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Smart Cities

Digital Transformation in Câmara Municipal de Cascais

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ABSTRACT

Global urbanization trends around sustainability present great challenges for the cities. A Smart City concept has been developed as a strategy to understand and solve the needs of the citizens. The present study aspires to understand and explore the concept of Smart City in Cascais, as a municipality, in the interest of a potential urban construct that can answer to the social and ecological sustainability challenges that a society faces. A smart city is an urban construction by integrating information and communication technology that aims to create a sustainable economic development and a higher quality of life by outdoing in key areas, such as economy, mobility, environment, people, living and government. By surveying employees of Câmara Municipal de Cascais and using Digital Maturity Framework, we aim to understand the strengths and limitations of the smart city concept. Based on the insights from the survey, and the benchmark in the literature, we propose a Strategic Development for the Municipality to identify and organize different strategies aiming to maximize the benefits of the Smart City concept.

Keywords: Smart City, Municipality, Sustainability, Efficiency, Citizen Participation

ACKNOWLEDGMENTS

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A. Summary

What should a city optimize for? (Gartner, 2017) The growth of cities is inexorable. The unprecedented pace of urbanization demands that we adopt new approaches to providing essential services, and realize the possibilities offered by technology. (Capgemini, 2011)

A lot of consumers are aware of technology which allows people to redefine the lines between digital and physical, like interactions with the products before they get to the physical stores. The interest in technology emerges mainly due to the needs to enhance experiences and to be more efficient. Digital Transformation is the change associated with the application of digital technology in all aspects of human society and in this case specific to a municipality. In this direct research, the focus is on a municipality. The goal is to understand how to instigate and nurture new types of innovation and creativity, rather than simply support the traditional methods of a municipal management. The opportunity of creating a smart city holds potentials in contributing to creating a city that is both efficient and conducive to innovativeness. A digital transformation in a municipality refers to the utilization of information and communication technologies, in order to provide efficiently, targeted, transparent and accountable local services (Accenture, 2016). The appearance of the millennial generation brings not only a new type of consumer but also a new kind of employee, with different thoughts and aspirations. In this sense, a motivation to become a smart city is to not only improve the infrastructure but also, to increase quality of life of the very population a city will serve in the next decades. The idea of creating a smart city is even broader, as cities compete to become more attractive for business and increase economic development (Cisco, 2012). A smart city in a municipality seeks to address public issues by implementing ICT (Information and Communication Technologies) solutions since a high-density population requires more water, transportation, infrastructures and more employment.

B. Research Questions

The purpose of this research will be to explore the concept of smart cities and to understand if it can be truly applied to Cascais in order to make it more sustainable and efficient. Research Question - **What suggestions can be made to help CMC move more effectively and efficiently towards a Smart City Structure?**

- What the Digital Maturity Framework reveals about the smart city concept in moving a city towards sustainability?

- Are CMC employees looking to innovate at work and to adapt to Digital Transformation?

C. Context Background

1. Municipalities

a. Cascais, a municipality

Cascais is a coastal municipality, an urban administrative division with a corporate status with powers of jurisdiction (All about Portugal, 2012). It was considered as a city in 1364 and it is situated 30 km from Lisbon, the capital of Portugal. The population in 2016 was 210,361, in an area of 97,40 km2 (All about Portugal, 2012). The privileged location near the Atlantic Ocean and several beaches and its socio-economic development are the causes for the increasing population, which has grown in the last few years, about 21 % from 2001 to 2011, according to the last census (INE, 2012). The former fishing village become a popular vacation spot and has been one of the most stable municipalities of Portugal. As a municipality tries to attract leading investments, by fostering knowledge and the preservation of natural resources, appealing to citizen participation (www.cm-cascais.pt).

b. Mission, Vision, Strategic Objectives

The mission of Cascais municipality is to contribute to the well-being of the citizens by adding value and following principles such as solidarity, liberty, transparency and equity. More than

that is to create a sustainable city. One of the main goals is to respond to the basic needs of citizens, as poverty, counseling and social care and at the same time trying to solve environmental issues and employment issues. Hence, it is important to improve personal and social skills, by developing cultural and disciplinary projects, creating job opportunities and fostering entrepreneurship. Câmara Municipal de Cascais aims to maximize and optimize factors that will enable sustainability, social inclusion, economic growth, modernity and innovation. More than that aims to adopt organizational measures that foster rigor, social and economic equity in order to minimize risks and social differences (www.cascais.pt, www.cm-cascais.pt & Lei n.º 169/99, de 18 de Setembro – Autarquias Locais – Competências e Regime Jurídico).

c. Limitations

There are several limitations for a municipality like the financial supports since usually, budgets given to cities are not able to respond to all the necessary needs. Furthermore, municipalities are often prepared to deal with a growth scenario since it brings more job opportunities and inhabitants. However, they are not organized in order to deal with a population decrease. As a municipality, they are dependent on a social-political perspective, always related to peoples' reality. In the end, the impressions and perceptions created in the citizens' minds can influence the appearance of resources and political support. So everything a municipality does is being evaluated not only by the governments that provide grants but also by all the citizens that are normally aware of all the decisions made regarding land development, infrastructures, events, among others (Lei n.º 169/99, de 18 de Setembro, Autarquias Locais, Competências e Regime Jurídico & www.cm-cascais.pt).

2. Smart Cities

a. Definition

*A city is not a computer. Urban intelligence is more than information processing (*Mattern, 2017*).* The concept of smart city has been created in order to develop a city to work better and more efficiently, using technology (Rakesh, 2015 & www.citiscope.org). A city can be defined as smart when investments for human and social capital and communication infrastructure foster a sustainable economic development and a high quality of life. (Deloitte, 2015). For a normal person a light post is just what it is, but for a city, it can be an opportunity to build a framework for optimizing city operations such as environment, transportation or safety. Nowadays, city governments are moving toward technological solutions. Smart cities specialists should implement solutions that will enable a city to use data collected from different devices in order to optimize city operations and to make it more efficient. Moreover, an urbanization based on networked cities can help the world reach its demographic challenges, since this rapidly urbanization has created a huge demographic imbalance. Smart cities are the key to deal with this transition and achieve growth that will be sustainable and inclusive (Elfrink, 2012).

b. Benefits

Digital technologies are doing for human brainpower what the steam engine and related technologies did for human muscle power. They're allowing us to overcome many limitations rapidly and to open up new frontiers with unprecedented speed. It's a very big deal. But how exactly it will play out is uncertain (Deloitte, 2015). The idea of introducing a digital transformation in a municipality is to improve citizen engagement. In the end, high-quality digital experiences are valued by citizens not only due to the user-experience but also because normally online services can be very user-friendly and practical. A digital transformation in a municipality can easily reduce the interactions due to an automation of services and can increase the eco-system by creating partnerships with other companies. Moreover, the use of digital channels for advertising and sharing information can increase revenue and data storage

can easily reduce costs. Furthermore, this digital transformation by creating a smart city can anticipate citizens' needs just by observing and analyzing data. Smart Cities will enable authorities to track for example a person's location and that will enable the municipality to understand what are their routines and which services they often use, in order to develop strategies that improve citizens' life (UrbanTide, 2014). Therefore, the goals of creating a smart city will usually focus on a sharing economy concept, data-driven policy, co-creation of decision making, a sustainable city and more than that the well-being and an increase in the quality of life of the citizens.

c. Characteristics and Limitations

A smart city has several concepts according to Frost & Sullivan, as below. A smart governance and a smart education it is crucial in the sense that all main decisions in order to create a smart city are made by the governments. In this sense, the municipality should define political strategies and perspectives in order to have a god transparency. Regarding Smart Education fostering a digital education and good infrastructures will be relevant in order to enable citizens to be more open-mindedness in relation to digital transformation. This will always be related to the Smart Building and Smart Infrastructure concepts since infrastructures should be built according to the concept of Smart City. Furthermore, technology and energy should be implemented by considering a good sustainable resource management, in order to reduce pollution and increase environmental protection. Hence, all this is nothing if a municipality is not worried about citizens and with an economic approach. Subsequently citizen's active participation in very important and the best way to stimulate, that is by creating innovative and creative cultural offers, individual safety and good health conditions.
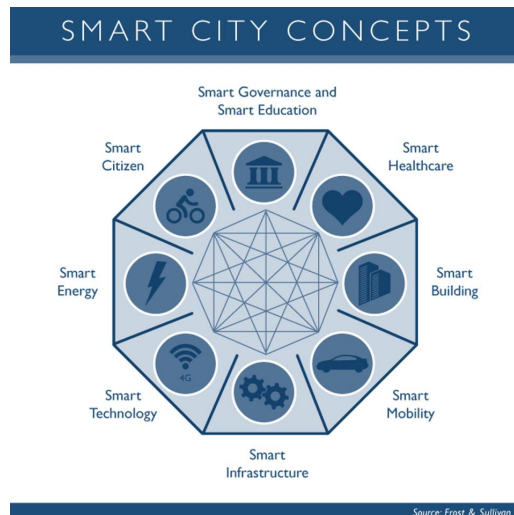
Figure 1- Smart City Concepts (Frost & Sullivan, 2013)

Considering all these concepts, there will be fundamental smart city participants that can assume different roles considering the areas implemented. The first one will be the integrators, which the main function is end-to-end service providers. Next, we have the network service providers that offer data analytics and enterprise working solutions to connect people, products and systems. Their main goal is to understand how data is being collected and analyze that in order to define strategies to connect citizens with the products provided by the city and also all the services related to that. So fostering the communication between the citizens and the smart city has to be done at first by assessing the importance of all the data that can be collected. By doing it, a city can identify the potentials, possible implementations, and opportunities to improve (Microsoft, 2015). The concept of Smart City is very attractive, any city will be motivated to have a highly efficient system, fed by sensors and data that will ease the challenges of urbanization. However, the main barrier of adopting the concept of smart city is the complexity of how cities operate, are being financed, regulated and planned. This budget and capability constraints can easily block municipalities from investing in the correct and more adaptable digital solutions (Cisco, 2012). Another important obstacle is the lack of cross-departmental coordination and association with priorities (Cisco, 2012). A collaborative nature is required to shift the paradigm and rethink the needs of a city. (Novikov, Fedor, 2015 &

Matson, Cat, 2016). Privacy is another big issue in any digital transformation project. The ultimate question is if we are willing to trade privacy for safety and efficiency. A digital transformation will completely transform a city because when making a city "smart" a person's activity will stop being completely private, since the idea is to collect and store a person's information. More than that a municipality deals with sensitive information every day. Even if we do not know exactly the location of the person, by piecing together a variety of data we can easily understand and observe a path. Likewise, the limitation to a digital transformation in a public entity is even bigger due to an imposition of time and resource costs on organizations and in order to proceed to a digital transformation one of the most important things is change of business processes.

d. Portuguese context

The implementation of smart city projects is being privileged by European policies, since this projects can be funded under Horizon 2020 and other funding programs, due to the goal of creating and increasing the smart city market through the implementation of lighthouse projects. One of the main reasons why this implementation is being privileged and fostered is because cities are facing several challenges including a population increased since more than 50% of the world's population live in cities, which is causing a huge impact on city infrastructures (Cisco, 2012). INTELI has created the Smart Cities Portugal platform, which intends to promote the cooperation between several infrastructures, such as municipalities, companies, clusters, universities and R&D centers in order to develop and experiment technology solutions. The main goal of this association is to solve urban problems through shared knowledge between the infrastructures referred and through innovation. Regarding the municipalities, there is a company that is representing them, RENER Living Lab – Portuguese Smart Cities Network that acts as a place to develop those strategies (Inteli, 2014). Moreover, this is key to promote the country and to improve the participation of Portuguese citizens and

companies in the smart city project. Nowadays INTELY has already an ongoing project co-financed by COMPETE, that promote opportunities related to smart cities, focusing on fostering urban entrepreneurship (Cronosgroup, 2015).

e. Smart City Framework and Development

To be able to implement a project for a creation of a smart city is important to focus in several areas. First of all, is key for a city to know exactly the strategy that they want to implement and the vision created, *Smart cities have a clear vision of what they want to be and a strategy to realize this ambition. A clear vision is required as effective counterweight to technology push (Deloitte, 2015).* Moreover, to create a smart city the municipality should have access to data and technology, to create open networks and sensors to acquire all the data necessary to understand which services should be created and the ones that should be enhanced. Nevertheless, to do so is necessary that the persons involved in this project have the skills, have an openness to innovation, attractiveness for business and challenge and more than that are eager to present new projects and solutions. *As smart solutions aim at changing the behavior of people, cities need experts who understand the mechanisms of human behavior (Deloitte, 2015).* With the strategy planned, the development of the smart city will grow and with it the maturity, that can be accessed by several models (Deloitte, 2015).

f. Trends

In the future, everyone will have and use a computer. Since every person interacts with the computer in a different way, is important to create a unique technological ambient for each person. More and more all technological services are being globalized and omnipresent, due to this is important to create secured and transparent environments, since regarding smart cities we are always relating it to open data. Another huge trend is the networking technologies, which enables the easy access to some services such as healthcare, work environment. When using this technology, the person can work from everywhere or even have his/her diagnosis

delivered by e-mail. Hence, we will be able to observe the reduction of time and resources use. Moreover, Open Data is key, since without its availability, quality and analysis, it is very hard to create a Smart City. By re-using data and fostering innovation the value of all the data acquired increase. Other trends are GIS (Geographic Information System) and e-Government. The first one provides a platform where a municipality can have easy access to a lot of geographical information, which reduces time wasted in visiting the locations and enables an analysis of services use, routes chosen or even for security purposes. E-Government will foster the efficiency of the services provided and the creation of consistent technologies and infrastructures that will help create personalized facilities. According to Microsoft, cities should focus on four main areas: sustainability (environment), efficiency (transport and resources), people (citizen participation and high-quality of life) and security (Municipal Institute of Information, Barcelona, 2014 & Microsoft, 2015) (For more Details, see Annex A). Cities contribute significantly to climate change and due to an increase in population density, a rising demand for energy. In this sense, is fundamental to improve sustainability, by changing the way energy is managed. Second, transportation it is also a key factor since an effective transport system is fundamental to a city's productivity and provides not only environmental and health benefits but economic and social. Moreover, is important to have a collaborative leadership in order to engage the citizens in a way that is going to be easy to develop a smart city project. Besides, focusing on the relation between the citizens and the municipality will enable a better smart city project. It is fundamental that the main focus are the citizens and their satisfaction, fostering a feeling of community and integration. In this sense, we have identified several trends in smart cities according to the areas identified and the problems observed:

Smart Cities Trends

Sustainability ♻	Efficiency 💡	People 👥	Security 🔒
A)Energy management – Smart Meters B) Water smart meter C) Smart Building D) Waste Management E) Self parking cars F) Noise detectors G) Conscious Home – Sensors to controls light, energy monitoring, and even remote pet feeding	A) Intelligent Transport B) Traffic management (detecting traffic jams) C) GPS location and performance monitoring regarding transportation D) Smart parking E) Fleet Management F) EV Infrastructure	A) Tele-Health - Telemedicine B) Itown – broadband network between the municipality and the citizens C) Elderly monitoring D) Smart toilet E) Hospital Capacity Tacking F) E-Tourism G) Connected Retailer	A) Smart TV – Video surveillance B) Facial recognition C) Fire and smoke detectors D) Acoustic sensors E) City maintenance – app so that citizens can inform municipalities about defects observed

Figure 2 – Smart City Trends

D. Addressing the Work Project Questions

1. Methodology

A digital transformation to be well implemented needs to be supported by an analysis of the internal processes of Câmara Municipal de Cascais, the digital maturity existent and how citizens react to innovation. For that, we created two surveys (For more Details see Annex B & C) based on Forrester Digital Maturity Model and on TDWI Big Data Maturity Model (For more Details see Annex D) to access digital maturity and how citizens are reacting to the digital services purposed. First, by using the survey method, and applying it to Câmara Municipal de Cascais, we aim to understand the structure of the population of employees in the Municipality. This will bring an idea of how people that work in CMC are dealing with innovation and new processes, and their perceptions related to digital transformation. Innovation is a sudden creativity that leads to developing an action into to the municipality strategy, that requires collaboration and communication and that will lead to a transformation and the implementation of the process (Newman, Forbes, 2017). In that sense, we will divide the sample in three categories:

- Travelers - Innovation Group, the members of CMC that will demonstrate that innovation are important and that wish to take Cascais' city to the next level by implementing the Smart City project;

- Digital Persona, the members of CMC that have a sense of being lost in the digital transformation. However, are willing to understand and learn about this project;

- Lost in Digital - Non-Innovation Group, the members of CMC that don't know yet about any efforts made towards this project and that are not eager to start dealing with it.

The employees are classified in one of three groups based on the questions designated to define them. Second, by doing a Customers' survey we will observe the community openness to the digital transformation in CMC. Finally, we will apply exploratory analysis to understand:

- the relationship between innovative behavior and performance and image outcome - the efficiency-oriented perspective since one of the main reasons why people innovate at work is to bring performance gains and efficiency;

- the relationship between innovation and social-political perspective, due to the construction of people's reality that it is determined by impressions and perceptions.

These surveys are also used in order to understand the digital maturity of this municipality, which is the extent to which digital technologies have changed the internal processes, by creating new opportunities for improving services and develop a better engagement with citizens. Moreover, is the number of quality digital experiences created across web, mobile and social media channels. By assessing this we will be able to present new strategies to strengthen the connection with the local community.

2. Main Research Insights

Both Surveys were conducted from the 22th to the 24th May. The first survey was sent to all employees in Câmara Municipal de Cascais by CMC Head of Future Marco Espinheira. The

second one was sent to citizens that live in the area of Cascais, which we only had 14 answers. Regarding the first survey, the total response number sums up to 67 respondents who have completed all the questions, representing approximately 3% of the workforce (considering the total number of employees to be 1820). Both surveys were led to better understand CMC's realities, not as methodical analysis given the time constraints and limitations existent. Furthermore, the results should be considered carefully due to the length of the sample and also they include a non-response bias, due to a complex survey, lack of knowledge from the inquests and short deadline. Results should be viewed as guidelines since no casual research was made, so no cause-effect relationships should be done. On the open question regarding the major problems identify of accepting a project of big data we can observe that the ones chosen are the privacy, security, costs and resistance to adopting digital solutions (Graphic 3, Annex E). Most of the answers came from "Técnicos Superiores" (38%). The respondents are mostly over 35 (97%) and most of them (88%) have been working in CMC for more than 5 years (Graphic 1 and 2, Annex E). In this sense, we decided to divide our sample in three categories considering theirs answers in specific questions, regarding the openness to innovation and knowledge about internal digital processes. Considering our sample, we suggest that our sample are represented mostly by Digital Personas (65%) (figure 3), which leads to the conclusion that employees in CMC are eager to start introducing new digital solutions and to adapt new digitalized processes.
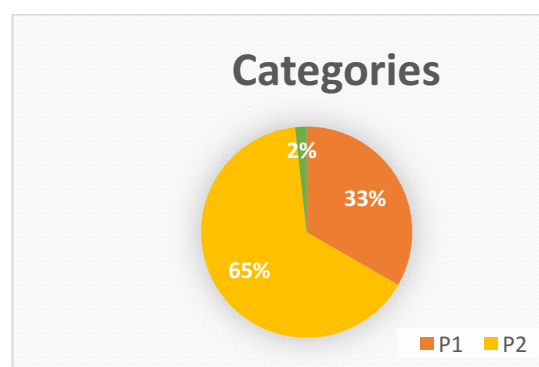
Figure 3 - Categories

	Nº	% (do total)	Score	
			Max	Média
Travelers	19	33%	0,00	54,26
Digital Persona	37	65%	0,00	43,16
Lost in Digital	1	2%	0,00	19,00
Total	57	-	-	-

Figure 4 – Categories

Due to this finding, we can presume that employees in CMC are used to innovation and new technologies, and even more that CMC is ready to start the path to develop a Smart City Considering. Also, most of the respondents (49,3%) believe that creativity and innovation are important and fostered in CMC (Figure 4):
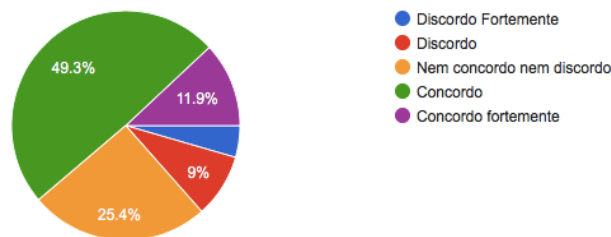
Figure 4 – Creativity and innovation are fostered in CMC

Regarding bid data, the sample suggests that 40% affirms that they have a sufficient knowledge and understand for what it is used for (Figure 3).
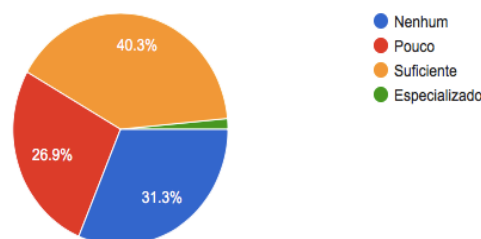
Figure 5 – How you evaluate your knowledge about big data and its use?

Considering the innovation as fundamental to any Smart City project, we decided to analyze innovation as the creativity and openness that will enable the development of digital strategies and relate it with performance. According to the graphic below (Figure 6) we can observe what

it seems to be a correlation between performance improvements with innovation behavior, which may indicate employees of CMC are willing to adopt new processes to improve their outcomes and to facilitate their work.
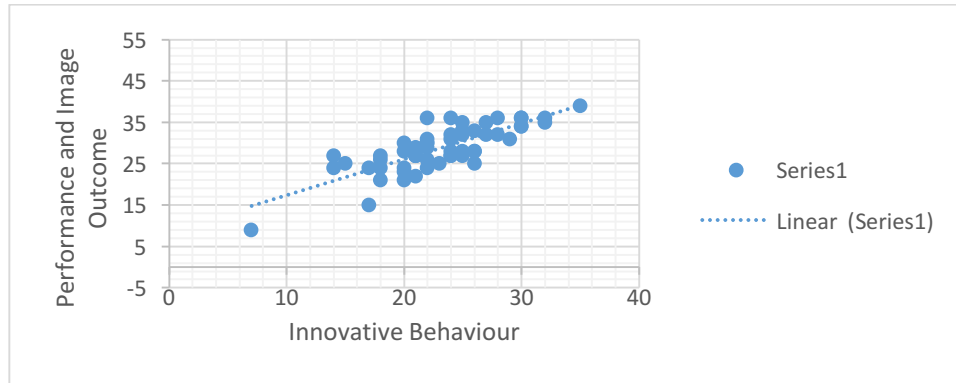
Figure 6 – Innovation vs Performance and Image Outcome

However, despite performance and image outcome being inclined to grow with innovation, some of the problems identified by the respondents is that data is sometimes complex and they do not have a specific program where they can analyze as a whole all the data acquired, which complicates the task and further analysis and understanding the information obtained. Most of the tools used by our respondents are Microsoft Office, Email and Social Media tools. More than that 26% of our respondents use apps that are not managed by IT (Figure 4, Annex E). When asked about internal processes efficiency, 34% of the sample think that processes are efficient and 22% feel they are not efficient (Figure 5, Annex E), due to lack of communication between departments and due to bureaucracies. However, according to the respondents, a lot of internal processes are already automatized (51%) (Figure 6, Annex E). Also, we can conclude that the way that employees were working five years ago is not the same as it is now (38,8%) which may mean that CMC is trying to develop new processes and to adapt to the new digitalization era (Figure 7, Annex E). Furthermore, 51% of the respondents refer that a team specialized in digital transformation exists already in CMC and 32% of our sample feels that decisions in CMC are driven by data (Figure 8 & 9, Annex E). Regarding data access, 55% of our sample affirms that they have access to data and 49% believes that digitalization is

assuming a more relevant role in CMC (Figure 10 & 11, Annex E). Regarding strategy implementations, 39% of the sample believes that there is a strategy of big data in CMC. Moreover, when trying to understand how innovation can be related with social perspective using both surveys, no conclusions were withdrawn, probably due to the fact of the small sample size. This correlation was done because it is important to understand if CMC innovations would influence citizens' reactions and therefore, image and political considerations.

Innovation vs Social Perspective

	Avg Social Perspective	Avg Innovation
Entre 25 e 35	28,42	23,00
Mais do que 35	32,00	23,07

Figure 7 – Innovation vs Social Perspective

Digital Maturity Framework for CMC

Four dimensions were analysed (Culture, Organization, Technology, Insights) in the final part of the survey according to the questions suggested by Forrester's Digital Maturity Model 4.0 (Forrester, 2016). However, since the sample is only 3% of the workforce in CMC, the maturity levels described below should not be assumed as reality.
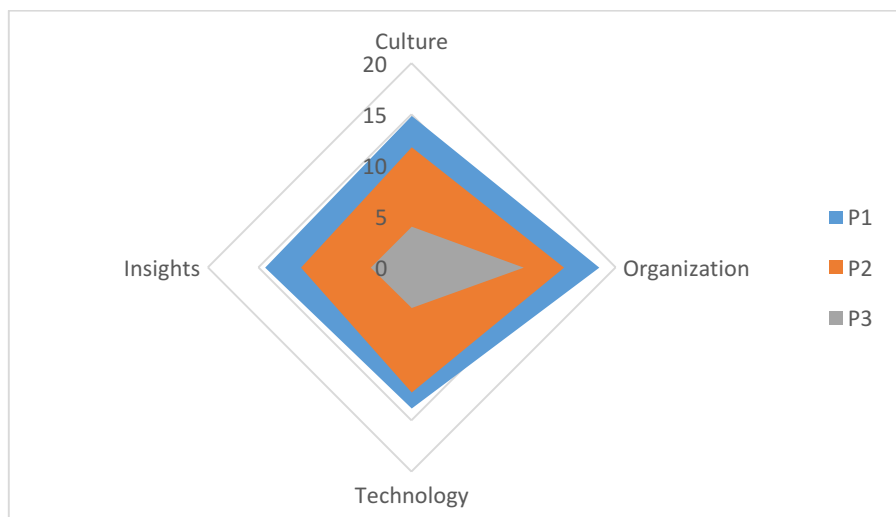
Figure 8 – Digital Maturity Framework (P1 – Travelers, P2 – Digital Persona, P3 – Lost in Digital)

According to Figure 7, most of the respondents consider their maturity level to be high. Moreover, we can see by the graphic that as more openness to digital transformation the employee is, bigger is their digital maturity. So it can be observed that a correlation between digital maturity and openness to digital transformation and innovation exists. However even if it seems that most of the sample represented by the Digital Persona (Orange area) have a high maturity level, some of questions on the survey show the opposite, due to the fact that some do not have the knowledge of big data processes or of any innovation solutions implemented. Overall, we can conclude that most of employees according to the sample have some knowledge about digital transformation and big data and are open to new solutions and new processes to be implemented to take Cascais to the next level, a more sustainable and efficient city to live.

3. Recommendations

A smart city contains different figures, among ICT and Operating Technology, that should then integrate the project itself. Subsequently, is important to relate the tradition and digital infrastructure with the human and social capital, since some of the new technologies by themselves are useful, however when combine with social capital can be powerful. Taking into consideration this features and the limitations of the municipality of Cascais, some recommendations were though in order to start implementing a smart city in Cascais which is presented on the table below (figure 9). Considering that we are studying the digital maturity of the municipality, it is important to suggest recommendations for some of the services that the municipality provides. Moreover, it was decided to focus mainly on the citizens since they are the ones who make the city. In that sense, some recommendations regarding citizens, municipalities and the relationship between them will be carried out below.

Smart City Recommendations

Municipality	City	People
Government	Infrastructures	Education
Finance	Sustainability	Safety
	Energy	
	Water	
Tourism	Mobility	Health
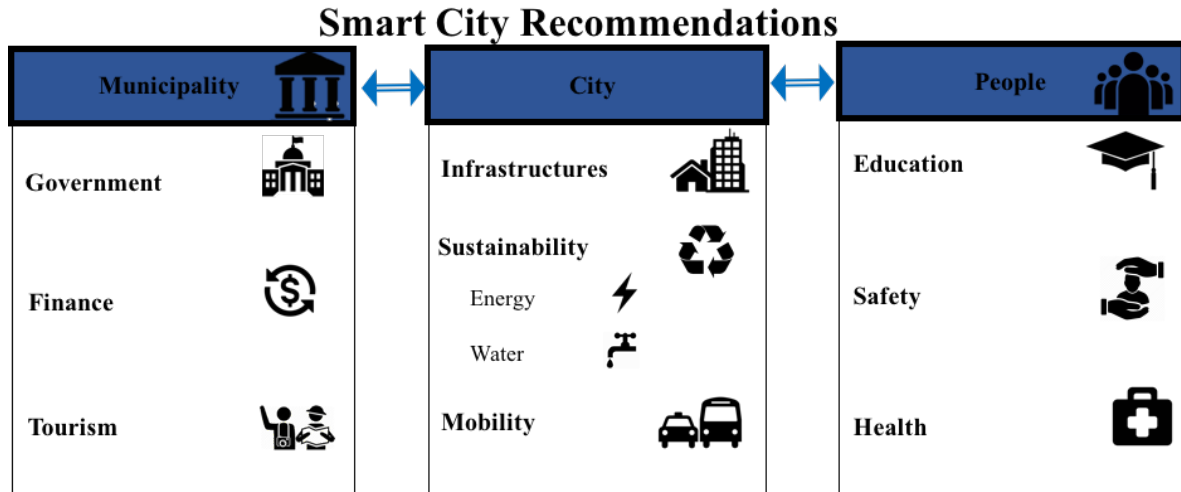
Figure 9 – Smart City Recommendations

These recommendations were based on the theoretical research available and on the necessities of the city. According to the survey, digital maturity levels have not shown to be incredibly low, which could mean that activities and initiatives to further enhance citizen's capabilities could be undergone. First, regarding Municipality, recommendations were divided into three big areas: Government, Finance and Tourism, so that we can not only increase economic efficiency but also improve. internal processes. Three main focus areas were considered inside the municipality:

Government

- Innovating inside the municipality considering data and technology in all internal and external areas

- Acquire intelligent data to analyze social problems
- Create digital productivity tools for employees and automate internal processes
- Create an App for citizens to provide information, give feedback and use public services

- Partnerships between CMC and private companies to provide solutions for the social problems
- Economic efficiency due to independence of location and time
- Improve data analysis internally in the municipality

Figure 10 – Government Recommendations

Finance

- Economic efficiency

- Robots to decrease risks – self driving cars
- New payment systems that generate real-time data and due to that dynamic pricing
- LoT Data can provide information regarding citizens habits such as driving behavior

- Reduction costs derived from traffic accidents plus this self driving cars can send data to CMC regarding car parking violations
- CMC create an open data system with companies that wish to have information regarding citizens behavior and in exchange create partnership or even receive some services in return (partnerships)
- Insurance companies and retail companies can observe the habits of the citizens and direct their campaigns according to that

Figure 11 – Finance Recommendations

Tourism

- Economic Efficiency
- Engagement with citizens

- Events Insights: understand behavior and needs of citizens (Sensors, GPS Trackers and Social Media)
- Locations Guide: creation of an app that will indicate historical, cultural and leisure places where habitants and tourists should visit in Cascais, indicating the routes and enabling feedback
- Laws and regulations for Uber/Airbnb so this initiatives can be controlled in defense of public interests

- CMC can address and create events more directed to the desires and needs of the citizens, having bigger affluence and a bigger outcome
- CMC will have more people visiting the city by sharing the app on social media, with that more outcome and engagement with the citizens
- Improving tourist experience by receiving feedback on the app
- CMC by controlling initiatives of sharing economy can hinder rent prices increase

Figure 12 – Tourism Recommendations

Secondly, it was decided to suggest recommendations to improve the experience of the citizens, through the infrastructures of the city, based on citizens wants and needs, which the city should sponsor.

Infrastructures

- Increase sustainability and economic efficiency

- Energy rids to lower energy consumption at peak times and save energy from HVAC systems
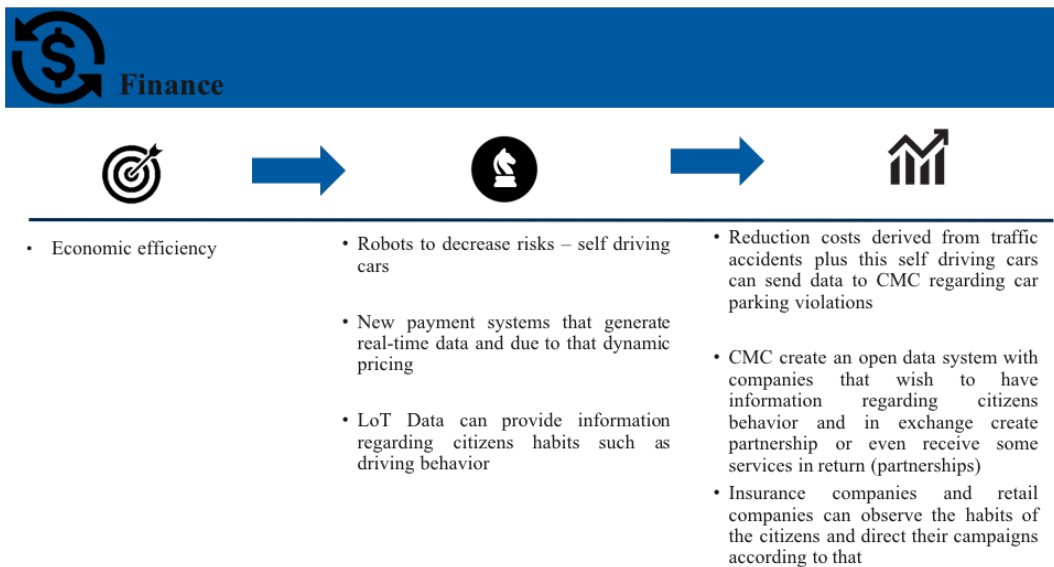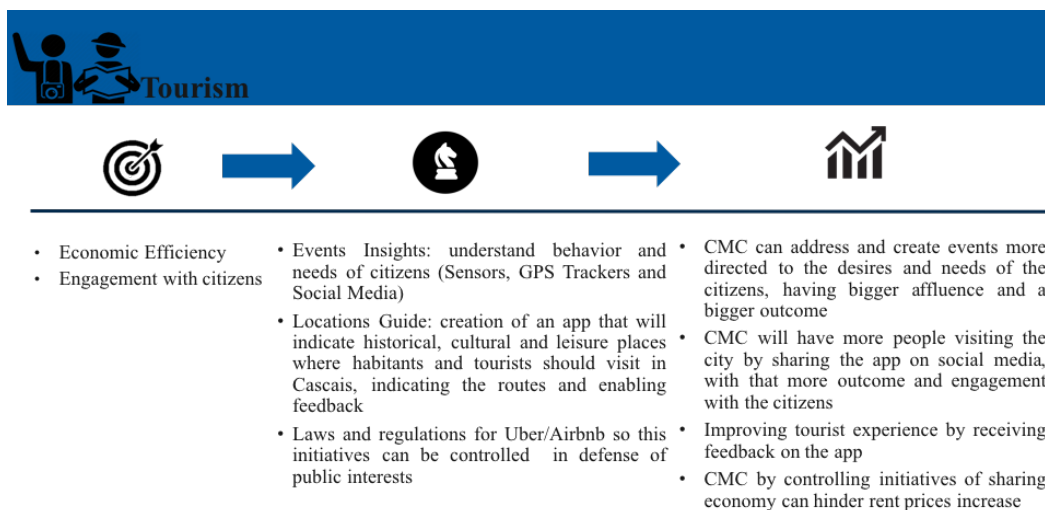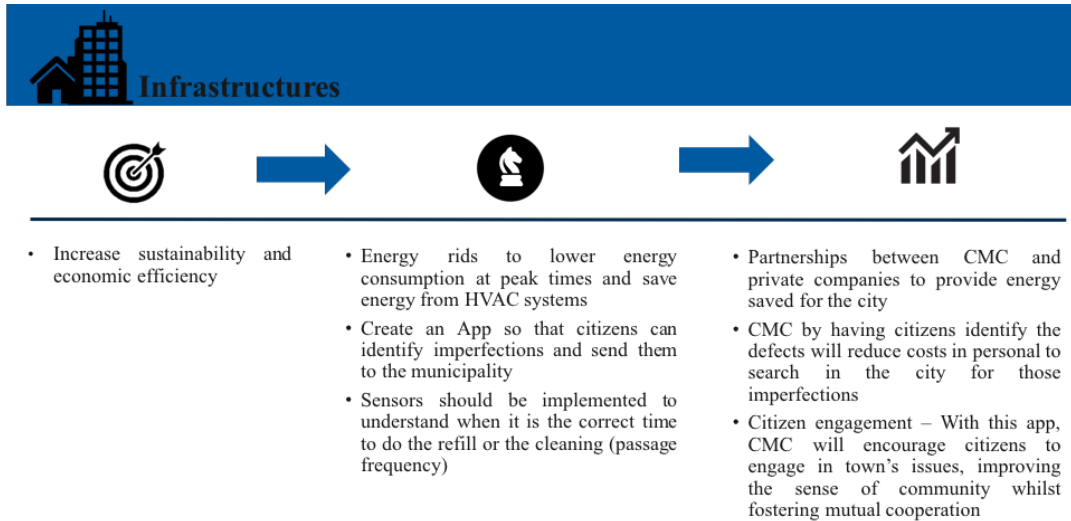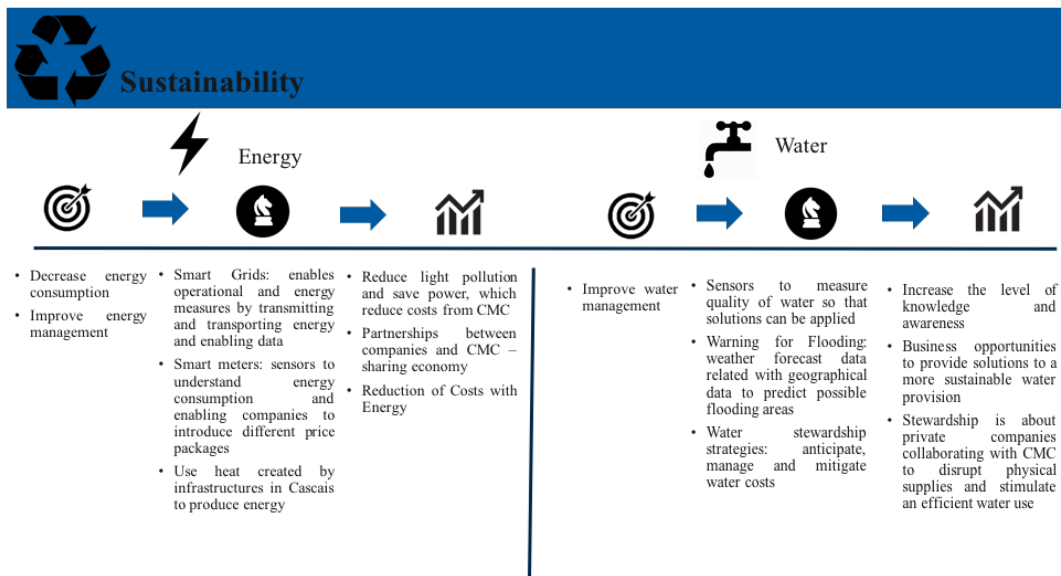- Create an App so that citizens can identify imperfections and send them to the municipality
- Sensors should be implemented to understand when it is the correct time to do the refill or the cleaning (passage frequency)

- Partnerships between CMC and private companies to provide energy saved for the city
- CMC by having citizens identify the defects will reduce costs in personal to search in the city for those imperfections
- Citizen engagement – With this app, CMC will encourage citizens to engage in town's issues, improving the sense of community whilst fostering mutual cooperation

Figure 13 – Infrastructures Recommendations

Sustainability

Energy

- Decrease energy consumption
- Improve energy management

- Smart Grids: enables operational and energy measures by transmitting and transporting energy and enabling data
- Smart meters: sensors to understand energy consumption and enabling companies to introduce different price packages
- Use heat created by infrastructures in Cascais to produce energy

- Reduce light pollution and save power, which reduce costs from CMC
- Partnerships between companies and CMC – sharing economy
- Reduction of Costs with Energy

Water

- Improve water management

- Sensors to measure quality of water so that solutions can be applied
- Warning for Flooding: weather forecast data related with geographical data to predict possible flooding areas
- Water stewardship strategies: anticipate, manage and mitigate water costs

- Increase the level of knowledge and awareness
- Business opportunities to provide solutions to a more sustainable water provision
- Stewardship is about private companies collaborating with CMC to disrupt physical supplies and stimulate an efficient water use

Figure 14 – Sustainability Recommendations

Mobility

- Reduce traffic congestion
- Enable faster and cheaper transportation

- Sensors to provide information about traffic congestion and personalized optional routes
- Create an app that will inform about the best combination of transports that can be used to arrive to a certain destination
- Parking: App that will inform about the nearest free parking space
- Shared Driving Cars: App that will enable citizens to drive shared cars

- Partnerships between CMC and private companies to provide parking space during weekends
- Create a city with good quality of life, so that more people would like to live there
- Reduce cars in this Cascais and pollution and the parking spaces necessary – reduction of costs

Figure 15 – Mobility Recommendations

Recommendations that will improve the quality of life of the citizens are of the utmost importance for any municipality, hence should be accounted as strategic in the leadership team plan.
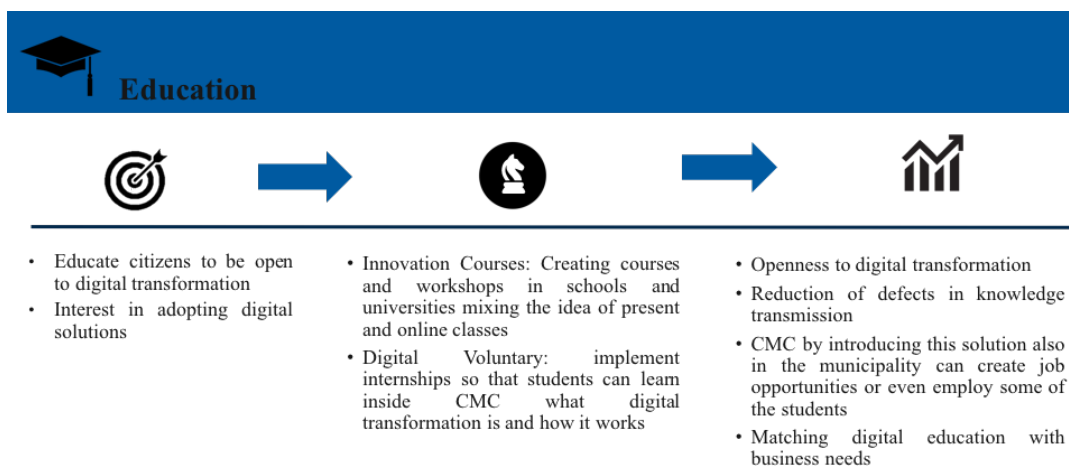

Education

- Educate citizens to be open to digital transformation
- Interest in adopting digital solutions

- Innovation Courses: Creating courses and workshops in schools and universities mixing the idea of present and online classes
- Digital Voluntary: implement internships so that students can learn inside CMC what digital transformation is and how it works

- Openness to digital transformation
- Reduction of defects in knowledge transmission
- CMC by introducing this solution also in the municipality can create job opportunities or even employ some of the students
- Matching digital education with business needs
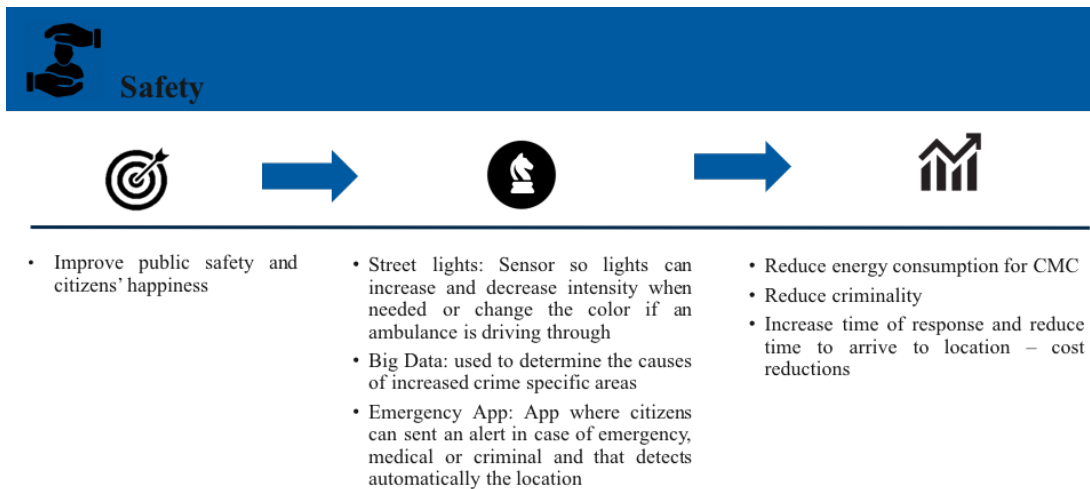
Figure 16 – Education Recommendations
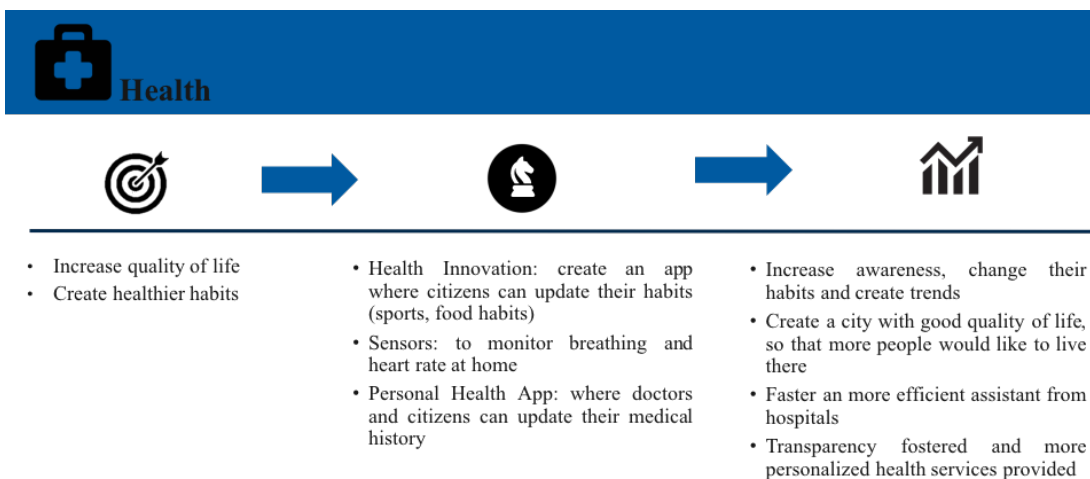
Figure 17 – Safety Recommendations

Figure 18 – Health Recommendations

E. Conclusions

Learning to listen to customers and cater to their needs is an essential lesson in analytics. Sometimes, even when "big data" is available, small data will do, identifying areas for quick wins to secure further support (EY, 2016). Nowadays, municipalities want to understand how to have a key role in leading their cities regarding the journey to become a Smart City. Hence, it is fundamental to understand municipalities internal processes and how they can be improved. more than that understand the needs of the citizens and how the municipality can increase their quality of life. A municipality that shows commitment in

improving through digital initiatives is more likely to build strong and healthy communities. Furthermore, smart cities not only save money to municipalities but also attract new residents. Smart Cities projects are thus improving citizens' quality of life and making cities more economic and efficient, on a social level. However, it should be much more since the goal is to become a better city to its inhabitants while transmitting a feeling of happiness and belonging to the municipality. *Thanks to digital technologies, we'll be able to produce more: more health care, more education, more entertainment, and more of all the other material goods and services we value. And we'll be able to extend this bounty to more and more people around the world while treading lightly on the planet's resources (Deloitte, 2015).*

F. References

7th Constitutional Revision, 2014, Assembly of the Republic – Portugal

Accenture, 2016, *Technology Vision 2016, People First: The Primacy of People in a Digital Age*

All about Portugal, 2012, History of Cascais, retrieved from: http://www.all-about-portugal.com/the-history-of-cascais/

Câmara Municipal de Cascais, general information retrieved from: http://www.cm-cascais.pt

Capgemini Consulting, 2011, Digital Transformation: A roadmap for billion-dollar organizations

Capgemini, 2011, *Creating sustainable cities for the 21st century*

Cis-India Org, *Smart Cities in India: An Overview*

Cisco, 2012, *Smart City Framework, A Systematic Process for Enabling Smart Connected Communities*

Citiscope, *A Global Smart City Community, A Smarter Way to Coexist*

City of Vancouver, 2012, *Digital Strategy Focus Group*

Cronosgroup, 2015, *Telecoms are leading Smart Cities*

Deloitte Digital, 2015, *How Digital Are you?, Digital Maturity Assessment*

Deloitte, 2015, *Smart Cities - Big Data*
Deloitte, 2015, Smart Cities How rapid advances in technology are reshaping our economy and society

Deloitte, 2015, Smart Cities, How rapid advances in technology are reshaping our economy and society

Ernst&Young, 2016, *The upside of disruption, Megatrends shaping 2016 and beyond*

European Programme for Sustainable Urban Development, 2012, *Smart Cities, Citizen Innovation in Smart Cities*

Feirong, Yuan and Woodman, Richard W., 2010, *Innovative Behavior in the Workplace: the role of performance and image outcome expectations*

Forbes, 2017, *Innovation Vs. Transformation: The Difference In A Digital World*

Forrester, 2015, Rank Yourself with the Digital Maturity Model

Frost & Sullivan, 2013, *Strategic Opportunity Analysis of the Global Smart City Market*

Gartner, 2017, Smart Cities Look to the Future, CIOs focused on smart cities should plan infrastructure to support the IoT

Harvard Business Review, 2008, *Design Thinking*

I9 Magazine, 2017, *Smart Cities Portugal: o cluster das cidades inteligentes, competitivas e sustentáveis,* retrieved from: http://portal.i9magazine.pt/smart-cities-portugal-cluster-das-cidades-inteligentes-competitivas-sustentaveis/

Inteli, 2014, *Smart Cities Portugal RoadMap*

Inteli, Smart Cities Portugal - A Sustainable and Competitive Network, retrieved from: http://www.inteli.pt/en/go/smart-cities-portugal

International Electrotechnical Commission, 2016, *Smart Cities*

Manual Lima, 2005, *Divisões Administrativas de Portugal: Um olhar pela diversidade da divisão territorial portuguesa*

Matson, Cat, 2016, *The Problem with Smart Cities*

Mattern, Shannon, 2017, *A City Is Not a Computer,* retrieved from: *https://placesjournal.org/article/a-city-is-not-a-computer/*

McKinsey, 2012, *The smart-city solution*

McKinsey, Digital Quotient - *A comprehensive assessment of how an organization's digital maturity and capabilities drive financial* performance

Microsoft, 2015, *Digital Trends 2015, The evolution of digital consumer experiences*

MIT Sloan Management Review, 2015, Technology, Drives Digital Transformation, Becoming a Digitally Mature

Municipal Institute of information, 2014, *Barcelona 5.0, A Roman village transforming into a Smart City*

National Institute of Standards and Technology, *International Technical Working Group on IoT-Enabled Smart City Framework*

Nikolaus, Franke and Sonali, Shah 2002, *How communities support innovative activities: an exploration of assistance and sharing among end-users*

Novikov, Fedor, 2015, *Why Smart City Failed and why we should embrace that,* retrieved from: https://medium.com/@fedornovikov/why-smart-cities-failed-f47c6c5ef73e

Partnering to Build Smart Cities, 2012, Better communications between local government leaders and technology vendors can encourage the development of connected, resource-efficient urban areas.

PwC, 2012, *Smart cities, From earthen walls to smart grids*

Siemens, 2015, *Smart Cities - Wired for an Urban World*

TDWI, 2013-2014, *Big Data Maturity Model Guide, Interpreting Your Assessment Score*

Urbanize Hub, 2017, *Smart cities: trends and challenges*

UrbanTide, 2014, *Overview of the Smart Cities Maturity Model*

Wallbank, Paul, 2016, *Trade Offs in the Smart City, Decoding the new economy*

A Direct Research Project, presented as part of the requirements for the Award of a Master

Degree in Management from NOVA – School of Business and Economics

APPENDIX

Smart Cities

Digital Transformation in Câmara Municipal de Cascais

Marta Maria Proença de Amorim Cabrita

Student ID: 2963/25208

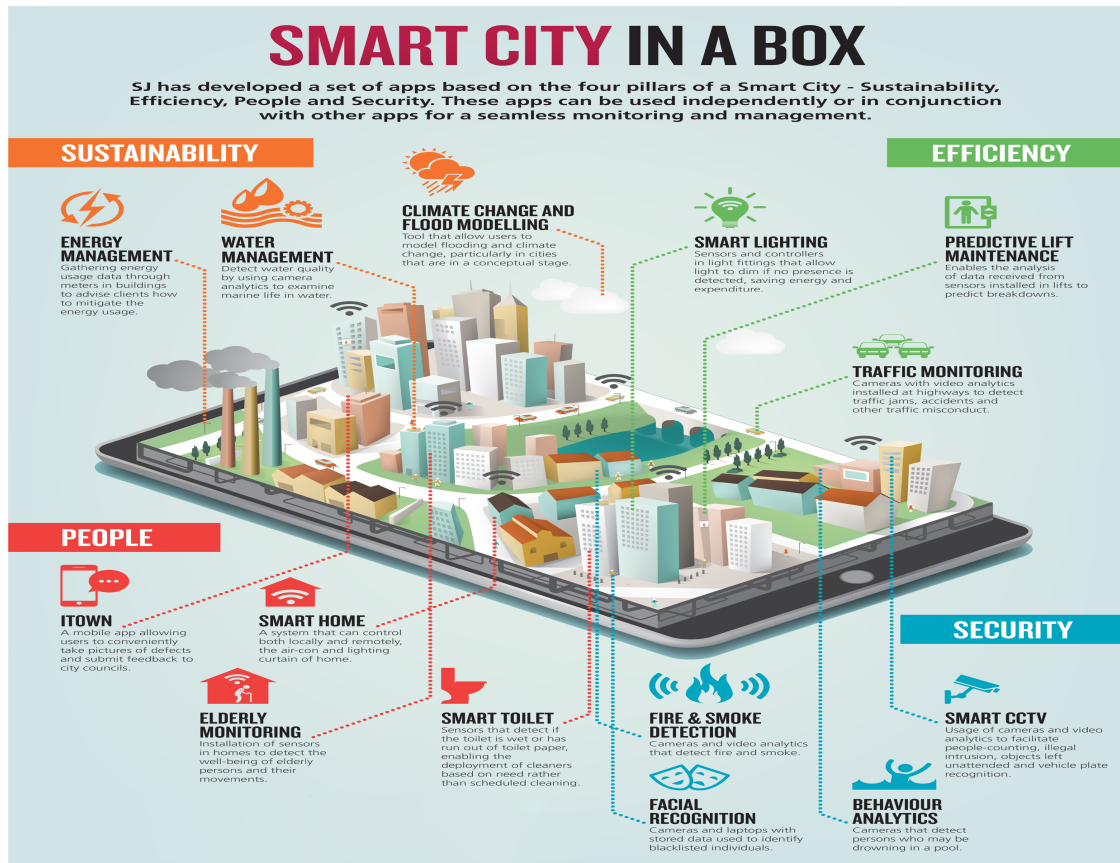Project carried out on the Master in Management Program, under the supervision of Professor

Leid Zejnilovic

May 26, 2017

Table of Contents

Annex A – Smart City Main Areas and Trends

(Microsoft, 2015)

Annex B – Câmara Municipal de Cascais Survey

Câmara Municipal de Cascais Survey

The questionnaire is intended for a Master study at Nova SBE. Its purpose is to explore the CMC's current digital maturity status. We estimate the time to complete the survey to be about 15 min. Please, note that we do not collect your name or a private identifier, and we do not track your IP address or location to match it with your answers. Your answers will only be evaluated and presented as aggregated results, and not individually.

I thank you for your collaboration.

Marta Cabrita

I - General

a) What is your role in Câmara Municipal de Cascais (CMC)?

b) What is your age? *Mark only one*

> Between 18 and 25
>
> Between 25 and 35
>
> More than 35

c) For how many years have you been working in CMC? *Mark only one*

> Less than 2
>
> Between 2 and 5
>
> More than 5

d) On a scale from 1 (not at all) to 5 (I am an expert), how would you evaluate your knowledge about big data (large data sets that are analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions) and its use? *Mark only one.*

> Not at all
>
> Poor knowledge
>
> Moderate knowledge
>
> High knowledge
>
> Expert

II - Problem Assesment

a) Which problems in your work, that could be solved using data analytics, is the most challenging one?

b) Which resources would you like to have available to help you overcome the challenges of the problem you identified above? *Tick all that apply.*

> Software
>
> Data
>
> Communication between departments
>
> Other:

c) Which of the following is the dominant way to share information/data with your customers (citizens) and partners? *Tick all that apply.*

> Digital Channels (e.g. email)
>
> Social Media
>
> Papers
>
> Other:

To what extent do you agree with the following statements.

d) CMC has a big data strategy in place or a big data road map in place. *Mark only one*

Strongly disagree

> Disagree
>
> Neither agree nor disagree
>
> Agree
>
> Strongly agree

e) Creativity and innovation are valued in CMC.   *Mark only one*

        Strongly disagree

        Disagree

        Neutral

        Agree

        Strongly agree

f) The company has a collaborative culture and people are willing to work together and share data. *Mark only one*

        Strongly disagree

        Disagree

        Neutral

        Agree

        Strongly agree

III - Tools

a) Which software do you use on a day-to-day basis?

b) Which personal social networks do you use, at least once on a weekly basis? *Tick all that apply*

        Facebook

        Instagram

        LinkedIn

        Tweeter

        Other:

To what extent do you agree with the following statements

c) For the software that I use, I received an appropriate training. *Mark only one .*

       Strongly disagree

       Disagree

       Neither agree nor disagree

       Agree

       Strongly agree

       Do not need training/Do not use any software

d) I use the following non-corporate tools to communicate with clients (list WhatsApp, Messenger, SMS, etc.) *Mark only one*

       Do not use it at all

       Use it rarely

       Use it moderately

       Use it often

       Use it all the time

IV - Processes

a) Which statement better matches how CMC are obtaining the skills to deal with the implementation of big data? *Mark only one*

       Nothing in place yet

       Outsourcing

       Training employees

       Already have a highly trained team

       Other:

To what extent do you agree with the following statements

b) Majority of the decisions in CMC are data-driven. *Mark only one*

       Strongly disagree

       Disagree

       Neither agree nor disagree

       Agree

       Strongly agree

c) CMC has well-defined internal processes. *Mark only one .*

       Strongly disagree

       Disagree

       Neither agree nor disagree

       Agree

       Strongly agree

d) The processes at CMC has a great degree of automatization. *Mark only one*

       Strongly disagree

       Disagree

       Neither agree nor disagree

       Agree

       Strongly agree

e) CMC has the ability to gather and process data. *Mark only one*

       Strongly disagree

       Disagree

Neither agree nor disagree

Agree

Strongly agree

V - Data

a) How do you define your current big data implementation? *Mark only one*

Nothing yet

Experimentation

Proof of Concept (POC)

Production system in the department

b) How many kinds of data do you currently collect and manage as part of your data/big data efforts? Please select one or more. *Tick all that apply.*

Structure data

Internally generated data

Social media data

Real-time event data

Audio, video, weblogs, etc.

Scientific data

Demographic data

Other:

c) Which best describes why you are implementing big data analytics? *Mark only one*

We don't have a reason yet; we just think it is important and want to get a head

start

Cost savings

Competitive differentiator

Revenue generator

Better fulfillment of our mission

None of the above

d) What do you see as the biggest challenges for big data? Please select all that apply. *Tick all that apply.*

Security issues

Privacy issues

IT resistance

Cost issues

Governance issues

Management resistance

Culture

Lack of Vision

Other:

To what extent do you agree with the following statements.

e) I have access to data when I need it for my work. *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

f) I always know where to find relevant data for my work. *Mark only one*

        Strongly disagree

        Disagree

        Neither agree nor disagree

        Agree

        Strongly agree

g) The CMC has a clear idea of what business problems we are trying to solve with big data

Mark only one.

        Strongly disagree

        Disagree

        Neither agree nor disagree

        Agree

        Strongly agree

VI - Innovation To what extent do you agree with the following statements?

a) Digital technology is becoming a more significant factor for CMC. *Mark only one.*

        Strongly disagree

        Disagree

        Neither agree nor disagree

        Agree

        Strongly agree

b) CMC is leading innovation when compared to other Portuguese municipalities. *Mark only*

one.

       Strongly disagree

       Disagree

       Neither agree nor disagree

       Agree

       Strongly agree

c) My way of working (tools, processes…) is different from what it was 5 years ago (or since I started working). *Mark only one.*

       Strongly disagree

       Disagree

       Neither agree nor disagree

       Agree

       Strongly agree

d) Digital transformation will eventually replace my job with an automated system (software, robot, or similar). *Mark only one.*

       Strongly disagree

       Disagree

       Neither agree nor disagree

       Agree

       Strongly agree

VII - Digital Maturity Assessment To what extent do you agree with the following statements?

I - Culture

a)In CMC we believe that our success depends on digital *Mark only one.*

        Strongly disagree

        Disagree

        Neither agree nor disagree

        Agree

        Strongly agree

b) In CMC we invest in targeted digital education and training at all levels of our organization

Mark only one.

        Strongly disagree

        Disagree

        Neither agree nor disagree

        Agree

        Strongly agree

c) CMC communicates its digital vision, both internally and externally. *Mark only one.*

        Strongly disagree

        Disagree

        Neither agree nor disagree

        Agree

        Strongly agree

d) In CMC we prioritize overall customer experience over the performance of any individual

channel *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

II- Organization

a) In CMC we dedicate resources to digital strategy, governance and execution *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

b) CMC has a dedicated team to support digital functions *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

c) CMC dedicates resources for a digital training specialized to the area of municipalities

Mark only one.

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

d) In CMC cross-functional collaboration is encouraged. *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

e) In my department, there are defined processes for managing digital programs. *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

III - Technology

a) CMC technology budget is fluid to allow shifting priorities *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

b) CMC's technology resources and marketing work together to create a digital roadmap *Mark only one*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

c) CMC uses customer experience asset in order to develop journey maps to understand what is being use and done in the city *Mark only one*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

d) CMC has a flexible, interactive and collaborative approach inside the community *Mark only one*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

IV - Insights

a) CMC have clear and quantifiable goals to measure the purpose of our digital strategy *Mark only one*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

b) In CMC every employee understands the connection between their mission and their digital strategy *Mark only one*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

c) In CMC all the channels use, are measured in order to understand and to accomplish the desire outcome *Mark only one*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

d) In CMC we measure people insights regarding what CMC is doing and the implementation of their digital strategy *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

Annex C – Customers' Survey

Customers' Survey

As part of a NOVA SBE and Câmara Municipal de Cascais (CMC) project, the present questionnaire will enable us to understand CMC' s current digital maturity status by observing how customers react to their actions. It should take no more than 5 min and will have a great impact on CMC' s way of work. Your answers will be evaluated as part of the Project and not individually (your personal information will not be asked or tracked).

I - General

a) Do you live in Cascais? *Mark only one.*

Yes

No

b) What is your age? *Mark only one.*

Between 18 and 25

Between 25 and 35

Over 35

c) Do you own and use your computer?   *Mark only one.*

Yes

No

II - Customer Behavior

a) What are your preferred channels to contact CMC? Please select one or more.   *Tick all that*

apply.

Website

Email

Phone

Social Media

Face to face

b) How frequent do you try to acquire information from CMC?   *Mark only one.*

Once a week

Twice a month

Once a month

Never

To what extent do you agree with the following statements.

c) I normally contact Câmara Municipal de Cascais (CMC).   *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

d) I know about the existence of CMC portal? *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

e) If so, do you think the current city portal is useful and user-friendly? *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

III - Insights

a) What content is important for an interesting internet portal? *Mark only one.*

General information

Calendar of Events

Official information

Responsibilities, contacts and opening times

Other:

b) What service developments do you find a priority to be included on the digital services provided by CMC? Please select one or more. *Tick all that apply.*

to receive information about transportation, use of energy and waste management

to be able to report problems to the local authorities

to book tickets for performances and events

to receive information about registration

to receive information about events

Other:

IV - Satisfaction From the following sentences how much do you agree (1 completely disagree, 2 somewhat disagree, 3 neither agree or disagree, 4 somewhat agree, 5 completely agree)

a) I am satisfied with how good and fast my request is solved *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

b) I normally do not contact CMC *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

c) the staff is interactive and shows knowledge about all the issues presented *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

d) all the processes from CMC (ex: registration) were simple and straightforward *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

e) I am clear about the policies and guidelines related to all the questions posted *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

f) All the answers given are consistent and clear *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

g) Normally the time use to solve an issue is acceptable *Mark only one.*

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

Annex D – Digital Maturity Models

TDWI Big Data Maturity Model: The Context for Benchmark Scores

TDWI Big Data Maturity Model: The Context for Benchmark Scores

Big data maturity can be described as the evolution of an organization to integrate, manage, and leverage all relevant internal and external data sources. It means creating an innovative ecosystem, delivering insightful business value, and enabling impactful transformations. In other words, big data maturity is not simply about having some technology in place to deal with high volumes of data. Nor is it simply about using social media to analyze buzz about your brand. It is a journey that involves building an ecosystem that includes technologies, data management, analytics, governance, and organizational components.

A maturity model for big data is useful for a number of reasons for any organization that is considering or in the process of implementing a big data project. First, it helps to create structure around a big data program and determine where to start. It also helps identify and define the organization's goals around the program and creates a process to communicate that vision across the entire organization. A maturity model will provide a methodology to measure and monitor the

state of the program and the effort needed to complete the current stage, as well as steps to move to the next stage of maturity. It serves as a kind of odometer to measure and manage the speed of your progress and adoption within the company for a big data program.

The TDWI Big Data Maturity Model consists of five stages: nascent, pre-adoption, early adoption, corporate adoption, and mature/visionary. As organizations move through these stages, they should be gaining more value from their investments. Figure 1 illustrates these stages and the movement from one stage to the next. There is also a chasm as organizations move from early adoption to corporate adoption. Although big data and big data analytics are relatively new and few companies are in the mature or visionary category, many large and larger midsize companies, as well as smaller Internet firms, are moving out of the nascent stage to begin to experiment with and even embrace big data and big data analytics. In fact, at some point, we will be able to draw a curve to depict big data stages of adoption.

In the figure, you'll note that—currently—the amount of time that users spend in the early adoption phase is often longer than the other phases. We discuss this in more detail below. In addition, although the stages in the figure are divided into discrete blocks, the reality is that companies don't necessarily move from one phase to the next so cleanly. For example, an organization might be advanced in one aspect of big data, such as its infrastructure, but relatively immature in its management strategy.

Big Data Stages of Maturity

CHASM

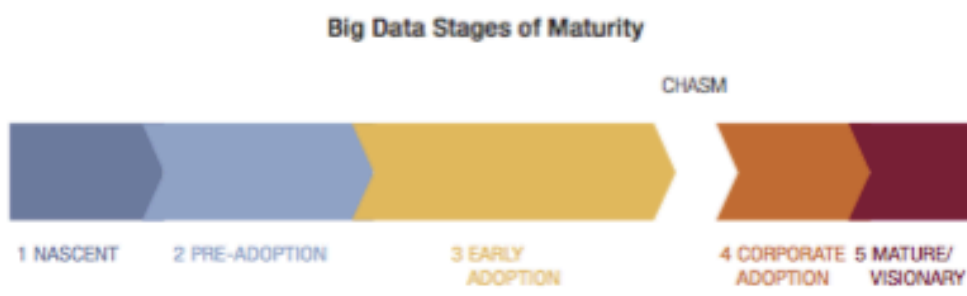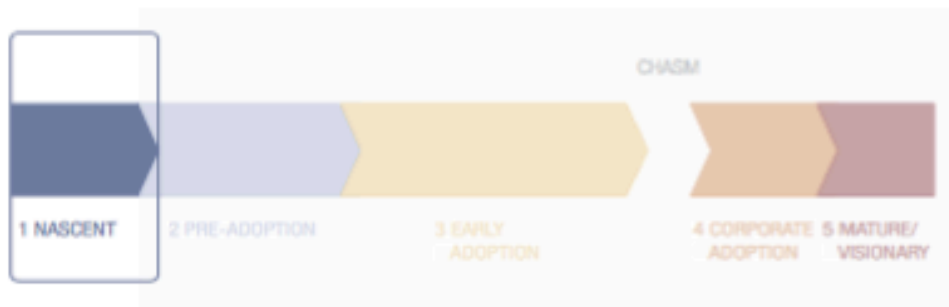| 1 NASCENT | 2 PRE-ADOPTION | 3 EARLY ADOPTION | 4 CORPORATE ADOPTION | 5 MATURE/ VISIONARY |

Figure 1. Stages of maturity in the TDWI Big Data Maturity Model.

The first section of the benchmark guide provides an overview of each of these five stages of the TDWI Big Data Maturity Model. This description provides a context to use to interpret your scores when you take the assessment. The TDWI Big Data Maturity Model Assessment Tool measures the maturity of a big data and big data analytics program in an objective way across various dimensions that are key to deriving value from big data analytics. These dimensions are organization, infrastructure, data management, analytics, and governance. (See Figure 2, page 14, for more information.)

Stages of Maturity

| 1 NASCENT | 2 PRE-ADOPTION | 3 EARLY ADOPTION | CHASM | 4 CORPORATE ADOPTION | 5 MATURE/ VISIONARY |

Stage 1: Nascent

The nascent stage represents a pre–big data environment. In this stage, most companies have a low awareness of big data or its value across much of the business. There is no real executive support for the effort, although there are pockets of people spread throughout the company who may be interested in the potential value of big data. Often, the organization has bought into the concept of analytics and it may have a data warehouse, for instance, but it has not yet started to explore advanced analytics or begun its big data journey. This may also mean that its governance strategy is more IT centric than business-and-IT centric. Some key characteristics of the nascent organization include:

Data management. Often, despite having some sort of data warehouse (especially in the case of the enterprise), a nascent organization will have also collected data as files with different formats, but without naming standards, and with storage structures that are minimally defined. A nascent Internet-based business may have the same problem in terms of collecting data with no real data management strategy in place or idea of what to do with the data. In fact, data that could be useful may be discarded in this phase because no one knows what to do with it. In addition, the organization typically does not have much in the way of an end-state data architecture. Its data strategy and data life cycle management strategy are not strong and are often more about immediate results and silos of information than an overall plan.

Nascent organizations are also often not that far along in terms of an overall unified data strategy, nor do they see a reason to have one. These organizations may not yet have thought about what it means to be data driven.

Infrastructure. A key piece of the enterprise and its information management standards lies with the infrastructure of the corporation. Big data management requires an in-depth understanding of the new infrastructure to support critical big data components such as data types, data volume, user and data security, access to information, processing requirements, and information storage. The nascent organization often misunderstands the need to differentiate between infrastructure and data, leading to short-lived success in their big data journey.

Analytics. Nascent organizations may or may not make use of advanced analytics. However, the nascent organization is often pushing the boundaries of what it can do analytically. If the company has an analytics group in place, it is generally within a department or line of business and targeted at a specific function such as marketing. In other words, analytics is occurring in pockets and silos in the organization. Typically, if the organization is utilizing advanced analytics such as predictive analytics, it is working with structured data only.

CHASM

1 NASCENT   2 PRE-ADOPTION   3 EARLY ADOPTION   4 CORPORATE ADOPTION   5 MATURE/ VISIONARY

Stage 2: Pre-Adoption

During the pre-adoption stage, the organization is starting to do its homework regarding big data analytics. Staff may be reading up on the topic and attending conferences. The organization may have invested in some new technology, such as Hadoop, in support of big data. It knows that it will be implementing big data analytics in the near term, although the effort is usually departmental in scope.

Organization. In this stage, the organization is just beginning its big data journey. In traditional companies, typically, one executive sponsor is on board, but companywide support can be spotty. Often the sponsor is in the CIO organization and not in the business. The mindset is generally around experimentation. The team charged with exploring big data is trying to determine the top business problems to solve and may have brought in some business partners to help with this. They realize that identifying the right business problem is critical for success. The company typically utilizes analytics as part of its decision-making process in various departments, but the company itself isn't necessarily analytics driven. In some companies at this stage, there may even be skepticism around big data and analytics.

In Internet-based companies, where the mindset might be to get it done as quickly as possible, the goal might be to get the first application up and running and worry about the rest later. Typically the CIO team might be working with a business sponsor who is the driver behind the effort, but who may not yet be totally engaged.

Infrastructure. In this stage of maturity the company may be trying out Hadoop or some other big data technologies as part of the experimentation phase leading to a proof of concept. The installation, configuration, and maintenance are defined, and there is a level of compliance to an enterprise standard, although the class of infrastructure may not be close to production ready or may utilize a basic use case. For example, some companies may stand up a Hadoop cluster or invest in a NoSQL database, but this is likely only supporting one kind of workload to support a single initiative or department.

Data management. In this stage of maturity, the organization may have started to identify and collect some big data sources (these are typically internal) as part of the experimentation process. However, these files typically have different formats, with minimal naming standards and minimally defined storage structure. From a data strategy perspective, there is often metadata attributed at the departmental level and a defined end state data architecture, whether it is in a semantic layer, in the platform architecture, or in a database layer. There is no defined data life cycle management and no data auditability and lineage.

Analytics. Typically, the organization has explored some kind of advanced analytics. There may be some groups of individuals, especially at traditional companies, who are adept at predictive modeling, for example, but they may be aligned at the department or line-of-business level. These statisticians or business analysts may be part of the overall voice of the organization that sees the need for a big data implementation because they see the value. There may also be some outside organizations helping to set the analytics strategy or involved with performing some kind of advanced analytics.

Governance. At this stage of maturity, organizations might have a steering committee overseeing the program from a governance perspective, with representatives from the department providing reports on progress and compliance. However, most do not. For data governance, a similar effort may be in place with departmental data strategy, management, and a corporate data management steering committee overseeing the integration of data.
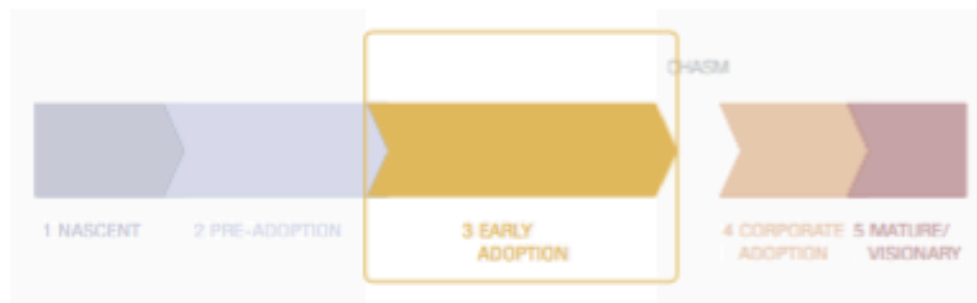
Stage 3: Early Adoption

This stage of maturity is typically characterized by one or two proofs of concept (POCs) which become more established and production ready. Organizations tend to spend a long time in this stage, often because it is hard to cross the chasm that leads to corporatewide adoption of big data and big data analytics.
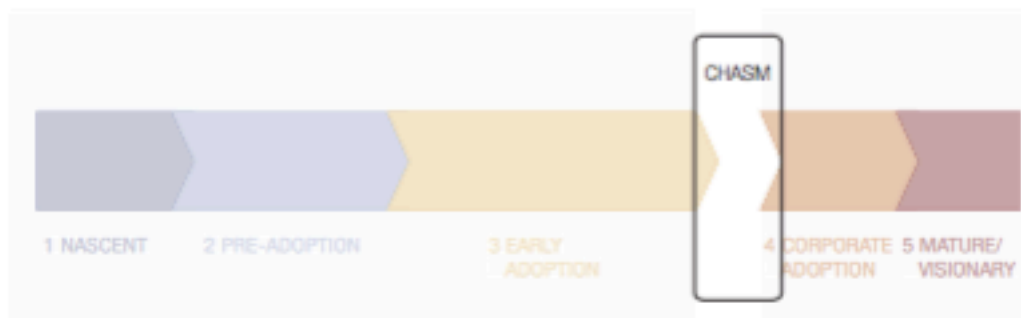
Organization. At this point, there is generally at least one executive sponsor involved. However, it is also at this stage when more executives might start to become interested in the program as companies show some wins in the POCs. As the organization gets excited about the prospects of big data, more people start to come on board. This often means that a team is established to start to plan and strategize for a wider big data scope. This also means that politics may start to kick in, especially in cases where the goal of the big data project is cost containment rather than competitive advantage.

Infrastructure. During the early adoption stage, there may be various kinds of big data technology in place. This might include an appliance or a Hadoop cluster. NoSQL databases might be in place. However, the notion of a unified architecture or ecosystem is not yet widespread and these technologies are not operationalized. A typical infrastructure is a tier 2 production-class cluster that is installed and maintained in the company's data center or even in the cloud. The installation, configuration, and maintenance are defined per enterprise standard. If a NoSQL database is in place, its use is generally offline and not part of the operational infrastructure. In some companies where cost savings are paramount, Hadoop may be used to take advantage of growing data volumes without expanding the data warehouse. Although this is a valid hybrid approach, it may not be well managed and the data may not be used yet for meaningful analysis.

Data management. In this stage of maturity, organizations will have data collected as files of different formats, potentially with division or enterprise standards for naming and storage management. From a data strategy perspective, there may be metadata attributed at the division level and a defined end

state data architecture, whether it is in a semantic layer, in the platform architecture, or in a database layer. At this stage, the organization is not throwing data out unless there is a specific purpose for doing so. However, a solid companywide big data management strategy is typically not in place. Ideally, if the organization is moving at a fast pace to implement its big data initiatives, they are aware of issues related to data quality and security.

Analytics. The organization may be utilizing descriptive or even predictive analytics in its projects. In early adoption, the kind of analytics tools will depend on the problem that the company is trying to solve. Typically, organizations are still using one kind of data, although that may vary among organizations in this phase. For example, some companies in early adoption are utilizing large volumes (i.e., more than 10 TB) of structured data that is stored in an appliance. The company may be running some sort of predictive model on this data. This is an established and production-ready implementation, but it still may be departmental in scope and has not moved on to other forms of data. Alternately, a company (e.g., a publisher) might be mature in managing and utilizing large amounts of content but not strong analytically. Some companies might be utilizing different kinds of data but not in an integrated fashion. For instance, some organizations may be primarily utilizing internal structured data but making use of unstructured social media data in another part of the company. In addition, sometimes one department in a company has a specific use for big data analytics. This might be the network monitoring department in the case of a wireless carrier. That department might be advanced in using location data as well as other kinds of data for its analysis, but the deployment is isolated to that department.

CHASM

1 NASCENT   2 PRE-ADOPTION   3 EARLY ADOPTION   4 CORPORATE ADOPTION   5 MATURE/ VISIONARY

The Chasm

As organizations try to move from early adoption to corporate adoption, there is generally a series of hurdles they need to overcome. This is often why companies spend a large amount of time in this phase. There is the obvious challenge of obtaining the right skill set. Hadoop skills and advanced analytics skills may not be present in the organization. There may also be political issues. For example, one organization may have been driving the company's big data effort and has brought other departments on board. However, when it comes time to extend the platform or put more stringent standards and governance in place, departments begin to fight for control over who owns the data or who may want their particular vision in place. In the case of smaller companies that want to be nimble, there comes a point after several projects or as they start to grow when they realize they might need to put some structure in place and deal with issues such as data security or management.

To successfully cross the chasm, you'll need to address the following challenges:

Funding. Many early big data projects are bootstrapped or driven by a visionary executive IT champion. Of course, it is critical to establish wins with these early projects in order to secure future funding. IT funding is often not enough; business involvement is critical. Some companies are unable to get past the prototyping or POC phase because they don't have business funding and

buy-in. There needs to be a bridge between IT and the business in big data initiatives. Business involvement is needed because big data projects must have business value with tangible business outcomes.

Data management and data governance. In order to move forward to corporate adoption and sharing of data, a solid data management and governance plan needs to be in place. Some organizations believe this is the single most important key to big data maturity. To get to corporate adoption, data is going to need to be shared across the organization. This means that some sort of unified information architecture or companywide analytics platform, or at least a coherent way to get at data for analytics, is in place. That means data management and governance are critical. Even for smaller and arguably more nimble organizations, there comes a point when process becomes important to growth.

Architecture. Some companies in early adoption try to put together best-of-breed approaches, but this often results in an architecture that is too heavy before it gets off the ground. Big data is complex. Companies that have been successful take it one step at a time. They are often surgically precise in how they deploy big data technologies.

Skill sets. A big barrier for big data projects moving past the chasm is developing the skill set for new technologies such as Hadoop or NoSQL databases. If the company can afford it, they will go out and hire staff for this. For instance, some companies find university hires to be effective. However, these hires may not understand the business, so there is often a significant learning curve. There can also be a disconnect between the Hadoop development team and the traditional data warehouse team. It is important to get these two teams together. Some organizations have found that moving teams together helps develop skills across the board and makes it easier to drive an ecosystem approach going forward. For example, the ETL team understands data quality and data models and can provide that insight, along with a knowledge of the business, to the Hadoop team. Companies also need the skills to operationalize the big data technologies and might move to commercial-grade Hadoop clusters or enterprise NoSQL to cross the chasm, if they weren't in place before. More mature organization will have a view about the kind of staff they need to run these systems.

Cultural and political issues. Often it is the cultural and political issues that can stop big data analytics from becoming more pervasive throughout the organization, especially when the motivation for big data is more about cost containment than competitive advantage. For example, a company might have built a solid POC that is being used to drive competitive advantage. However, an executive might get wind of this and think that the data management infrastructure needs to go into the cloud, although not everyone agrees. If there is no solid plan and road map or business case in place with executive sponsorship (that staunchly supports the plan) or a determined set of product managers, this may stall the project. Of course, it might get stalled anyway while the discussions are under way. This kind of roadblock is often more of an issue in large, more established companies than in small or midsize companies.

Governance. Moving to corporate adoption requires a big data governance team. Some companies may feel that they are mature because they have corporate sponsorship and a big Hadoop cluster in place. However, they are now faced with data management, life cycle, and governance issues. At this stage of maturity, organizations should have program governance in place, with program management office (PMO) guidance for the program and a steering committee that oversees the program from a division's perspective. The program should be executed as a budgeted and planned initiative from the division's perspective and be treated on par with other data integration programs. Of course, Internet companies might feel that it is more important to be agile than to be weighed

down by issues such as governance because of the push to get products out the door. Company growth will most likely be the determinant here. If companies grow quickly, they will need to put governance processes in place or deal with the consequences.

Crossing the chasm can be a long exercise in the big data journey unless the organization has both top-down and bottom-up team strategies in place or is compelled by a strong business reason to make big data happen. To cross the chasm, companies need to ensure that the right governance, data architecture, data life cycle management security strategies, and organizational structures are in place. In our observations to date, we have seen many organizations spend extra time as they near the chasm and require additional staffing to cross it.
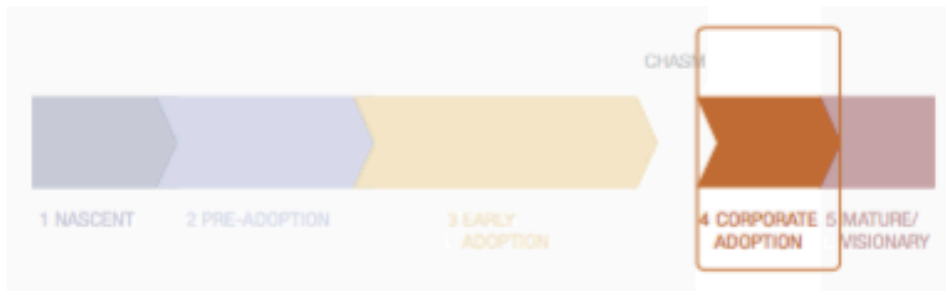
Stage 4: Corporate Adoption

Corporate adoption is the major crossover phase in any organization's big data journey. During corporate adoption, end users typically get involved, gain insights, and transform how they do business. For instance, they may change how decisions are made by operationalizing big data analytics in the organization.

Most organizations trying to reach this stage of maturity might have repeatedly addressed certain gaps in organization, infrastructure, data management, analytics, and governance.

Organization. At this stage, the company has usually come to realize that analytics is a competitive differentiator. Innovation in data and data analysis is a core value, and an analytics culture prevails. The business strategy is generally top-down and bottom-up, with a data infrastructure that can support this. The funding process is secured, and an ROI is in place for big data analytics.

Infrastructure. In this stage of maturity, the typical company infrastructure is a tier 1 production-class cluster that is installed and maintained in the data center, which might include the cloud. A range of technologies might be used, including enterprise NoSQL databases, Hadoop, and appliances or a data warehouse, but the information architecture is unified in a way that underpins the analytics. A Hadoop cluster might include 50 to 100 nodes at this phase (although cluster size is not always tied to maturity). This might also be a commercial distribution because as the company moves out of early adoption, it is actually concerned about managing the clusters. Another sign of operational maturity is that the company can perform multiple workloads on a cluster. The installation, configuration, and maintenance of the infrastructure are defined per enterprise standards. The deployment is driven at an enterprise level in the organization with the complete support of IT teams and line-of-business participation. The infrastructure and architecture of the big data ecosystem comply with backup and recovery or disaster recovery procedures, which are in place. A unified architecture that takes an ecosystem approach is also in place.

Data management. The more mature a company is, the better it is able to manage and make use of its data. In this stage of maturity, organizations can make use of many forms of data. Data sharing is a collaborative activity that is well managed through strong data governance policies. Data siloing is minimized in this phase, and the company sees value from all components of the data infrastructure. The company is always looking for new data to enhance its analytics. From a data strategy perspective, there is metadata attributed at the division or company level and a defined end state data architecture, whether it is in a semantic layer, in the platform architecture, or in a database layer. There is a defined data life cycle management and a data auditability and lineage process or framework.

Analytics. Any company might collect a lot of data but not make use of it. It's a sign of maturity when new data coming into the organization can be analyzed quickly and made part of the logical infrastructure. In this stage, analytics supports the organization. Typically, a company at this stage also has a center of excellence (COE) in place that serves different parts of the organization. The COE includes the data science team, which might even train other groups in the use of analytics in different forms. The COE is generally also tasked with evangelizing big data, and its members might also be looking for commonalities in analytic needs to determine what might be reusable in other parts of the company. At this point, analytics might be operationalized as part of a business process. In other words, analytics might be automated or integrated with the business process. An example of this might be using machine-generated data together with other data about customers to determine a next best offer. These companies are typically using new capabilities and not just existing BI infrastructure.

Governance. The truly mature company understands that big data can be a liability waiting to happen. This company is concerned with answering questions such as, "Whose data was it? Whose data is it? Where is it going? How long will it last?" At this stage of maturity, organizations will have program governance in place, with PMO guidance for the program and a steering committee that oversees the program from a company perspective. For data governance, a similar effort will be in place with a well-defined data strategy and management and steering committee overseeing the progress of data. The overall executive sponsor is involved from a monthly update perspective. The program is executed as a budgeted and planned enterprise initiative and treated on par with other data integration programs.
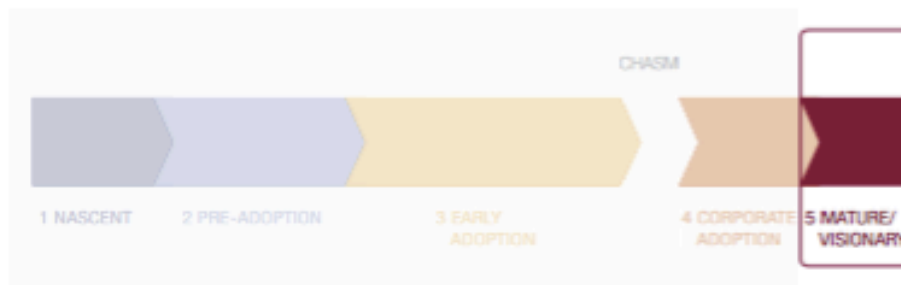
Stage 5: Mature/Visionary

Only a few companies can currently be considered visionary in terms of big data and big data analytics. At this stage, organizations are executing big data programs as a well-oiled machine using a highly tuned infrastructure with well-established program and data governance strategies. The program is executed as a budgeted and planned initiative from the company perspective. In the visionary stage, there is excitement and energy around big data and big data analytics.

Organization. The visionary company exhibits several characteristics. First, executives have bought into analytics and big data analytics and view it as critical, de facto standard for how to do business. Analytics is seen as a competitive weapon and the mindset is creative. Second, analytics is not simply used to drive strategy or insight; instead, the business is always looking for opportunities to use analytics in new ways. In fact, a key characteristic of a visionary company is that it is continuously determining new ways to use and create value from analytics. Finally, collaboration is a big part of the culture.

Infrastructure and data management. The way you manage complexity is key to big data maturity. The visionary company has deployed a coherent analytics infrastructure that is fully operational and can be used in the mission-critical aspects of the business. Part of the infrastructure includes the ability to integrate new sources of data for analytics, whether they are internal or external to the company. The infrastructure leverages commercial Hadoop and enterprise NoSQL databases and there is security, disaster recovery, backup and recovery, performance management, and proactive infrastructure monitoring in place—even if the public cloud is used. The program is treated as mission critical and given the right amount of staffing and skills. Data is shared across the organization.

Analytics. In the visionary company, the mindset is to continually develop analytics. Typically, this kind of company makes use of all kinds of data, including real-time data, and uses this as part of its decision making and incorporates into business processes. The visionary company can connect the dots between new data and existing assets. The business can tap into this to enhance product offerings and bring new products to market. The infrastructure, data, and analytics are completely intertwined. There are COEs in place, and teams are working to deliver new and exciting forms of analytics. Some visionary organizations build an innovation team consisting of business and IT that innovates on the technologies, brings them back to the business, and takes them into production.

Forrester Digital Maturity Model

THE DIGITAL MATURITY MODEL IS A USEFUL TOOL FOR RETAIL ECOMMERCE

eBusiness professionals must lead their firms' efforts at digitally transforming their customer experiences and operations. To help eBusiness professionals benchmark their companies' digital business maturity against that of others, Forrester revamped its maturity framework in 2014.[1] While the framework is broad enough to apply to any business — such as insurance, hospitality, and telecommunications — retailers often find this evaluation useful in helping identify which weaknesses are the biggest inhibitors to their businesses. We believe that there are three key components of digital maturity, each with four specific dimensions — culture, organization, technology, and metrics (see Figure 1 and see Figure 2):

1. **The base module.** The base module applies to all organizations. It assesses foundational aspects that are common to any digital function, such as where digital leadership is positioned, how teams are resources, and how digital success is measured.

2. **eBusiness maturity.** The eBusiness module assesses how digital supports sales and service interactions, including touchpoint integration, technology sophistication, and IT relationship effectiveness.[2]

3. **Digital marketing maturity.** The digital marketing module assesses digital marketing specifics, tracking how digital supports the overall brand strategy, how campaigns are planned, and how customer insights are leveraged.

Figure 1 The Three Key Components Of Digital Maturity

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FORRESTER HAS IDENTIFIED FOUR LEVELS OF DIGITAL MATURITY

By assessing digital activities against a framework of best practices, eBusiness professionals can plot their paths to digital maturity. This journey typically places firms in one of four transformational stages (see Figure 3).[1] These stages are as follows:

- **Repair.** Firms in the "repair" stage are typically just starting out on their digital journeys. They may be kick-starting their digital marketing activities or just starting to sell online. Digital leaders in these firms must concentrate on fixing the basics — articulating an initial vision of how digital supports the company strategy and developing robust operational digital capabilities such as eCommerce or analytics to help their firms grow.

- **Elevate.** eBusiness professionals in the "elevate" stage are becoming cross-functional leaders. They have increased accountabilities for new touchpoints such as social, mobile, and branch or store technology. To reach the next stage of maturity, they must focus on communicating and evangelizing the digital strategy throughout the organization while establishing robust governance and customer-centric digital metrics to ensure that strategy is adhered to.

- **Optimize.** As digital interactions reach a critical mass, digital leaders must work to optimize their digital experiences, processes, and technologies to enhance traditional touchpoints. Digital leaders in these firms must focus on creating cross-touchpoint customer experiences by blending physical and digital customer experiences. This requires a deep understanding of customers and their specific journeys and a fine-tuning of digital processes and capabilities to drive cross-functional working as the rule, not the exception.

- **Differentiate.** Digital leaders who have taken their firms to the highest levels of digital maturity are aligning their entire organizations around their customers to provide differentiated experiences. They leverage advanced digital technology, both internally and externally, to enable a seamless collaboration between employees, suppliers, and customers and are unlocking new digital revenue streams that enhance both customer and shareholder value.

Figure 3 Your Firm's Digital Maturity Guides Your Path To Improvement

Differentiate	Develop next-generation digital experiences to unlock new sources of customer value.
Optimize	Embed digital into the business to personalize customer experiences.
Elevate	Evangelize digital to drive cross-functional collaboration.
Repair	Develop foundational digital processes, technologies, and competencies.

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Retailer Digital Business Efforts Lag Behind The Averages

In late 2013, we fielded an online survey to global eBusiness and channel strategy professionals asking them to rate their strategies against our maturity model criteria. We found that the average score was 72 out of a possible 108, but for retailers this fell to 70; on average, retailers somewhat disagreed that their firms have clear and quantifiable goals for measuring the success of their digital strategies and retailers also somewhat disagreed that their digital teams are appropriately resourced with no significant skill gaps (see Figure 4). To determine where you think your firm stacks up, download the spreadsheet and score yourself on the same criteria. We classified our respondents on a spectrum of maturity segments — repair, elevate, optimize, differentiate — and found that our data nearly mirrored that of prior years: Few retailers fell into the differentiate category, with the majority falling into the middle elevate and optimize categories. Looking deeper at the data by maturity model category, we find that:

- **Overall digital maturity is in decent shape, but has some pain points.** It's clear from our data that most retailers feel that they have the right basics in place to execute their eBusiness plans. For example, 71% somewhat or completely agree that there is consensus among all senior leaders in their companies on the strategic business value of the Web and other digital touchpoints. Moreover, 68% of retail respondents feel that their business executives have technology expertise. At the same time, just 18% of respondents completely agree that they have control over technology resources required to execute their digital strategies and priorities.

- **eBusiness maturity is moving along, but there are skill gaps.** Respondents to our survey also feel that they have adequate business and technology processes. For example, 90% of respondents somewhat or completely agree that their eBusiness teams' digital visions and strategies have backing from board or C-level executives. Technology is evolving to support digital business: Seventy-five percent somewhat or completely agree that they jointly define a multi-year digital technology road map with business technology (BT), thereby consecrating effective BT agendas. Unfortunately, however, most respondents somewhat or completely disagreed that their digital teams are appropriately resourced with no significant skill gaps.

- **Digital marketing is maturing, but channel and touchpoint integration needs work.** Retailers who responded to the survey are optimistic when it comes to marketing metrics and customer insights: Ninety-one percent report that their firms use customer insights to inform marketing programs, and 71% somewhat or completely agree that their firm uses metrics such as customer acquisition cost or retention rate to understand the success of each touchpoint. At the same time, eBusiness professionals rank themselves most critically on multichannel and touchpoint integration: Forty-five percent of respondents do not feel their firms' customer experiences are consistent across channels.

Figure 4 Forrester's Digital Maturity Model Average Scores For Retailers, 2014

Digital module	Maximum possible score	Average score of retailer respondents
Overall digital maturity	36	23
eBusiness maturity	36	23
Digital marketing maturity	36	24
Total	108	70

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Annex E – Research Results
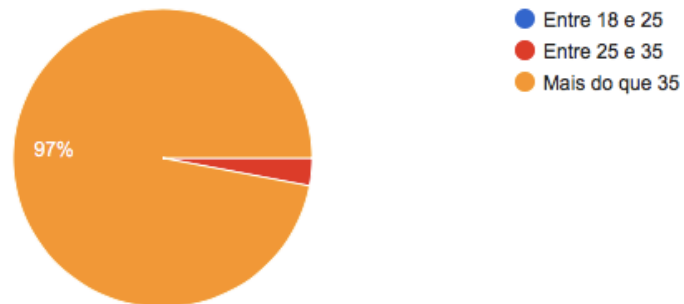
Figure 1 – What is your age?

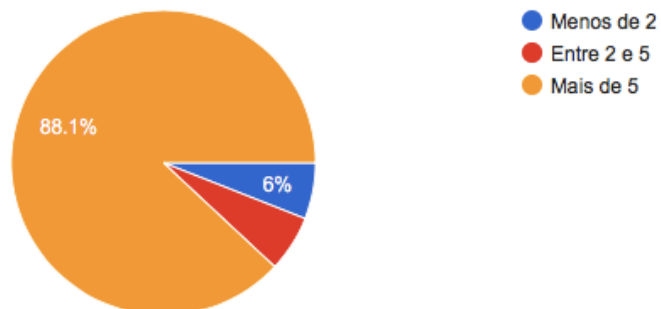Figure 2 – For how many years have you been working in CMC?

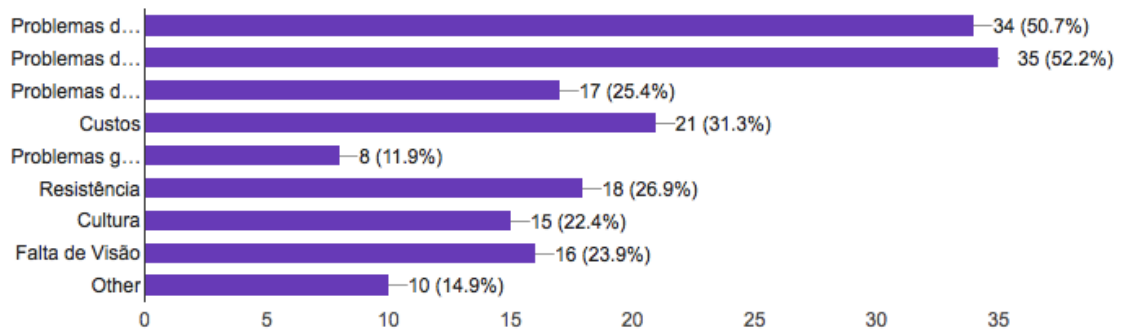Figure 3 - What do you see as the biggest challenges for big data?

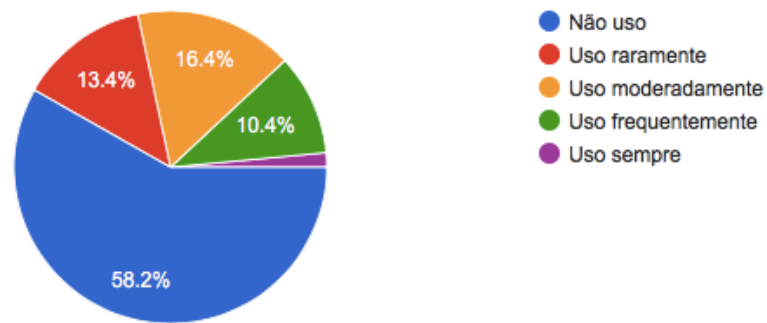Figure 4 – Use of tools like WhatsApp, Messenger or Messages to communicate with citizens

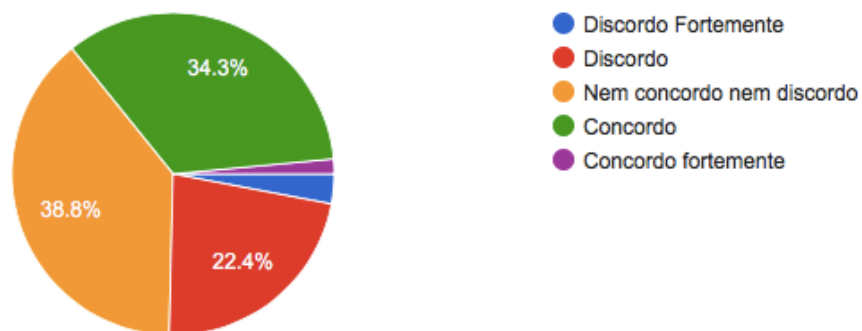Figure 5 – CMC has good internal processes defined

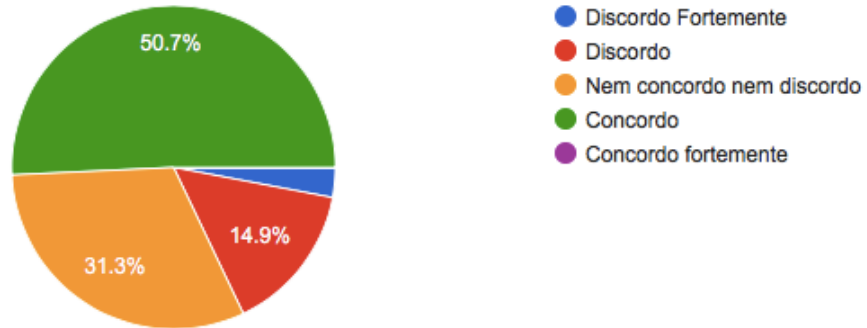Figure 6 – Internal processes in CMC are automatized

Figure 7 – My way of work (tools, process) is completely different than it was 5 years ago (or since i started working)
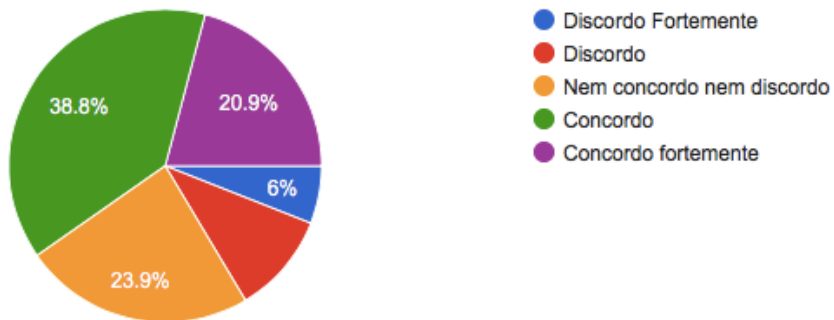

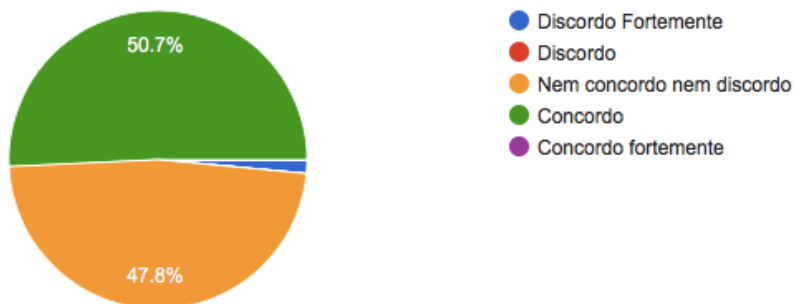Figure 8 – CMC has a dedicated team to support digital functions

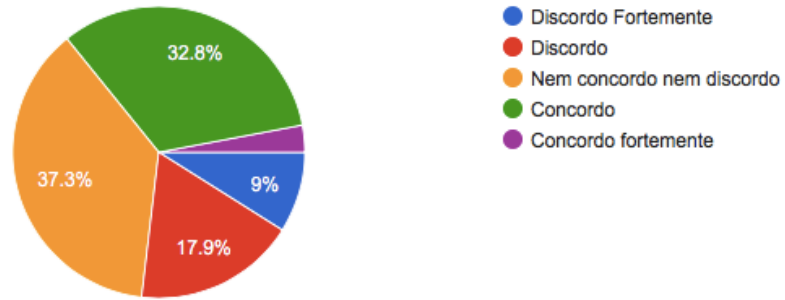Figure 9 – Decisions in CMC are driven by data

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32.8%
37.3%
9%
17.9%

Figure 10 – CMC has the capacity to process and acquire data

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- Concordo fortemente

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31.3%
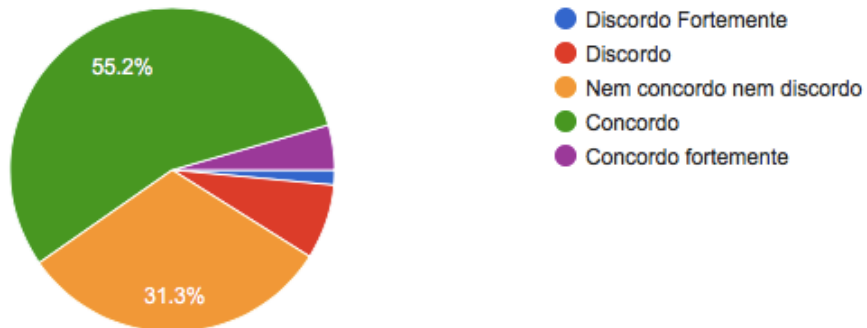
Figure 11 – Digital transformation is becoming more relevant for CMC

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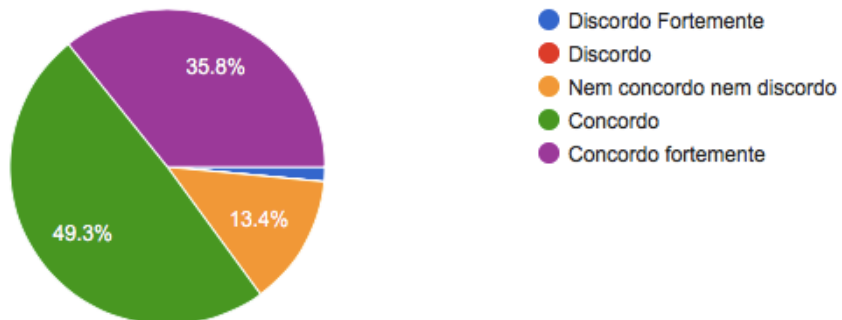- Nem concordo nem discordo
- Concordo
- Concordo fortemente

35.8%
49.3%
13.4%

Figure 12 – CMC has a big data strategy in place.

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- Discordo
- Nem concordo nem discordo
- Concordo
- Concordo fortemente

32.8%

7.5%

49.3%