very long and hard years, the country does seem to be out of this pit and at the same time, it has found a way to be attractive for technological businesses. In 2017, Portugal's tech industry has raised over 350 million dollars in venture capital and technology conferences are setting shop in the capital (Armand-Delille, 2018). The most known technology conference is Web Summit, who has decided to stay in Lisbon until 2028, attracting 80.000 tech professionals every year. This will generate a total of 3.5 billion dollars in revenue (from 2018 until 2028). Furthermore, the Lisbon Invest Summit, hands the opportunity to start-ups to pitch to international venture firms and has made it possible for big companies to install their headquarters in Lisbon (Armand-Delille, 2018). This has drastically changed the European tech map, with Lisbon as its frontrunner.

Education in Portugal has also fuelled the tech-transformation in the country. With the universities having a strong focus on high tech skills that are much appreciated by the different tech companies in the city. Portugal also has a very high ratio of engineers per capita, with great universities offering these courses like Politecnico Institute in Braganca, UpTec in Porto, Tecnico and Instituto Politecnico in Lisbon (Armand-Delille, 2018).

Furthermore, setting up shop in the capital is very easy and attractive to do. Previous to the pandemic, Beta-I, Lisbon's co-working spaces and accelerators, tripled in size in 2018 and dozens of new workspaces opened in that same year (Armand-Delille, 2018).

Establishing this tech-transformation of Lisbon is very much needed for the research of this paper: Data protection in the Smart City of Lisbon. This research will consist of 4 big parts: the concept of a Smart City in Lisbon, data in Smart Cities, field research on data protection in Lisbon and the recommendations for Lisbon regarding data protection.

The goal of this research paper is to find out what Lisbon can do better in regards to data protection, to make sure it sustains its future as a Smart City.

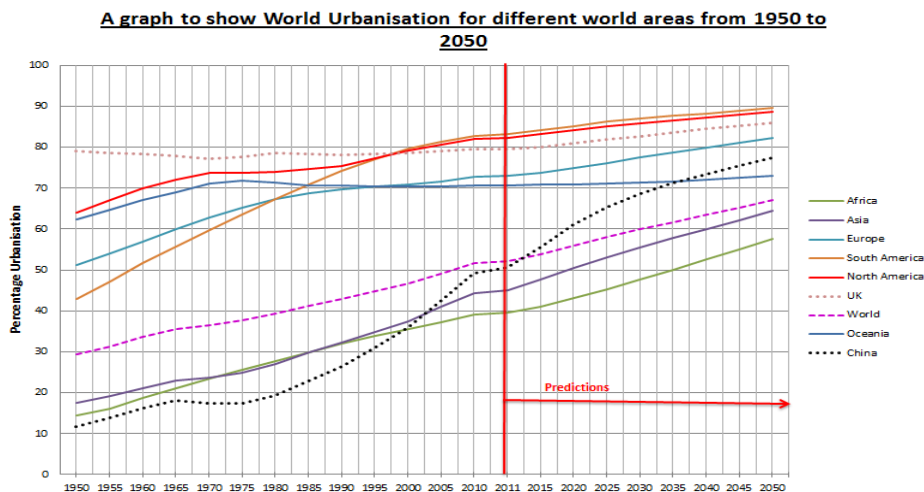


3. THE SMART CITY CONCEPT

3.1 THE PROBLEM

A city has different definitions in the world. Across the globe, many cities use a minimum population criteria that varies from 2.500 individuals (Argentina) to 20.000 individuals (Nigeria), but a city can also be labelled as an urban area on the population density, administrative set ups, economic attributes,... (Nagrakal, 2020) In general, a city is a place where a great amount of people live closely together and is managed by its own (city) government.

Urbanization, the move of increasing numbers of people to live in cities, is a trend that is growing increasingly. The world's population has rapidly changed its rural habitat to an urban habitat in the course of the last 100 years. Graph 1 shows the increasing amount of people living in cities and the prediction until 2050, which forecasts that almost two thirds of the world population will be located in such urban areas by 2050.



Graph 1: World Urbanisation for different areas from 1950 to 2050 (<https://133089blog.wordpress.com/category/geen-categorie/>)

This poses big challenges for various (city) governments. National Geographic (2020) established several problems and threats surrounding this trend:

- Intensive urban growth can lead to greater poverty, with the local governments unable to provide services for all people.
- Concentrated energy use leads to greater air pollution, with significant impact on human health.
- Large volumes of uncollected waste create multiple health hazards.

In general, health issues are a very big concern with people living closely together, and it will only increase if the amount of people enlarges during the time.

But luckily, for all problems there are solutions. In our case, one solution is the modern concept of Smart Cities.

3.2 WHAT IS A SMART CITY?

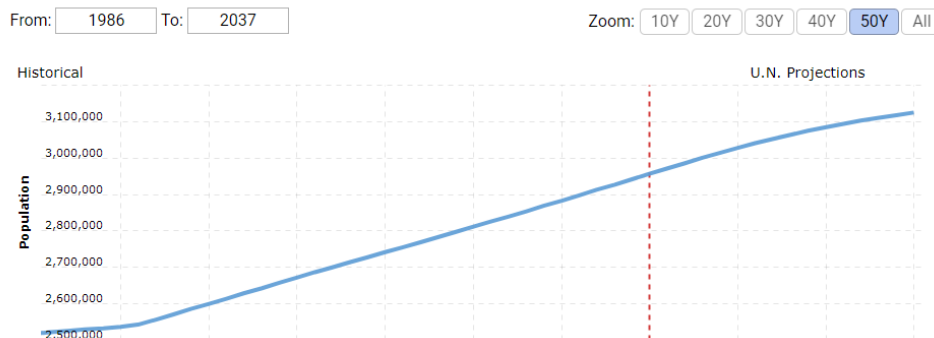
Agoria, the Belgian Federation of Industrial Technology, defines a Smart City as: ‘A city that uses smart technology and integrated data to improve the quality of life and comfort of every citizen (Agoria, sd). A more international company, Thales, interprets the concept as: ‘a framework, predominantly composed of Information and Communication Technologies (ICT), to develop, deploy, and promote sustainable development practices to address growing urbanization challenges. A big part of this ICT framework is essentially an intelligent network of connected objects and machines that transmit data using wireless technology and the cloud.’ (Thales, sd)

Although different definitions of this concept are available, two elements clearly surface in the definitions above and are crucial for a Smart City. Smart cities aspire to become a place (1) using smart technology and data (2) in order to improve city and therefore live better in that city.

3.3 LISBON AS AN EXAMPLE OF A SMART CITY

Is Lisbon considered a Smart City? What has it done already to be labelled this? This section will look into what the city has done in order to become smarter, in relation with the problem of cities and the definitions.

Lisbon encounters the upcoming urbanization-trend as well, with the United Nations projecting that the number of habitants in the Portuguese capital will only increase (Macrotrends, sd).



Graph 2: Population growth in Lisbon from 1986 to 2037

(<https://www.macrotrends.net/cities/22167/lisbon/population#:~:text=United%20Nations%20population%20projections%20are,a%200.51%25%20increase%20from%202019.>)

Besides from this prediction, like every city, Lisbon encounters its own different problems, and the city government decided that to tackle current and future challenges, it must become a ‘smarter’ city.

Since 2010, the European commission awards 1 European city as 'The European Green Capital' every year. This selection process depends on 3 factors: the capital needs to reach high environmental standards, it has to commit to ambitious goals for the further improvement of the environment and sustainable development and, last but not least, the capital must be a role model to inspire other cities (Sharing cities, 2017).

On the 21st of June in 2018, Lisbon was granted this award. Even though Portugal was struck hard by the global economic crisis in 2008, they never stopped making progress in the field of becoming smarter and more habitable (Sharing cities, 2017). An example of this is an environmentally-conscious vision for the urban mobility, and having installed 516 charging points for electrical vehicles. But they also inspired the other big cities in Portugal (like Porto, Viseu,...) and eventually received this award again in 2020 (Sharing cities, 2017).



(Figure 1: translation: Being the European green capital is COOL)

The 'Programa Operacional Regional de Lisboa 2020', was Lisbon's operational program in relation to improving the city to being even more environmental-friendly. This had aims that ranged from attracting more civilians by improving the housing quality, to broaden the access to higher education (Lisboa 2020, sd).

Besides these goals, Lisbon has even bigger aspirations. The 'Lisbon Climate Action 2030' perfectly describes what the city's viewpoint is in her battle against climate change, with the ambition of challenging every stakeholder to commit to this plan. It was introduced by the 'European Covenant of Mayors for Climate & Energy', which is a gathering of local governments who voluntarily commit to achieve the energy targets and improving EU climate. Lisbon is one of these signatories and agrees on the aims of this plan to reduce carbon dioxide by 60% (by 2030) and to be carbon neutral in 2050 (Covenant of mayors, sd).

These programs all have great goals that definitely improve very important fragments of the city. But in relation to our definition of a Smart City, data and smart technology are as important as the improvement

4. DATA IN SMART CITIES

But what does data mean in relation to Smart Cities? What is it and why is it so important in the creation and future of Smart Cities? This part will explain what data is in Smart Cities, what the importance is of this and what Lisbon does in regards to data.

4.1 DATA IN COMPUTER SCIENCE

The Cambridge dictionary offers as first definition: “facts or information, especially when examined and used to find out things or to make decisions” (Cambridge dictionary, sd) . The second focuses more on our technological approach: “information that is stored by a computer”. Computer data is information that can be processed or stored by a computer and is known as binary data. This binary data is information that may be in the form of text documents, audio, clips, images,...

When data is generated in Smart Cities, it is called ‘Big Data’. Big data is defined as: data that is so large, fast or complex that it’s impossible to process using traditional methods. Big data is broken down in three properties, by industry analyst Doug Laney, into the so-called 3 V’s of Big Data (SAS, sd):

- **Volume:** Big Data consists of volumes of data that reaches unprecedented heights. The estimation of this height is 2.5 quintillion bytes per day in 2020, which is an increase of 300 times in comparison with 2005. This results in large companies having Tera- (1.024 times a gigabyte) and even Petabytes (1.000 times a terabyte) of data in storage devices and on servers.
- **Velocity:** Because of this growth, the corporate view of data has completely changed. Once data was seen as non-important, but changing how we gather the data has revolutionized this. The Velocity of data measures how fast we gather this data, which can differ from receiving it in real-time or in batches.
- **Variety:** data has known a lot of shapes throughout its existence. Once the shape of database files (Excel, CSV and Access), it can now be presented with non-traditional forms, like video, text, pdf or graphics on social media (SAS, sd).

But Big Data is not simply ‘lots of data’, it is also a way to utilise new and existing data to possibly gather future data. By using these massive amounts of data one can analyse possible hidden patterns and correlations, and so be ahead of the upcoming trends (SAS, sd).

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4.2 WHAT IS DATA IN SMART CITIES AND HOW DO THEY COLLECT IT?

As we established the importance of Big Data, to be able to store and analyse it to use for smart solutions, it must be collected first. For this to be done, there are different types of ways.



Figure 2: title (<https://www.itsitio.com/cl/la-nube-puede-colaborar-las-ciudades-inteligentes/>)

In figure 2, 5 different types of collectors of this Big Data are presented. These 5 collectors are:

1. **Internal data sources:** this data is information, statistics and trends that cities discover through their operations. It is pulled from internal databases. Examples of this are budgets, citizen profiles, results from surveys, etc (Sammy, 2016).
2. **External data feeds:** data defined as all the data outside of the organization or city's operating system, not subtracted out of the operating system (opposite of internal data). This kind of data can come from research and citizen feedback on certain operations a city has undertaken (Walters).
3. **Open data:** data that can be accessed, used and shared by anyone. Governments can use this type of data for social, economic and environmental benefits.
4. **Sensors and devices:** The data creation made through these tools are made by appliances that are installed all over the city, together with things the citizens use on an everyday basis. Examples of this last one are home routers, security cameras, baby monitors, etc.

All these sensors and devices are gathered into one word: the Internet Of Things (IoT). This refers to a system of interrelated, internet-connected objects that are able to collect and transfer data over a wireless network without human intervention. To explain this, there is a very easy example of how it can be used in cities.



The Internet of Things can very easily and efficiently solve the problem of extensive waste in a city, using

Figure 3: collection of waste using IOT (<https://www.themayor.eu/fr>)

sensors in garbage cans. These sensors transmit the data of how full they are, to the garbage trucks. These trucks can see on their GPS all the cans that are, for example, filled with more than 75% and change the trajectory of the truck according to this data. This can lead to less traffic in the city and a faster way of collecting the trash.

5. **Citizen data:** data collected through the devices used by the citizens. As for the examples given before (home routers, security cameras, baby monitors, etc.), there are many devices that serve to the purpose of the creation of citizen data. The most common and versatile device is the smartphone.

Bernard Marr (2018) describes the five utilities where citizen data is/can be collected, through the smartphone:

- 1) **Internet:** All the information searched on the internet leads to an increasing of our data 'stockpile'. For this information, we head over to the search engines that gives us all the possible information we are looking for. Almost 4 Billion people use the internet in total and 77% of the searches are conducted on Google, which has, on average, 40.000 searches every second. Worldwide there are almost 5 Billion searches on Google each day (Marr, 2018).
- 2) **Social Media:** As social media is so much integrated in our lives, it also fuels data creation on a daily level. Every minute of the day (Marr, 2018):
 - a. Snapchat users share 527.760 photos
 - b. More than 120 persons join LinkedIn.
 - c. YouTube users watch 4.146.600 videos
 - d. 456.000 tweets are sent
 - e. 46.740 photos are posted on Instagram

But with all these incredible numbers, Facebook is still the social media-king, with almost 1.7 billion users, which is almost one quarter of the whole world population (7.594 billion) (Marr, 2018).

- 3) **Communication:** Data trails are left behind every time we use communication methods, from emails to Tinder swipes and from Skype calls to text messages (Marr, 2018).
- 4) **Digital photos:** We all carry cameras on our phones and make good use of this, but every photo taken is a kind of data as well. In 2019, 1.42 trillion photos were taken and stored on our phones. To put this in perspective, if someone would take 1 photo every second, it would take him/her 45.544 years to snap the number of photos humans took in 2019 (Marr, 2018).

- 5) Services: Surprisingly, service providers on the internet platforms generate astonishing numbers as well. For every minute (Marr, 2018):
- a. The Weather Channel receives 18.055.556 forecast requests
 - b. Venmo processes \$51.892 peer-to-peer transactions
 - c. Spotify adds 13 new songs
 - d. Uber riders take on 45.788 trips
 - e. 600 page edits are made to Wikipedia

Conclusion

To summarize, we have seen what the term data is in itself and what it is in regards to a Smart City. The data used in Smart Cities is called Big Data, which means that it is a great amount of data, is collected very fast and varies from text to, for example, images.

Relating to Smart Cities, the collection of Big Data is done through multiple ways. The focus of this research is on the sensors and devices, and citizen data. Both of them share a relation, where the sensors and devices conclude the tools where citizen data can be collected. All these devices together are called the Internet of Things.

Besides the collection of Big Data, this Internet of Things is used for improvement of different fragments of the city. For example, one of the problems urbanization poses, are the health hazards extensive and uncollected waste cause for the citizens of the city. With the aid of the Internet of Things, the sensors in garbage cans can map the best way for garbage trucks to collect the waste of the city.

This problem-solving, using ICT-tools, fits perfectly in the definition of a Smart City we saw earlier.

As regards to the creation of citizen data by different Internet of Things devices, the most important one and the device that creates the most, is the smartphone. The usage of this tool and the applications create massive amount of citizen data every day.

But does the usage of the Internet of Things, to create citizen data, pose problems towards the city governments? After all, it makes it possible to have a look in the lives of the citizens who create this data and disregards privacy. Article 8 of the Human Rights Act states that: 'Everyone has the right to respect for his private and family life, his home and his correspondence'.

This poses a very big dilemma, because the better the insight in the citizen's lives, the better city governments can tackle real problems, but also the less privacy citizens have. City governments will therefore be challenged to handle this dilemma.

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4.3 CONCERNS OF BIG (CITIZEN) DATA

Collecting data, especially citizen data, raises ethical questions: Are people open to governments having a view in their everyday lives, interests and sensitive information? Do the cities and organizations violate article 8 of the Human Rights Act?

Not only do cities and organizations see the value of Big Data, also cyber-criminals see a way to steal and make profit by selling this. As an example, in only the first 6 months of 2019 there has been successfully exposed or stolen roughly 4.1 billion records of cyberattacks which are later sold for high prices (Sobers, 2020). A phenomenon called data breaches.

The connection of the Internet of Things only makes it more dangerous for data breaches to happen, with the interconnection of an enormous amount of devices. Hacks will be made more elaborated and collect more information than originally anticipated. Of the 15 greatest data breaches in history, 10 took place in the past decade. Hundreds of millions of records like login credentials, financial information and personal data were accessed and stolen (Holmes, 2019).

Since we have seen that Smart Cities are a collection of Internet of Things, the concerns about data breaches to happen are greater. Also the exposure of this data will be much bigger than in other cases, because of the data used in Smart Cities is Big Data. Regarding the privacy of the citizens, and the collection of their data in Smart Cities, these are the six biggest concerns critics have (Future of privacy forum):

1. **Surveillance:** Does this data collection of all kinds of sensors in the city lead to detailed records of people's lives?
2. **Data spills:** Leak or exposure of personal information when a database or information system is compromised.
3. **Unexpected uses:** The data obtained for one purpose is used for another, unexpected purpose, without notice or consent to the person about this.
4. **Open data vs Privacy:** The risk of revealing personally identifiable information to the public through public records laws, freedom of information requests and open data portals.
5. **Discrimination:** The reliance of civic data may lead to algorithms that reinforce existing societal bias, disguise prejudiced decision-making and in that way block opportunity for diverse populations.
6. **Data quality:** Poor, inaccurate data may lead to inefficient decision-making or unethical, illegal uses of data and discriminatory outcomes.



Figure 4: Data privacy concerns in Smart Cities (<https://fpf.org/smart-city-privacy/>)

In general, the biggest fear and concern the people have, is the very asymmetrical relationship the governments have with their citizens. The people don't know a lot of the government, while the government knows almost every detail of the people's life. This, together with the fear that there is a chance that this data might leak or being hacked, leads to a very fearful thought of citizen data.

For this to be avoided, there are two very important principles already in place: privacy and security.

(Information) Privacy

Privacy is 'the capacity of an individual or group to stop information about themselves from becoming known to people other than those they give the information to.' (Privacy and Security concerns in Big Data, 2016)

An individual has the privilege to have control over how their personal information is collected and used. If they trust a website, organization, company, municipality,... of their e.g. political opinion, racial or ethnic origin, philosophical belief, etc., they trust that it will not be shared by that entity to other people or other organizations. But also simpler data like a person's address is entrusted and should not be leaked or published anywhere (Privacy and Security concerns in Big Data, 2016).

Security

Security is 'the practice of defending information and information assets through the use of technology, processes and training from: Unauthorized access, Disclosure, Disruption, Modification, Inspection, Recording, and Destruction.' (Privacy and Security concerns in Big Data, 2016)

The entities obtaining this sensitive information should do everything possible to protect this data, so that they don't break the trust of the people. Security also must ensure that the data keeps being protected from various cyber-attacks (Privacy and Security concerns in Big Data, 2016).



The difference with an example



Figure 5: online purchase (<https://www.informabt.com/spensetters-un-nuevo-segmento-del-mercado-online/>)

The fictional company EDC sells decorative lamps. Dave (fictional customer) has recently moved in a new apartment and would like to buy a lamp from the website. He fills out the information of his address and eventually buys a lamp, using his credit card, which he also had to write down the numbers on the website.

The difference here is that **privacy** says that the company is entrusted by Dave to not sell his information to a third party without him giving his allowance. On top of that, the company has to use various techniques, like encryption, firewall,... , to make his data **secure** and that it is not being compromised by a third party (a cyber-criminal, for example).

But these two protective measures are clearly not enough, as we have seen that cyberattacks are still in place and only rising. Therefore, there was a need of something that protects our data more. On a company, national and international level, so that every entity/organization is able to protect the data that it handles, and the sensitive information is guarded for third parties.

4.4 DATA PROTECTION ON AN INTERNATIONAL LEVEL

European Union

How did the European Union react on the rising data breaches and exposures of personal data? How will it challenge the lacking protection of privacy and security? In 2018, the greatest and most secure data protection entity came into force for the European Union: the General Data Protection Regulation.

General Data Protection Regulation (GDPR)

GDPR is Europe's new data privacy and security law that is considered as the toughest privacy and security law in the world. It imposes obligations onto organizations anywhere, as long as they target or collect data related to people in the EU. Ever since the 25th of May 2018, this authority has the power to levy harsh fines to those who have violated the privacy and security standards, set by GDPR (GDPR.EU).

The data protection rules

These standards or rules are defined as the ‘data protection principles’ and apply to all companies/municipalities/entities/... that process data. In total, there are seven protection and accountability principles (GDPR.EU):

1. Lawfulness, fairness and transparency processing of the data subject
2. Purpose limitation: data must be processed for the purposes specified explicitly to the data subject the company collected it
3. Data minimization: collection and process of data must be only as much as absolutely necessary for the specified purpose
4. Accuracy of the data
5. Storage limitation: storage of personal data is for as long as necessary
6. Integrity and confidentiality of the processing
7. Accountability: data controller (DPO) is responsible for the organisation to follow these principles

Data Protection Officer (DPO)

As you can see, GDPR also introduces the duty of a public authority or body to appoint a Data Protection Officer (DPO). He or she performs his/her duties independently from the company, but is a very important part of the organisation. It is mostly someone outside of the company that is contacted to make sure the GDPR is followed. In general, his/ her duties or tasks are, ensuring that the data protection rules are respected in cooperation with the Data Protection Authority, but in detail the DPO must (GDPR.EU):

1. Ensure that controllers and data subjects are informed about their data protection rights, obligations and responsibilities, and raise awareness about them
2. Give advice and recommendations to the institution about the interpretation or application of the data protection rules
3. Create a register of processing operations within the institution and notify the European Data Protection Supervisor (EDPS) about those that present specific risks.
4. Ensure data protection compliance within her institution and help the latter to be accountable in this respect
5. Handle queries or complaints on request by the institution, the controller, other person(s), or on her own initiative;
6. Cooperate with the EDPS (responding to his requests about investigations, complaint handling, inspections conducted by the EDPS, etc.);
7. Draw the institution’s attention to any failure to comply with the applicable data protection rules.

As a data protector is responsible for handling the data of the organisation, it does not take away the fact that the company/entity/municipality/... does not have to ensure that the personal data is processed in accordance with the GDPR. It is both parties' responsibility to make sure that every aspect of the personal data is being handled within the window of GDPR (GDPR.EU).

If one party or the other does not comply with the rules of this law, it will see great fines or penalties, dependant from the scale of the organisation.

For this to be done, the European Union introduced an independent body that ensures the consistent application of the data protection rules: The European Data Protection Board (EDPB).

European Data Protection Board (EDPB)

This board is made up of all the national Data Protection Authorities of all the member states in the EU, and are in charge of the application of the data protection law in the European Union, issue guidelines on the interpretation of the GDPR and also rule by binding decisions. In that way they can make decisions in disputes between 2 or multiple countries without the case being dealt with different jurisdictions (EDPB).

As an individual thinks that their data has been exposed or stolen, it can contact the EDPB and they will research this. If after thorough investigation the EDPB finds that the company did not do enough to protect its customers' data and thus violates GDPR, they will impose fines or penalties (EDPB).



Figure 6: EDPB (https://edpb.europa.eu/edpb_en)

Fines & Penalties

These GDPR-fines consist of 2 different tiers, with one being more severe than the other (GDPR.EU):

- a. The less severe tier has the possibility to result in fines up to €10 million, or 2% of the organisation's worldwide, annual revenue from the preceding financial year. Whichever amount is higher of these two options, will be applied.
- b. The more serious tier goes against the very principle of the right to privacy (stated in the Human Rights Act, article 8), which is at the heart of the GDPR. These fines have the possibility to go up to €20 million, or 4% of the organisation's worldwide, annual revenue from the preceding financial year. Whichever amount is higher of these two options will be applied.

Although the EDPB has governing power in whole European Union, the fines will be administered by the Data Protection Authorities in each EU member state. That authority determines whether the infringement has occurred and what the severity of the penalty will be. To decide if a fine will be assessed and in what amount, 10 criteria are being used (GDPR.EU):

1. Gravity and nature: What happened? How did it happen? Why did it happen? Number of people affected and what damage did they suffer? How long did it take to resolve the issue?
2. Intention: Was it intentionally or the result of negligence?
3. Mitigation: Did the organisation took any measures to mitigate the damage?
4. Precautionary measures: Did they use a reasonable amount of technical and organisational preparation to be in compliance with the GDPR?
5. History: Previous infringements?
6. Cooperation: Was there a good cooperation with the supervisory authority?
7. Data category: What type of personal data concerns this breach? Political standpoint, origin, sexual preference....?
8. Notification: Was there a proactive report of the infringement?
9. Certification: Was the company certified before or did it follow the approved codes?
10. Aggravating/mitigating factors: Other issues that might aggravate the data breach?

If an organisation has violated multiple GDPR-criteria, it will only be penalized for the most severe one.

Examples of fines or penalties given

This year, 2020, Google has seen the greatest GDPR-fine to this day. The French data regulator CNIL (Commission Nationale de l'Informatique et des Libertés) levied a penalty of 100 million euros for a breach of these rules (Fox, 2019).

They could prove that Google violated three consents related to dropping non-essential computer cookies, which help the website keep track of your visits and activity. This makes it possible for stores to, for example, keep track of what a customer has put in its shopping cart, but can also be used to keep a record of your previous visits of websites or record your login information (NortonLifeLock, 2019).

Article 82 of the Data Protection Act states that if this happens, the persons should receive a right to compensation, which did not happen.

This picture gives the total value of GDPR fines imposed from the start of GDPR, until 17 January 2020 (Google fine of France not included).

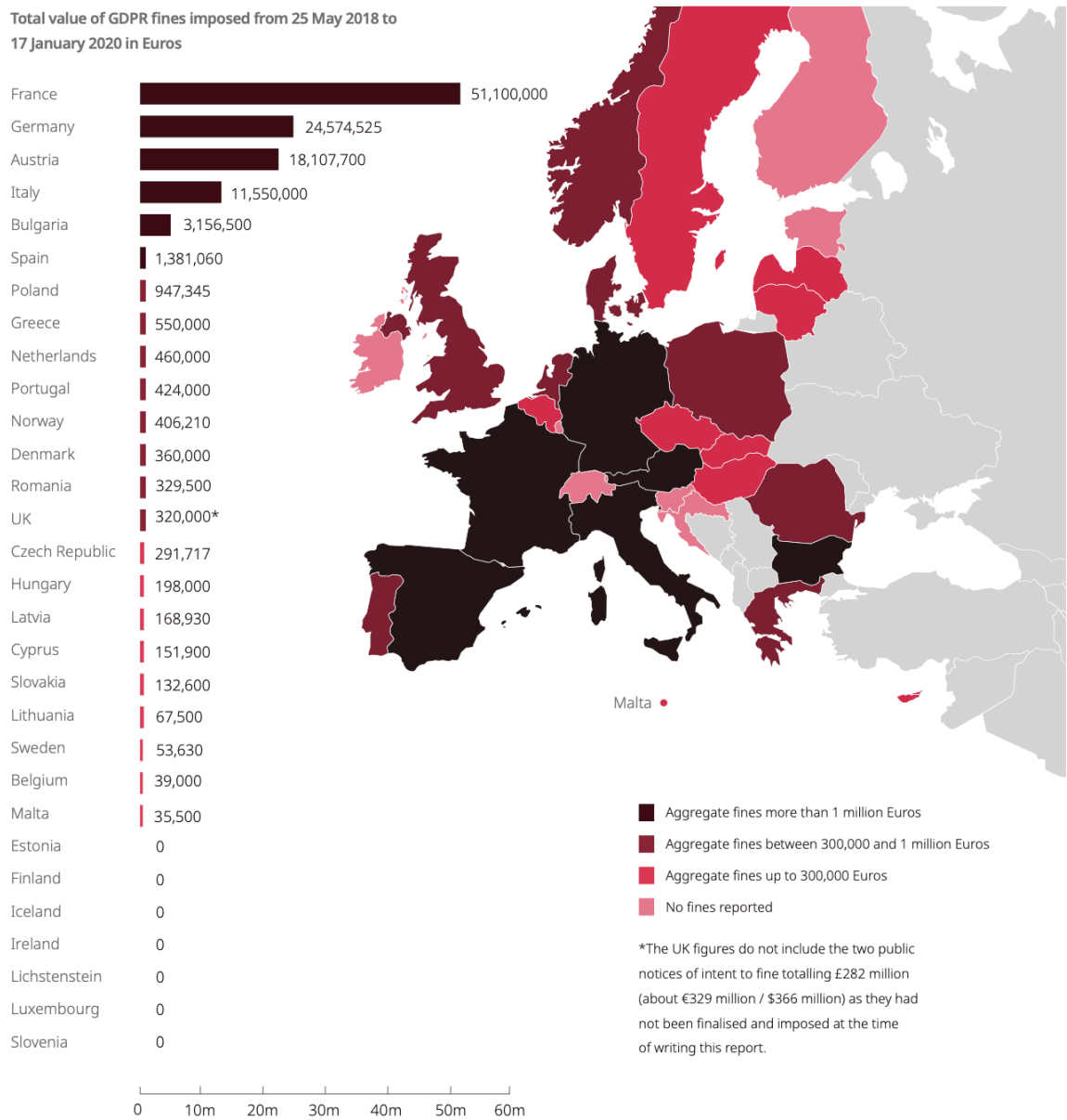


Figure 7: fines in member states (<https://nationalcybersecurity.com/cybersecurity-hackerspace-gdpr-regulators-have-imposed-126m-in-fines-thus-far-finds-survey/>)

4.5 DATA PROTECTION ON A NATIONAL LEVEL

Portugal

As a member state of the European Union, Portugal is obliged to follow the legislation concerning the data protection. The GDPR states that all member states must notify to the European Commission the provisions on (GDPR.EU):

- Data protection authority in the nation
- Certain penalties
- Reconciling the right to data protection with the right to freedom of expression and information

In case a member state regulates data protection at a national level (by a Data Protection Authority), further provisions are also notified to the European Commission (GDPR.EU):

- The processing of personal data in the employment context
- Obligations of secrecy
- Limitations to the transfer of specific categories of data for important reasons of public interests
- Other legal remedies instead of administrative fines

In regards to the national Data Protection Authority, Portugal introduced the Comissão Nacional de Proteção de Dados (CNPD) (translated: Nacional Commission of the Protection of Data).

Comissão Nacional de Proteção de Dados (CNPD)

The CNPD is the Portuguese authority for data protection, with power of authority in the whole national territory. It is the data protection regulator of Portugal that has the responsibility to supervise and monitor compliance with the laws and regulations in the area of personal data protection. It wants to ensure the fundamental freedom of every Portuguese in relation with its privacy and data (CNPD).

This entity has various tasks and responsibilities to ensure their promise, these tasks also vary from supervision, inspection with access to data undergoing processing, warning when there is non-compliance and using legal proceedings in case of violation. They report these criminal offences to the Public Prosecution Office of Portugal (CNPD).

The CNPD consists of seven members, each with a five-year mandate, elected/appointed by Parliament, Public Prosecution Council, Magistrature Council or Government and take office before the President of the Parliament (CNPD).

The first fine of the CNPD was against 'Centro Hospitalar Barreiro Montijo'. They were fined €400.000 for violating 3 principles of the GDPR (Moreiro, 2019).

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4.6 DATA PROTECTION ON MUNICIPAL LEVEL

Lisbon

We have seen that Lisbon is doing everything possible to be labelled a Smart City, but how is the organization of data protection done on a city-level? How will the city governments organize and make sure it is done properly and in accordance to GDPR? And does it go further than this?

Since Smart Cities are a collection of connected devices, concerns of data exposure and hacks are much higher. If data is leaked or breached, it could have consequences for all the connected devices and data they share.

Concerning this matter, research was done to showcase what Lisbon does surrounding the Big Data in the city.

Lisbon's data platforms

Lisboa Inteligente (Smart Lisbon)

The city council implemented this platform to deal with aspects of urban governance and aiming at improving citizen's life. Data analytics should provide effective and innovative solution for major urban issues. This comes from the urge to organise and understand the ever-growing data that is collected, because of the more the society is connected to the Internet of Things. The local administration has developed the Smart Management Platform of Lisbon, which makes it possible for the City Council to integrate and analyse data. This data both comes from sensors, internal and external systems, and social networks. In the framework of this platform, there is an integration of 4 initiatives:

- The operational Integrated Centre
- Smart Cities Projects
- Urban Data Lab of Lisbon – **LxDataLab**
- The Open Data Gate – **Lisboa Aberta**

Concerning the research for data, we will take a look at the last 2: Lisboa Aberta and LxDataLab.

LxDataLab

LxDataLab is a project that started in October 2019 and aims at making data available to academic community and business. In that way they have the objective to finding analytical solutions, to improve urban planning and urban management. Its core importance is to engage start-ups and research in the management of data to solve complex challenges, and that cooperation between the different actors is crucial in making the city more resilient (LxDataLab).

It intends to gather the data, the analytical tools and the innovation capacity of the academy and the innovative ecosystem, to return analytical solutions capable of solving real city problems and improving the services provided to those who live in the city of Lisbon, work there and visit it (LxDataLab).



This project aims to develop a new generation of public services in the context of intelligent cities exploring advanced analytical tools, artificial intelligence and supercomputing to analyse complex combinations of large data sets in areas of public interest (LxDataLab).

Lisboa Aberta (Open Lisbon)

This is the Lisbon Open Data Portal, a portal that provides data sets about the city of Lisbon, produced by the Lisbon City Council and partner entities (Lisboa Aberta).

Open data is data that can be accessed, used and shared by anyone. Governments can use this type of data for social, economic and environmental benefits. This kind of data is also the data that is left behind after, for example, an online event someone attended. In this example, there are symbolic traces that are left behind and can be copied, searched, aggregated and stored. Uniting open data of different aspects creates Big Data, which is trusted to the municipality to be protected (Lisboa Aberta).

Lisboa Aberta is the platform that fulfils this need and its mission and vision are the following (Lisboa Aberta):

- **Vision:** Lisboa Aberta is a free data sharing portal produced by the Lisbon City Council and the Open Lisbon Programme partners, with the aim of boosting citizen participation, encouraging data reuse and sharing, stimulating entrepreneurship and innovation.
- **Mission:** The mission of Open Lisbon is to empower the use of data. They seek to transform the way the city works through the use of data and believe that through its use, services can be improved. In doing so, it can lead to a higher quality of life and work for Lisbon residents, employers, employees and visitors.

These are the data sets that Lisboa Aberta handles.

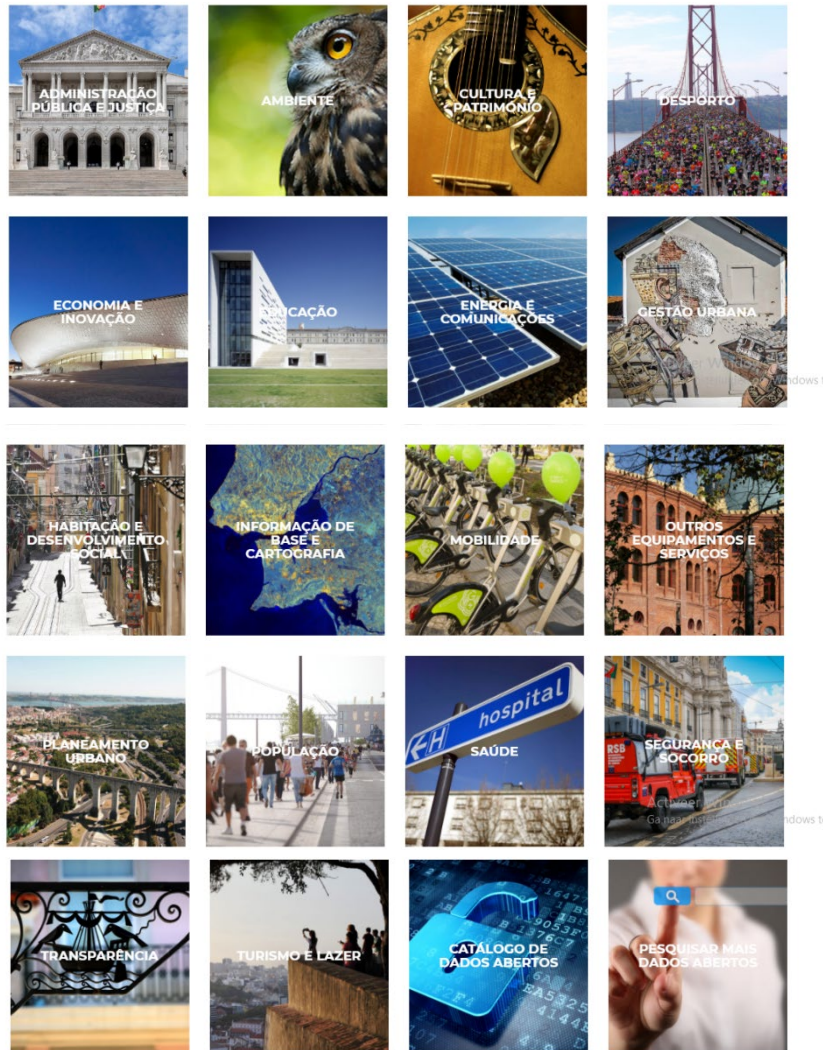


Figure 8: data sets of Lisboa Aberta (<http://lisboaaberta.cm-lisboa.pt/index.php/pt/>)

people generating citizen data will be at risk at any given moment and not experience the city in its full glory. Because if a visitor of Lisbon has to constantly think what is going with its data while being in the city, it takes a part of the experience away.

Through his career, he notices that there is indeed a bigger awareness by businesses about data protection than, for example, 10 years ago. But awareness does not mean solution. There is still a very big step from being aware of the problem and for business to invest in measures to prevent data breaches.

He mentions that to obligate businesses to do this, the GDPR and ISO are very good initiators. ISO is the International standardization in the field of Information Technology. It was introduced to develop, maintain and facilitate IT standards that global markets require for businesses concerning the design and development of IT systems and tools.

Although being optimistic about the measures of European Union for data protection, he states that preventing is better than recovering. If a business or municipality has to recover from a data breach, it means that records were stolen and people's sensitive information was accessed.

An example he gave is EDP, a Portuguese company that offers energetic services, like gas and electricity. For months it was being attacked and had data stolen without them even knowing. When eventually they did realize, they could not manage to find out what exactly was stolen.

This example shows how valuable a DPO and data protection measures are for businesses, even though they do not handle sensitive data of citizens. Because of the IoT, a data breach of one company can also unveil very sensitive corporate data and even though it is a big investment, it is still a low price to pay in comparison with a GDPR fine.

Therefore all businesses should consider installing measures that protect their data for cyber criminals, even though they do not handle any citizen data.

Interview with Mr. Almeida, business strategist of the company Schröder

As Mr. Almeida is more involved in the Smart City concept, his view of data and data protection in this concept is much more detailed and elaborated. He emphasizes that Lisbon has already a good view on the importance of the creation of citizen data using mobile phones. But he feels that regarding the usage of this data, the city still needs a lot of improvements.

Mobility is one of the aspects that is the biggest challenge for Lisbon, with some neighbourhoods being excluded from public transportation. Although, the Portuguese people are creative and found the solution of Uber to fulfil this need, he believes that more investments should be made to make improvements. One of the problems with mobility, in Mr. Almeida's opinion, is that there is no real-time data in the public transportation. Real-time data is data that is presented as soon as it is acquired, which would be very beneficial for people waiting on the bus or train. The city is already working on a unified ticketing initiative, that would integrate 1 ticket for trains, trams, buses, motor,... and also a transport information to give real-time data about traffic in the city. But it takes time to develop.



the city, they have a very good view on what a person is doing and have the chance to reward him/her on doing something good.

These suggestions given by the interviewees, can surely be used for Lisbon. Although it will not oblige businesses to hire a DPO, it most definitely can introduce a reward-based-system like Cascais. This not only persuades people to act more responsible, but also helps different fragments of the city, which relates back to the definition of Smart Cities.

5.2 THE NEEDS OF THE PEOPLE ON THE STREET

As a further part of the research, ordinary people on the street of Lisbon were questioned about data and data protection. The survey consisted of 7 questions (see annex) that ranged from if the people have knowledge of their data being used, to if they know some data protection and what they would expect from the organisations that use their data. In total there were 60 answers of people who lived in Lisbon.

Profile of respondents (questions 1-3)

In regards to the demography of the respondents, 80% of them ranged from an age of 20 to 22, 10.2% had an age of between 24 and 55 and 10% were between 16 and 19 year old.

What is your age?

60 antwoorden

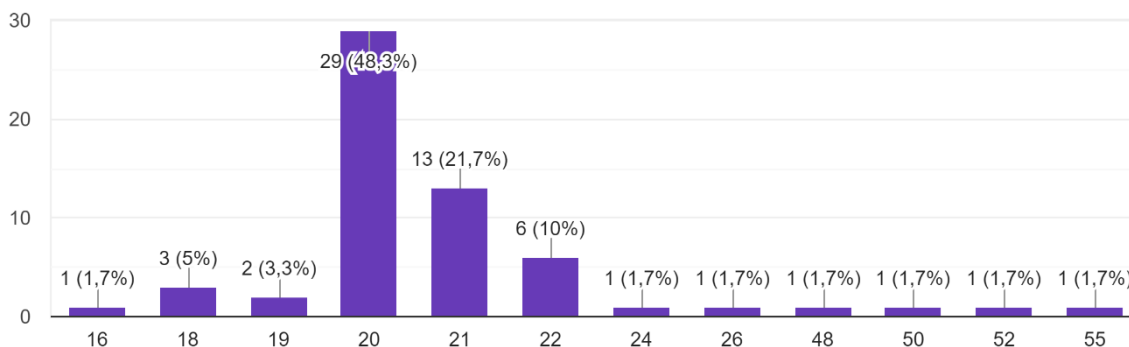


Figure 10: age of the respondents

85.7% scored themselves medium or above when describing their behaviour online. With 38.4% being very active online (1 being very unactive and 7 being very active).

When asking why people to validate why they are confident or scared, the answers varied.

Since this was an open question, quotes were used to summarize what the general reasons are for their feelings. All the answers can be found in the annexes.

“Scared because I don’t know how they could use my data”

“Because they can use it for whatever they want, it might leak”

“It is weird to know that someone else is using your data”

“Because you don’t know the people who are using it”

Although, some people are not worried about their data being used and analysed. Because they don’t share a lot of information, or just because they accept that it is used.

“I don’t really think about it...”

“It doesn’t really matter to me”

“I don’t care anymore, it is the future.”

The people that are active on the internet for different purpose, have a general feeling of being scared of not knowing what their data is used for. This ignorance leads to people being afraid that it is misused and leaked, and it gives them a scary thought that someone else is handling their data. This is clear proof of the asymmetrical relationship the people have with the government concerning their citizen data usage that was established earlier in the research.

For this relationship to be strengthened and give back to the citizens, GDPR came into force to ensure that people do not have to be afraid of data breaches, hacks or data leaks. It tries to protect their data as good and secure as possible, and punish the ones that do not comply with these newly implemented laws.

This raises the question if people are aware of this fact and have knowledge of the GDPR that protects their data.

Knowledge and feelings of data protection (question 7-9)

In regards to if people know if their data is being protected enough, 60% are aware of this. A great share of the people surveyed (41.7%), had no idea that their data was being protected.

Are you aware of some protection of the data in Europe?

60 antwoorden

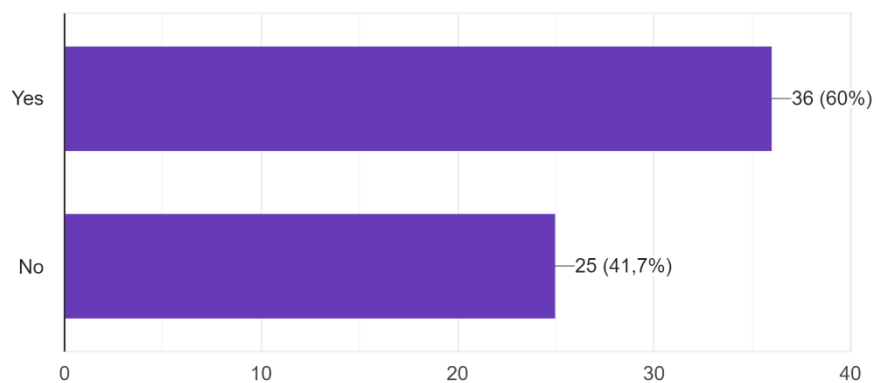


Figure 15: knowledge of data protection of the respondents

Almost two-thirds of the respondents answered that they do not feel that their data is being protected enough. One-fourth had no concerns about this, and the rest did not have enough information to answer this or did not know what to answer.

Do you feel that your data is being protected enough?

60 antwoorden

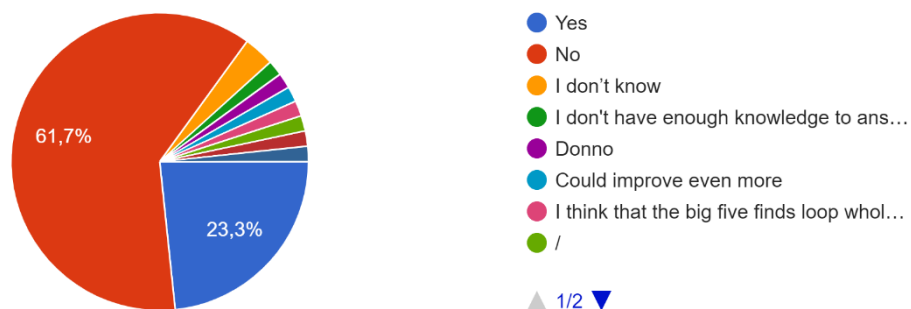
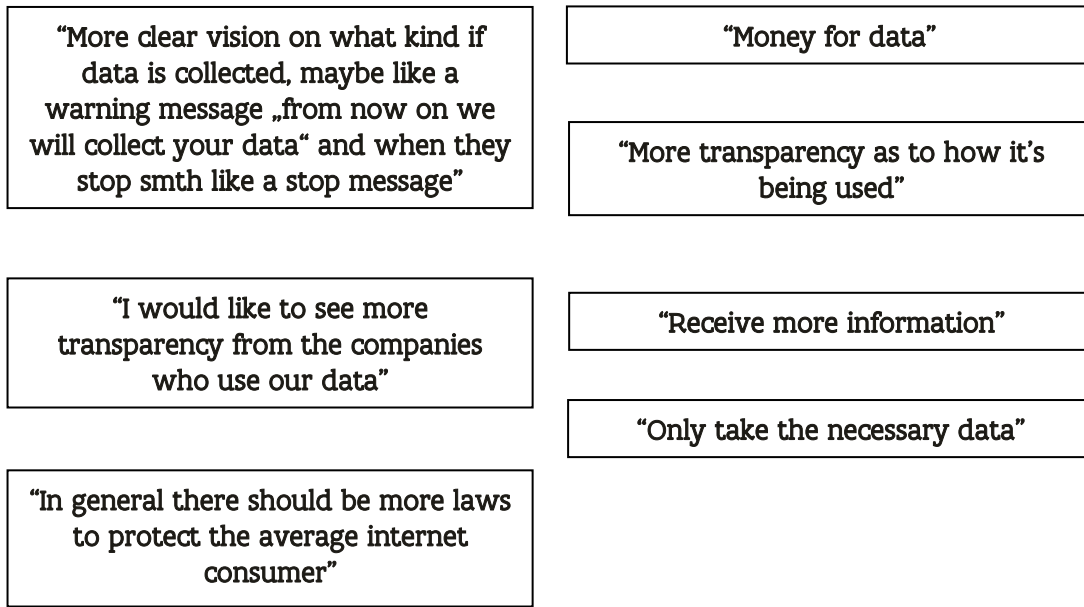


Figure 16: feelings of data protection of the respondents



If the people got the opportunity to come up with their own suggestions to improve or change data protection, the answers were wide-ranging. Different quotes of the people were used to summarize the different suggestions. All the answers can be found in the annexes.



In conclusion, almost half of the people surveyed were not informed about data protection in Europe. Measures like GDPR, the European Data Protection Board, Data Protection Officers and topics in the news about multiple fines given to big companies, are going unseen to a great portion of the people. Since these protection measures came in force in 2018, some people still do not know what protects their data and how it is done.

Although a big portion were not aware of this, people are still anxious of their data being used and analysed. In regards to this, different suggestions were made that could enhance the fact that organizations use their data and have a better relationship with these persons.

Conclusion of the survey

To summarize everything that was stated in the survey. It showed that a great part of the respondents of the survey consisted of a section of the general population that is very much active online. This part are the young-adults, who use the internet for various resources. Examples of these resources are social media, streaming-services and research. Earlier research has shown that these internet resources and platforms are the ones that really initiate and create the most data in general. In regards to a Smart City like Lisbon, this kind of data is called citizen data, and is very sensitive and personal information of the habitants of the city. It is being collected and analysed on a daily basis.

Asking this to the people that were surveyed, almost 20% made it clear that they were not aware of this collection and analysis. Furthermore, 71.6% of all respondents had a bad feeling of their personal data being used. This is due to them being afraid it might leak, be hacked and not being fond of the idea that someone else is using their personal, sensitive information.

This is clear proof of the asymmetrical relationship that was mentioned in the concerns of citizen data-usage in Smart Cities. The people in Lisbon are also afraid of being ignorant about the fact that their data is being used, without them being included in the process or being made aware of this.

For the collection and analysis to be done fairly, and with respects to the privacy of every citizen, different protection measures were installed. Although the surveyed people are not really aware of the fact. Only 60% of the people that filled in the survey, were informed of protection measures like GDPR, the EDPB or their national data authority. The other part was not aware of any protection of their citizen data.

On top of that, 61.7% of the respondents felt that their data was not being protected enough and 15% did not have enough information to make a decision regarding this topic. Which again shows that the communication and protection measures are limited and do not reach all the persons. Not only of the European protection measures, but also the Portuguese data protection authority. Even though all the sensitive and personal information of these citizens is being used to improve Lisbon, the people on the street have no idea why and what it is used for.

Different suggestions of these people to fill this need, consisted of more communication, transparency and a reward-based system. This last one is mentioned in one of the examples that Mr. Almeida gave in Cascais. Where they use an app that rewards citizens on their good behaviour, since they can clearly know what someone is doing every day. In that way they give back to the creators of citizen data, while they use it, as a return for having a view in their everyday lives.



6.3 REWARD-BASED SYSTEM

What Lisbon can use as return to the people for using their data, can be the same as the example that Mr. Almeida, business strategist of the company Schröder, gave about the system that the municipality of Cascais uses. MobiCascais is an app that is used by the municipality of Cascais to give back to the citizens, for the usage of their citizen data. Since the municipality has a very detailed look into the everyday lives of the citizens, it can map out the day of every individual and have an eye in what they are doing. To be able to do this, they have made an app that gives rewards back to the habitants of the municipality in the form of discounts, money,... This is something that the people that got surveyed in this research were looking for. This also further cancels the asymmetrical relationship and integrates the people in the govern of the city. The problem for Lisbon is that this city is much more touristic than Cascais and will have to look into what it can do to be able to offer this to tourists as well.



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5. What advice would you give the constructors of the Smart Cities? What advice would you give data protectors for Smart Cities? What advice would you give the costumers, whose data is used?

To prevent and no to remedy should be the main concern of those who are in the process of building a city. Ask the experts for help on the subjects that are not the main core of its company. Customers should be informed and demand their rights in subjects related to data protection.

8.2 INTERVIEW WITH MR. ALMEIDA, BUSINESS STRATEGIST OF THE COMPANY SCHRÈDER

For the interview with mister Almeida, there was also a file with the different answers of the interviewee. Though, the pc where the meeting was conducted broke down the day after tomorrow and this data was gone missing.

8.3 DATA OF THE SURVEY

The data of the conducted survey can be found on the next page.

Tijdstempel

Tijdstempel	What is your age?	How would you describe When surfing, what do yo	Are you aware that your d	Are you confident or scar	Why are you confident or	Are you aware of some pr	Do you feel that your data	If you had the power to change something of the data protection, what would you like to change?
5-12-2020 17:36:16	21	6 Social Media, Streaming, Yes		2	Scared because I don't kn	No	No	I don't know
5-12-2020 17:43:19	20	6 Social Media, YouTube Yes		3	I don't care anymore, it is	Yes	Yes	Just don't share pictures of people
5-12-2020 17:43:42	21	6 Social Media, Streaming, Yes		5	Ma non mi va di sentirti u	No	Yes	Money for data
5-12-2020 17:45:02	18	6 Social Media Yes		3	Idk	No	No	That they can use my data if they gev me mony it is still my data
5-12-2020 17:45:36	21	3 Social Media Yes		3	Because my data is using	Yes	No	humanity's mind, love is the key
5-12-2020 17:48:51	22	5 Social Media, For work, R Yes		2	Yes	No	No	More transparancy as to how it's being used
5-12-2020 17:49:56	21	6 Social Media Yes		3	Yes	No	No	more regulations
5-12-2020 17:52:45	21	6 Social Media, Streaming Yes		3	I know that my data is use	Yes		I don't have enough know I would like to see more transparency from the companies who use our data
5-12-2020 17:56:40	21	5 Social Media, For work, G No		3	Yes	Yes		rediscover the values of nature and stop destroying the planet as we are doing
5-12-2020 18:02:58	22	5 Social Media, Streaming Yes		2	Privacy rights	Yes	No	Transparency, clarity
5-12-2020 18:14:40	16	4 Social Media Yes		2	because they can use it f	Yes	Yes	don't know enough about it to say honestly
5-12-2020 18:32:49	20	4 Social Media, For work Yes		3	Yes, No	No	No	More protection, more certainty
5-12-2020 18:33:08	20	6 Social Media, Research Yes		3	Ik ben er mij bewust van,	No	No	A cookie blocker
5-12-2020 18:35:00	20	7 Social Media Yes		2	Het is eng omdat je niet w	No	No	Oei geen idee
5-12-2020 18:39:45	20	5 Social Media, For work, R Yes		3	I use VPN	Yes	Yes	The usage of unnecessary cookies
5-12-2020 18:46:54	48	3 Social Media Yes		4	It doesn't really matter to	Yes	Yes	Norhing
5-12-2020 18:47:45	20	3 Social Media, Streaming, No		3	It is weird to know that so	No	Yes	Only take the necessary data
5-12-2020 18:48:47	20	6 Social Media, Streaming, Yes		3	No	Yes	Yes	Nothing
5-12-2020 18:52:28	22	5 Social Media Yes		2	Because you don't know I	Yes	No	That the big companies have to pay an amount of money to use all the date they find/use. That I know more about what actually happens with my data and for what it's being used.
5-12-2020 18:54:12	20	5 Social Media, Streaming, Yes		3	I'm not really scared, but	No	No	
5-12-2020 18:59:40	19	6 Social Media, For work Yes		4	Yes	No	No	/



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