Seizing opportunities in Europe: A roadmap for efficient Big Data implementation in Spanish SMEs

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Abstract

Purpose - This article aims to help small- and medium-sized enterprises (SMEs) to seize the potential of Big Data in their marketing strategies in order to leverage a competitive advantage in the rising digital marketplace and lead the post-pandemic economic recovery. However, Spanish SMEs have had serious difficulties in working with Big Data.

Design/methodology/approach - In this study, a roadmap is designed to pave the way for a successful Big Data implementation.

Findings - SMEs with updated information on how to access the historic funding opportunities mobilised by the European Union. It not only generates financing opportunities for SMEs but also grants continuity to their strategies by offering the most profitable techniques by which they can efficiently analyse data and gain consumer insights, thus overcoming the many problems they face when working with Big Data as well as helping them to monetise their marketing strategies.

Originality/value - The main advantage of this research is its innovative approach to business strategy as it provides. The value added by this paper lies in its holistic and updated approach to supporting SMEs Big Data strategies.

Keywords Big Data, Business Intelligence, Behavioural analytics, Small- and Medium-sized Enterprises (SMEs), Marketing strategies, European Union

1. Introduction

After detecting outbreaks of the SARS-CoV-2 virus outside of China's borders in January 2020, the World Health Organization (WHO) declared an international health emergency (World Health Organization, 2020). Twelve months later, the year that changed it all- from the way humans interact to the manner in which businesses operate to the responses of policymakers- came to a close.

While December 2020 closed a year that shifted the world economy as we know it, also opened a window to hope during the Lisboan Web Summit. On 2 December 2020, the European Commission President Ursula Von der Leyen announced the Commission's ambitions for the upcoming Multiannual Financial Framework (MFF) 2021–2027 to help repair the economic and social damage caused by the coronavirus pandemic (European Commission, 2020c): "Our recovery plan, called NextGenerationEU, is an unprecedented public investment to reshape Europe's economy. It is worth €750 billion, and 20% of it will fund digital investment. NextGenerationEU will help small businesses take up the latest technologies that are already available on the market". This speech will remain engraved on our minds for posterity as it sets a turning point for the European economic recovery. The upcoming financial package represents a major scale-up in the European Union's (EU) public stimulus since the amounts devoted to fight the pandemic crisis will reach all-time-highs.

Digitalisation transforms the way businesses operate. The COVID-19 crisis has accelerated technological adoption, which sets data at the centre of this transformation (Akpan *et al.*, 2022). Due to the need to engage in this transformation, European businesses will receive a historic stimulus during the next MFF, and it is the aim of this report to help as many companies as possible benefit from it. Europe has addressed digitalisation as one of the necessary pillars to support economic recovery.

In this new framework, Spain is one of the Member States that has been most affected by the crisis because its businesses (especially small- and medium-sized enterprises; SMEs) have low flexibility given their limited capacity to manage the necessary data to adapt their strategies to market realities (Hirsch *et al.*, 2020). Since this report is intended to help the most vulnerable economic agents overcome their main strategic weaknesses as exposed by the pandemic, the ultimate goal of this work will be to meet the challenge of supporting the use of Big Data across Spanish SMEs. As emphasised by Sen *et al.* (2016),

SMEs require practical approaches from researchers in order to seize the potential of Big Data.

To date, only large companies have benefited from the use of Big Data as the barriers to entry in the data market for SMEs have been enormous. New technological advances (cloud computing, artificial intelligence, etc.) have significantly optimised data analysis processes, making it profitable for companies of all sizes to invest in Big Data (Liu *et al.*, 2020). However, SMEs may face several issues when they try to work with Big Data due to their lack of experience in the field and the data's complexity. This paper presents an essential tool for SMEs that are willing to unleash the potential that Big Data offers. It will not only bring Big Data closer to reality for SMEs but will also offer tools and techniques to apply Big Data in digital marketing strategies and to subsequently invest profitably in them.

2. Materials and methods

2.1 Materials: European investments in Big Data: Horizon Europe and NextGenerationEU

In the midst of the social and economic crisis, the European Union (EU) must decide its path for the next six years. Over the next MFF (2021-2027), Europe will make an historic financial effort to address the weaknesses exposed by the current crisis. Funds will mostly be distributed through the Member States and the Horizon Europe programme. In general, investments in digital technologies are considered to be one of the pillars for European economic recovery. The Commission has established that at least 20% of each Member State's recovery plan's budget must be spent on digitalisation (European Commission, 2020c).

The EU has also pointed to Big Data as a key to enabling technology for the digital revolution. The European Commission (2020a) considers data to be 'the lifeblood of economic development' and will deliver through the European Data Strategy a number of market opportunities for businesses of all sizes in the form of investment, training or support.

Despite the large size of the European budget, funding will not reach everyone. Organisations, both large and small, will need to align their objectives with the EU recovery plan's priorities in order to access public grants and loans. To build a successful

proposal and receive public funding, businesses must first assess their most significant challenges and investment opportunities.

The coronavirus crisis has unveiled the serious problems of external dependency that Europe faces in the digital landscape. The European ambition for a data strategy is "to enable the EU to become the most attractive, most secure and most dynamic data-agile economy in the world" (European Commission, 2020a, p. 25). According to this European Commission communication, the EU has to be able to take the lead in the data economy in order to guarantee and secure a digital future built upon European values. To achieve this goal, the strategy set up a 'Digital Compass' to underline the four main cardinal challenges that the EU must address within the 'European Digital Decade': "digital skills, secure and sustainable digital infrastructure, digital transformation of businesses and digitalisation of public services" (Jorge-Ricart, 2021).

To achieve the ambitious objective of positioning Europe at the top of the world data market, the Commission has established the 'European data strategy' initiative, which will mobilise large investments from both the EU and the Member States to promote a European data-driven economy. Moreover, the EU has planned to adapt the current data legislation (Open Data Directive) to contribute to the development of a more favourable ecosystem for the Open Data infrastructures that will help to address the data accessibility issues of SMEs.

2.2 Methodology

The methodology follows a series of steps to guarantee a successful Big Data implementation across Spanish SMEs. First, the research will go through the current literature to extract the main insights on the Big Data concept and will explore how to use them for marketing purposes. Second, market research will address the core limitations that marketing departments face when working with voluminous, varied and timely data. Additionally, in order to facilitate Big Data adoption in companies with limited resources, this paper will present the most cost-effective and widespread analytical techniques and tools for each case of digital marketing use and will delve into the available funding opportunities in the European programmes to identify key incentives to fund the projects. Finally, an interactive guide puts in a nutshell the most relevant calls to tackle the main weaknesses derived from the analysis.

The last step will involve the preparation of an exhaustive and updated guide with the most relevant public funding opportunities for Big Data implementation. This section of the work will summarise the most profitable upcoming funding opportunities for Spanish SMEs and how to apply for them. This roadmap is developed from public information related to funding opportunities to facilitate Big Data adoption in Spanish SMEs. Information mainly comes from European programmes and their calls and it will be revised to facilitate its readability to the objective audience (SMEs without specific training in European programmes). This methodology is an innovative approach to the development of a business strategy since the scope of the strategy is global and it will support SMEs from the beginning to the end of their Big Data implementation processes. It will do so by providing information that is totally up to date and highly relevant and valuable for Spanish businesses.

To sum up, this paper carries out a wholistic analysis with outcomes aimed to serve as a compass for Spanish SMEs willing to unleash the potential that Big Data can provide for their marketing strategies.

3. Literature review

3.1 Big Data and business intelligence

Since the early 2000s, the Internet revolution has set the groundwork for unique data collection and analytical research and development opportunities (Chen *et al.*, 2012). Datasets today are not only larger than before but they are also growing faster, and they have allowed businesses to produce valuable insightful information (Mayer-Schönberger and Cukier, 2013).

Data have swept into almost every industry and has become a major capital asset for many businesses. Information societies have contributed to the massive adoption of smart devices, a major source of data generation, and have developed visible information technology systems everywhere in our environment (Maroufkhani *et al.*, 2020). However, "information itself is less noticeable" (Mayer-Schönberger and Cukier, 2013, p. 3). The intangibility feature of the data has made the process of finding an appropriate definition really challenging.

The term 'Big Data' defines voluminous and ever-growing datasets coming from a wide range of sources. The term was first coined by the US National Aeronautics and Space

Administration (NASA) in the 1990s, and it was aimed at describing the problem NASA scientists had with visualisation due to the massive size of the data (Press, 2014). Today, however, other considerations should be taken into account before considering any information set to be 'Big Data'. Data analysis has been increasingly incorporated in many different ways to create value across industries and geographies. In fact, according to Ajah and Nweke (2019, p. 27), "enterprises that embarked on a Big Data project have experienced massive growth in business as they have been able to reduce costs, make faster and better decisions and even provide new offering for the customer". Nonetheless, the value of Big Data does not reside in the data itself but in the outcomes of its analysis (Zhao, 2013). Additionally, non-technical elements, such as legislation, advanced data professionals or business models, are also critical for the efficient use of Big Data (Becker *et al.*, 2016). To make strategic decisions based on Big Data, managers should understand all the elements behind business intelligence (Mashingaidze and Backhouse, 2017).

The use of Big Data has leveraged a competitive advantage across most business functions; however, *"no area has benefited from this Big Data more than marketing"* (Forbes Insights and Rocket Fuel, 2013, p. 5). Massive data generation is creating a major information analysis challenge for marketers. To generate value for a company, a data analyst must go through the weeds of information and extract the most relevant data in order to transform the retrieved information into actionable insights and construct an educated data-driven strategy (Fan *et al.*, 2014). Throughout the paper, the multiple advantages and benefits of implementing Big Data within an organisation's marketing strategy will be highlighted. However, many businesses, especially SMEs, face a myriad of obstacles when trying to include Big Data in their operations.

The literature on Big Data analytics (Marshal *et al.*, 2015; Saggi and Jain, 2018; Spencer Stuart, 2013) places organisational culture as a major obstacle to the implementation of an efficient data-driven marketing strategy. Despite the fact that almost all companies acknowledge Big Data's value, many of them are not working with it due to a lack of confidence among senior managers (McKinsey Digital, 2016; Spencer Stuart, 2013). Apart from the organisational culture, a survey carried out by Spencer Stuart (2013) with 171 US-based marketing executives identified other challenges which prevented managers from harnessing the value of their Big Data investments, such as lack of technological investment, insufficient training to make an efficient use of the datasets or lack of relevant external data (Figure 1).

[Insert Figure 1]

The outcomes of the analysis were revealing and announced a turning point in Big Data adoption among businesses. According to senior executives' responses, they did not distrust the information per se, but they considered that the results of its analysis were not sufficiently solid as a basis for making their company's strategic decisions.

Despite the lack of trust and understanding of Big Data analytics (McKinsey Digital, 2016), many senior marketers have acknowledged that Big Data analytics can become a potential tool to address their key strategic issues (Figure 2), such as increasing customer retention or building a long-term strategy for customers.

[Insert Figure 2]

Most marketers expect that Big Data is going to increase its impact in their marketing strategies. One of the main reasons for this strategic shift is the development of behavioural analytics. The use of predictive behavioural modelling for marketing purposes has boosted data's value. Behavioural analytics enable companies to deliver targeted marketing strategies for each stage of the customer journey through the use of various tools, such as funnel and cohort analysis, which, in turn, positively affect customer loyalty and long-term customer relationships.

3.2 Big Data in Spain

Although Big Data has been proven to be extremely beneficial, it seems that most companies within the Spanish borders are not aware of its potential; over 80% of Spanish SMEs are not analysing Big Data and are not considering it (Instituto Nacional de Estadística, 2020).

The main barriers encountered by Spanish SMEs when trying to work with Big Data are the inability to reach an appropriate workforce or difficulty in finding suitable quality data to carry out a profitable analysis. In addition, smaller companies face more barriers compared to larger firms when working with large datasets, especially in terms of legal compliance (Figure 3). The ability to profit from a Big Data strategy is also a major hurdle for the smallest firms. Public investments on digitisation are intended to cut costs from the data operations in order to make investments in this area profitable for companies of all sizes and sectors.

[Insert Figure 3]

In order to respond to this new market, that is, the need for online marketplaces, Spanish SMEs will have to make insightful use of large databases to be able to compete and target new customers. Nevertheless, companies will not be able to obtain great profitability from the public data offered by the State. In order to optimise their strategies, companies from different fields must collaborate by sharing data. To this end, the development of digital innovation hubs for data analysis has been pointed out as the most efficient collaboration tool.

Data innovation hubs support smaller businesses with their smart specialisation by granting them access to private databases, training them on how to analyse the data, financing them and providing support in compiling with their legal obligations (European Commission, 2021). In these common regional spaces in which data providers, users and regulators interact, the most significant hurdles for Spanish SMEs in trying to implement Big Data will be addressed.

Although the public procurement of data services has been outlined as one of the main objectives of the recovery plan, Spain is already a leader in this area (ranks second in Europe in the supply of Digital Public Services according to 2020's Digital Economy and Society Index (DESI) (European Commission, 2020c). Moreover, in light of the results of the current analysis, an increase in the procurement of public Big Data does not guarantee the implementation of Big Data analysis within organisations since the two are not correlated.

Figure 4 shows that only 5% of the cases of Big Data use in Europe are explained by an increased Big Data supply in open public repositories. In Spain, the public supply of Big Data is a worldwide referent, while its national companies are some of the organisations with the poorest Big Data analysis at that European level.

[Insert Figure 4]

In light of such results, Spanish businesses should be aware of the limitations that public data has with respect to their business plans. Although the national digitalisation plan encourages businesses to use this data, this strategy may not be the most profitable one for them. Before rushing to work with public Big Data, Spanish businesses must assess whether open public data are aligned with their organisational objectives in order to avoid incurring losses by wasting their limited resources.

4. Findings and discussion. How to implement Big Data by taking advantage of public funding opportunities

In previous sections, the European and Spanish digitalisation agendas have been analysed, including how businesses can benefit from Big Data analytics and the main funding opportunities open to them. The information in this section will be aimed at easing access for Spanish SMEs to these upcoming opportunities.

Digital talent and technological infrastructures are the main cornerstones for the implementation of a successful Big Data strategy in any firm. Nonetheless, before investing in technology or training, companies should be informed about where to invest, the cost of investing and the type of public funding that can be expected.

Spanish SMEs can access multiple initiatives to ask for basic information, network, scale up and updates in relevant funding opportunities. These are some of the most relevant ones:

- Europe Direct. Europe Direct is a platform which answers general questions related to EU funding opportunities in 24 languages and offers relevant contacts to solve specific inquires. They have a list of phone numbers available on their webpage (Figure 5).

- Startup Europe Club. This network's main goal is to build a single digital market where European firms can grow. The Startup Europe Club brings together relevant stakeholders in the European business ecosystem to provide European SMEs with knowledge on how to access funding processes and scale up, as well as support with their networking initiatives by organising events, summits, etc. In addition, the Startup Europe Club accounts for several funding instruments and acceleration platforms that can be of interest for new-born companies that want to grow in a digital environment. Some of the most relevant funding opportunities within the Startup Europe Club platform are the European Innovation Council (EIC) accelerator or the Eureka-Eurostar programmes. Each business can find the most appropriate instrument on their website (Figure 5).

- European Enterprise Network. This network offers a meeting place where businesses can find advice, support and partnership opportunities to carry out their digital transformation and grow. Furthermore, the European Enterprise Network accounts for the largest amount of data in Europe on business opportunities. Firms

will be able to receive news on the events and resources of most interest to them by signing up on the European Enterprise webpage (Figure 5).

- National Contact Points are national representatives from each Member State that are in charge of providing information about relevant events or webinars. They also offer networking opportunities and advice on how to participate in EU projects. While the previously mentioned opportunities are framed in a European context, National Contact Points operate at a country or even regional level. Small businesses facing language and cultural barriers may find this resource more appropriate for obtaining information and advice regarding EU funding initiatives. The Spanish Government periodically updates the list of national contact points on its website (Figure 6) so that interested businesses can easily reach this advice on European funding opportunities.

- Other meeting points for Big Data users and providers: Some Big Data partnerships, like the European Data Incubator, support SMEs' Big Data initiatives. Private platforms, such as the Big Data Value Association, have created public-private contractual agreements with the Commission (The Big Data Value Public-Private Partnership) to promote, coordinate and dynamize European projects and innovation hubs based on Big Data (Big Data Value Association, 2021). Future Big Data projects financed under the 2021–2027 MFF, will be linked on their website once the destinations for this partnership are signed by the EU (Figure 5). Smaller businesses may find accessing European Digitalisation Hubs challenging. For this purpose, Spain has devoted a significant amount of its resources to fund regional Digital Innovation Hubs (DIHs) to boost data use across national borders.

Previous analyses have pointed out that 'insufficient Big Data skills' are the biggest hurdle to the implementation and analysis of Big Data as part of the strategies of Spanish SMEs. As previously highlighted, publicly-funded training initiatives will primarily be administered by the Spanish government, as it has a better understanding of regional needs. SMEs seeking to train their employees in the data field can benefit from the multiple tools that the Spanish government will make available by the next cycle. These tools include:

- The Digital Toolkit is one of the basic instruments for SMEs digitalisation strategies. However, the government has not specified how to apply to this programme, although it has pointed out that synergies with the 'Acelera PYME'

programme will be exploited. Thus, it is recommended that businesses interested in this digital toolkit address the 'Acelera PYME' coordinators to resolve their doubts (Figure 6).

- The 'Acelera PYME' programme is a special recovery instrument that will follow a lifelong learning approach to digital training and will promote specific data initiatives. Spanish SMEs seeking to promote the digital talent in their organisations can sign up on the 'Acelera PYME' landing page or visit one of the 60 physical offices in Spain that will be opened within the next 2 years (Figure 6).

- Alternative training platforms. In conjunction with the previous initiative, Spanish companies will be able to find free training courses though alternative public platforms, such as the 'Fundación Estatal para la Formación en el Empleo' (The State Foundation for Employment Training) website, where large private corporation experts in Big Data analytics, such as Amazon or Google, will share their experiences.

- DigitalXBorder. The School of Industrial Organisation Network offers an excellent training opportunity for small business directors. This platform offers intensive training programmes at a regional level, which are aimed at training SMEs managers so that they can build strategic Big Data-based plans that allow them to leverage a competitive advantage in the digital market. Businesses interested in taking part in this free programme will find all the deadlines and application requirements detailed on the programme website (Figure 6).

Access to quality data which fits a business' strategic goals has been pinpointed as the second biggest challenge for smaller Spanish companies in working with data.

- Open Data Portals. The Spanish government has established public procurement of data as a main priority in the Digital Agenda (information in the datos.gob webpage's catalogue). The European Data Portal also provides large sets of open public data (Figure 6).

- 'Acelera PYME'. In order to operate with Big Data, businesses must have adequate infrastructures to manage them, and the programme 'Acelera PYME' finances the adoption of key enabling technologies, such as Big Data management infrastructures or artificial intelligence, and interested businesses may obtain more information by contacting the programme coordinators through their webpage

(Figure 6). The Digital Toolkit programme will also provide public grants to be spent by SMEs in their digitalisation.

- 'Activa crecimiento'. The support programme 'Activa crecimiento' will provide consultancy services to the applicants in order to help them with their data management. It will also help small businesses with the implementation of their digital marketing strategy. To benefit from this initiative and develop an efficient ecommerce strategy, the applicant must be an small- and medium-sized enterprise (SME) in Spain. Applications to this programme are via email (Figure 6).

To implement all the disruptive digital technologies in the Big Data field, Spanish entrepreneurs must not only have the knowledge but also the will to implement innovative business solutions. Aimed at promoting the digital innovative entrepreneurship culture in Spain, the Spanish government has established the following mechanisms:

- Data Innovation Hubs (DIH). As previously addressed, DIH will serve as a meeting point to dynamize the Big Data culture across Spanish businesses.
- Coworking spaces by the Organisational Industry School. This network aims at promoting an innovative entrepreneurship ecosystem in Spain by providing innovators with infrastructures (over 50 offices in Spain), networks and mentorship programmes. Companies applying to this programme (Figure 6) must be start-ups with less than 6 months.

Finally, Spanish SMEs may respond to Horizon Europe's calls for innovative Big Data projects as part of a consortium. Due to the networking limitations that an SME encounters at an international level, they can approach potential partners through the national contact points (Figure 6). To access innovation funding opportunities, Spanish SMEs do not need to be technological disruptors, but they can participate as part of the pilot business where the Big Data technology is tested.

Spanish SMEs typically achieve better success rates when they respond to national calls through the CDTI's (Centro para el Desarrollo Tecnológico Industrial) mechanisms (Figure 6).

Appendix 1 encapsulates all the aforementioned information on a single page, aiming to help Spanish SMEs overcome the bureaucratic constraints they face when trying to choose between different funding alternatives. Furthermore, for every dimension to be financed with the European budget, the table depicts whether the mechanism articulating

the funding programme is European or national, thus favouring a more efficient allocation of an SME's scarce resources. By looking at the dual classification of the funding opportunities, Spanish SMEs will be able to determine at a glance to which calls they should assign English speaking employees or workforces who perform better in multicultural environments. On the other hand, workers who are more proficient in their native language or are a better fit for projects in the Spanish market can directly apply to calls for proposals articulated at a national level.

5. Conclusions

Big Data has recently been referred to as 'the new oil' and digital marketing has been one of the big winners in the implementation of Big Data analytics (Olszak and March-Król, 2018). There is an urgent need for Spanish SMEs that want to take advantage of the upcoming European opportunities in the Big Data field. Nevertheless, to carry out a successful implementation of Big Data, organisations must first know how to deal with such a high-sounding concept. It has many times been thought that only large companies can profit from this technology, but thanks to recent technological advances in cloud computing along with the rise of artificial intelligence and the development of precise algorithms, the use of Big Data has become a widespread solution for many businesses of any size and industry.

The first innovative concept in this paper is that it takes a complete journey through the process of implementing the idea of Big Data in SMEs' marketing strategies to enable them to compete efficiently in the digital market. The paper does not only analyse what it means for a company to work with Big Data and what tools it should use but also addresses the challenges that Spanish SMEs must overcome and how they can finance the strategies to tackle them.

Accessing and managing Big Data is not an easy task, especially for small-sized businesses. In order to seize the potential of Big Data, smaller companies need to break down the core barriers they face when working with large and timely data coming from multiple sources (Del Vecchio *et al.*, 2018). The analysis has identified core weaknesses inside Spanish business' marketing departments in working with Big Data to be a lack of data talent, organisational culture, data accessibility and infrastructures to manage the data.

The European Commission as well as the Spanish government have brought together the main problems in the Big Data field in order to design the most efficient financing mechanisms that will allow SMEs to unleash the potential of Big Data and lead the economic recovery after the pandemic. Both of these institutions have shown their ambitions to make data the driving force for economic recovery, and they have decided to devote a large part of their all-time high budgets to the digital acceleration of the business fabric by creating programmes such as Horizon Europe and designing special mechanisms for economic recovery like the NextGenerationEU.

Despite efforts by public institutions to encourage access to financing to speed up the digitisation process of the most vulnerable companies, they have developed a very complex and dispersed bureaucratic scheme. The second innovation of this paper is that it sets out a single record which provides all the relevant upcoming funding opportunities for Spanish SMEs' Big Data adoption. It not only filters the public calls by analysing their relevance to the topic and their profitability but also selects the opportunities with higher success rates and provides a direct link by which to apply to each programme.

Companies must apply funding opportunities to train their employees with data skills if they want to successfully implement Big Data. Most of the funds devoted to training programmes will be managed by the Spanish public administration. The public authorities have opened a great number of opportunities to finance Spanish digital talent as it is one of the nation's greatest weaknesses, especially in the case of advanced digital skills. Since reluctance by senior managers has hindered Big Data adoption, training programmes oriented towards boosting director's knowledge of this disruptive technology will be key for the Spanish business ecosystem to embrace Big Data and catch up with its European partners. In this point, digital divide should be taken into consideration, because there is a gap between companies with access to digital technology and those who do not. SMEs located in regions with restricted access to Internet (e.g., rural areas) experience higher barriers in this field.

On the other hand, programmes aimed to promote innovative digital infrastructures, another fundamental constraint among the Spanish SMEs, will be mostly funded though Horizon Europe, and at the national level, the funds will be managed by the CDTI. Big Data disruptive technological developments will be fostered through data innovation hubs. Indeed, digital divide should be considered in these policies.

Finally, data access, will be enhanced though the development of a pan-European federated and interoperable cloud space. In addition, both Europe and Spain will increase their supply of open data. Spanish SMEs will have to analyse the profitability of working with open public Big Data, which is often too broad and fails to meet the marketing organisation's needs. Businesses are more likely to find better-fitting data by collaborating in public–private partnerships (PPP) with data providers, such as the Big Data Value PPP.

The potential of Big Data is undeniable and there is still much to exploit. In the next years, making an efficient use of Big Data will be necessary for businesses who want to stay competitive in the market. Public institutions have bet on Big Data to drive the economic recovery since they consider it 'an essential resource for economic growth, competitiveness, innovation, job creation and societal progress in general' (European Commission, 2020a). The European Union will devote a historic financial stimulus to transform the European economy into a global data leader. However, the EU has stressed that despite the volume of the financial grants, they will not be given away for free. Companies will have to earn them by submitting successful proposals to the appropriate calls for funding.

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Appendix 1. Spanish Big Data innovation hubs

| DIH Name	Location	City	Website
AIR4S - Artificial Intelligence & Robotics for Sustainable Development Goals	C/Ramiro de Maeztu 7	Madrid	http://www.upm.es/dih-air4s
AI4GALICIA: Artificial Intelligence for Galicia	Universidade da Coruña. Campus de Elviña s/n 15071, A Coruña (Spain)	A Coruña	http://ai4galicia.eu
Associació Clúster Digital de Catalunya	Carrer Bilbao 72, Ed. A, Complex Cornerstone	Barcelona	http://www.clusterdigital.cat
ASTURIAS DIGITAL INNOVATION HUB	Parque Tecnológico de Asturias	Llanera	https://www.asturiasindustria40.es/en/
Barça Innovation Hub (BIHUB)	Arístides Maillol s/n	Barcelona	http://barcainnovationhub.com/
Barcelona Science Park	Parc Científic de Barcelona c/ Baldiri Reixac, 10-12, 08028 Barcelona (Spain)	Barcelona	http://www.pcb.ub.edu
Basque Digital Innovation Hub (BDIH)	Alameda Urquijo 36	Bilbao	http://www.spri.eus/en/basque-industry/basque-digital-innovation-hub/
Catalonia AI DIH	Carrer de Bilbao, 72 A Building	Barcelona	https://www.bigdatabcn.com/en/catalonia-ai-dih/
Centre d'Innovació i Tecnologia de la UPC (CIT UPC)	Jordi Girona 31	Barcelona	https://cit.upc.edu/en
Cybersecurity Innovation HUB	Avenida Jóse Aguado, 41.	León	https://www.cyberdih.com/
Data Science and Artificial Intelligence (DASAI)	Daniel Saucedo Aranda, s/n, 18071, Granada (Spain)	Granada	https://dasciihub.dasci.es/
DATAlife	Edif. Emprendia, Campus Vida, S/N, USC	Santiago de Compostela	http://dihdatalife.com/
Digital Impulse Hub	Blasco de Garay, 29-49	Terrassa	https://digitalimpulsehub.eu
DIH-BAITUR: Digital Innovation Hub of the Balearic Islands for Artificial Intelligence and Tourism	Parc Bit	Palma	http://www.dihbai-tur.com
DIHBU Industry 4.0	C/ López Bravo nº 70.	Burgos	https://dihbu-industry.fundingbox.com/
Dinapsis DIH	Avenida Alfonso Puchades nº3	Benidorm	https://www.dinapsis.es/dih-dinapsis/
Ecosistema W	C/ Virgen de la Soledad 22	Badajoz	http://www.conectoride.com/
ETICOM, Digital economy cluster in Andalusia	Avd. Eduardo Dato, 69, 4th floor, 2 office	Seville	http://www.eticom.com
Experience-based industries Hub (e!xperience)	Edifici Cornerstone. C/Bilbao, 72	Barcelona	https://eurecat.org/en/sectors/cultural-and-creative-industries/
FIWARE Space	Avenida Javier Blanco Palenciano, s/n	Badajoz	https://www.fiware.space/
FIWARE Zone	Concejal Muñoz Cerván 3, Edificio Tabacalera, Módulo 5	Malaga	https://fiware.zone/
Fundación Cajamar	Puerta de Purchena, 10	Almeria	https://www.cajamar.es/es/agroalimentario/innovacion/
GALician manufACTuring Innovation ConsortiA (GALACTICA)	Polígono Industrial de Cataboi SUR-PPI-2 (Sector 2) Parcela 3 36418 O Porriño (Pontevedra)	O Porriño	http://www.galacticaDIH.eu/

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Granada Health Technology Park	Avenida del Conocimiento, 33	Granada	http://www.ptsgranada.com/
HPC-Cloud and Cognitive Systems for Smart Manufacturing processes, Robotics and Logistics.	C/ María de Luna 7-9	Zaragoza	https://www.aragondih.com
Hub 4.0 of Manufacturing Sectors in Valencian Region	Universitat Politécnica de Valencia. Instituto Universitario de Automática e Informática Industrial	Valencia	http://hub4manuval.ai2.upv.es
iAsturias 4.0	Avda. Jardín Botánico, 1345	Gijon	http://www.prodintec.es/es/
Industrial Technology Knowledge Linares DIH	Centro de Innovación Campus Científico-Tecnológico, RONDA SUR S/N	Linares	http://dih-itkl.es/
Innovation for Manufacturing in the South (I4MSOUTH)	Parque Cientifico Murcia 1 Floor Bulding T	Murcia	https://i4msouth.fundingbox.com/
Insomnia Digital Innovation Hub	Muelle de Poniente Poblados Marítimos	Valencia	http://www.innsomnia.es/
Intelligent Urban Lab, Alcobendas	Av. Doctor Severo Ochoa, 45	Alcobendas	https://alcobendashub.com/en/intelligent-urban-lab/
IoT Catalan Alliance	Carrer Gran Capità 2-4	Barcelona	https://www.cataloniaiot.com/
IRIS: European Digital Innovation Hub Navarra	Tajonar Street, 20	Pamplona	https://www.irisnavarra.com/
ITI Data Hub (The Data Cycle Hub)	Ciudad Politécnica de la Innovación - UPV Camino de Vera, s/n. Bldg. 8G. Acc. B – 4th Floor	Valencia	https://thedatacyclehub.com/en/
La Salle Technova Barcelona	Sant Joan de La Salle, 42	Barcelona	http://technovabarcelona.com/en
MaDIH: Manufacturing Digital Innovation Hub	Madrid Clúster de Automoción C/Príncipe de Vergara, 74. 1º Planta 28006 - Madrid	Madrid	https://madih.fundingbox.com/
Neàpolis	Rambla de l'Exposició, 59	Vilanova i la Geltrú	http://www.neapolis.cat
Parque Tecnológico de Andalucía (PTA)	Calle Maria Curie 35	Malaga	http://www.pta.es/es/
REIMAGINE Textile	Av. d'Ernest Lluch 36	Mataró	http://www.reimaginetextile.com/en/
RIOHUB	Calle Francisco Muro de La Mata 13	Logroño	http://riohub.fundingbox.com/
Science and Technology Park of Almeria, PITA S.A.	Avd/ de la Innovacion nº15. 04160 Almeria	Almeria	http://pitalmeria.es/
SmartCityTech	14 - 1º. Edificio Ibaeta 20.018 - Donostia	San Sebastián	http://www.smartcitytech.eu/
Spanish Digital Innovation Hub for HPC (esHPC)	c/Jordi Girona 29	Barcelona	https://www.res.es/es
Technologies for Efficiency Digital Innovation Hub Extremadura (T4E DIH)	Avenida de la Investigación, s/n. 06006 Badajoz	Badajoz	http://www.dih4e.eu
TECNOCAMPUS TECHNOLOGY PARK	Avinguda Ernest lluch 32, 08302 Mataró, Barcelona	Mataró	https://www.tecnocampus.cat/
University of Valencia Science Park DIH	Calle Catedrático Agustín Escardino, 9	Paterna (Valencia)	https://www.pcuv.es/en/dih

Figure 1. Marketers' most significant challenge in implementing Big Data in their marketing strategies
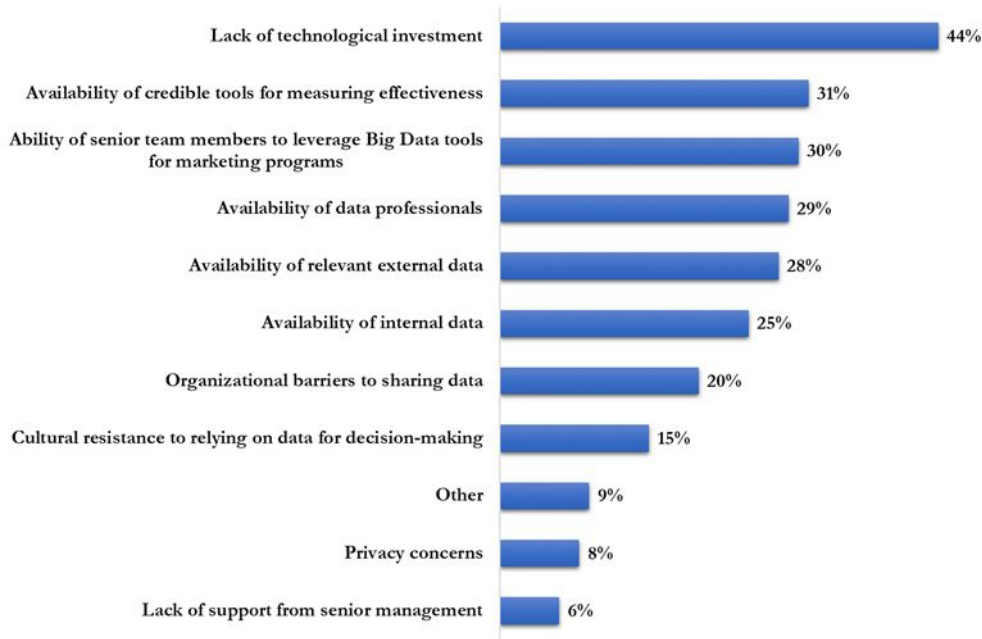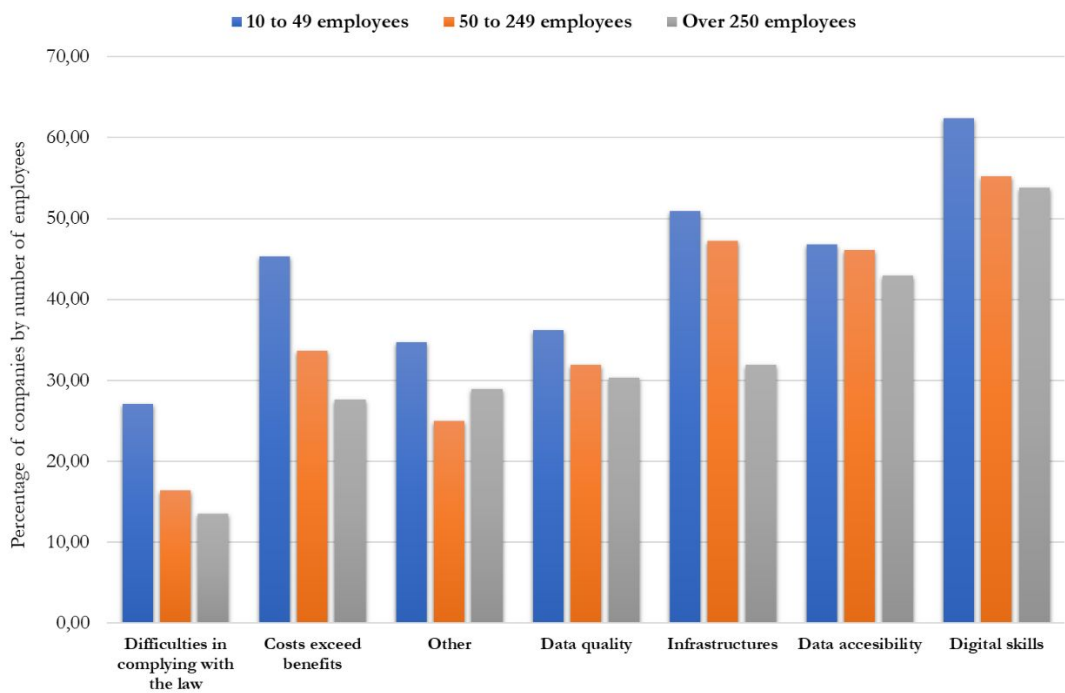

Source: Own elaboration with data retrieved from a report by Spencer Stuart after interviewing 171 US- based marketing executives

**Figure 2**. Areas in which Big Data analytics have the largest impact on the way marketing is executed.
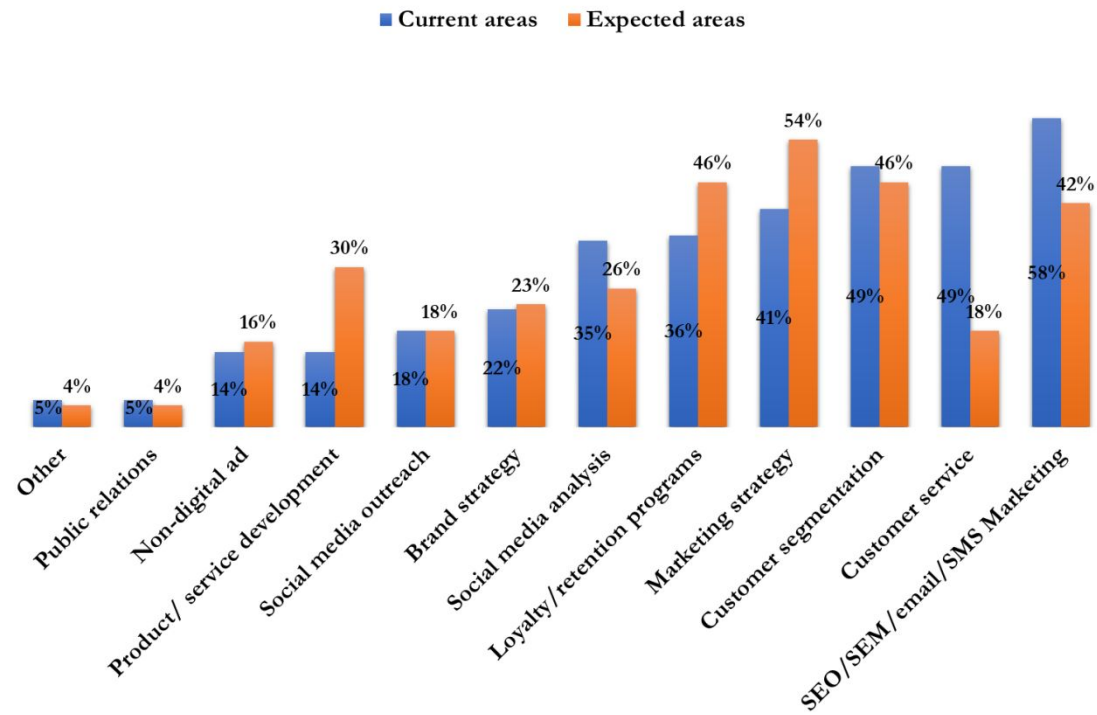
Source: own elaboration with data retrieved from a report by Spencer Stuart after interviewing 171 US-based marketing executives about their Big Data usage.

Figure 3. Spanish companies not analysing Big Data in 2020 by reason and company size.

Source: own elaboration with data from the Instituto Nacional de Estadística (2020).

Figure 4. Procurement of public Big Data vs Big Data analysis in the EU
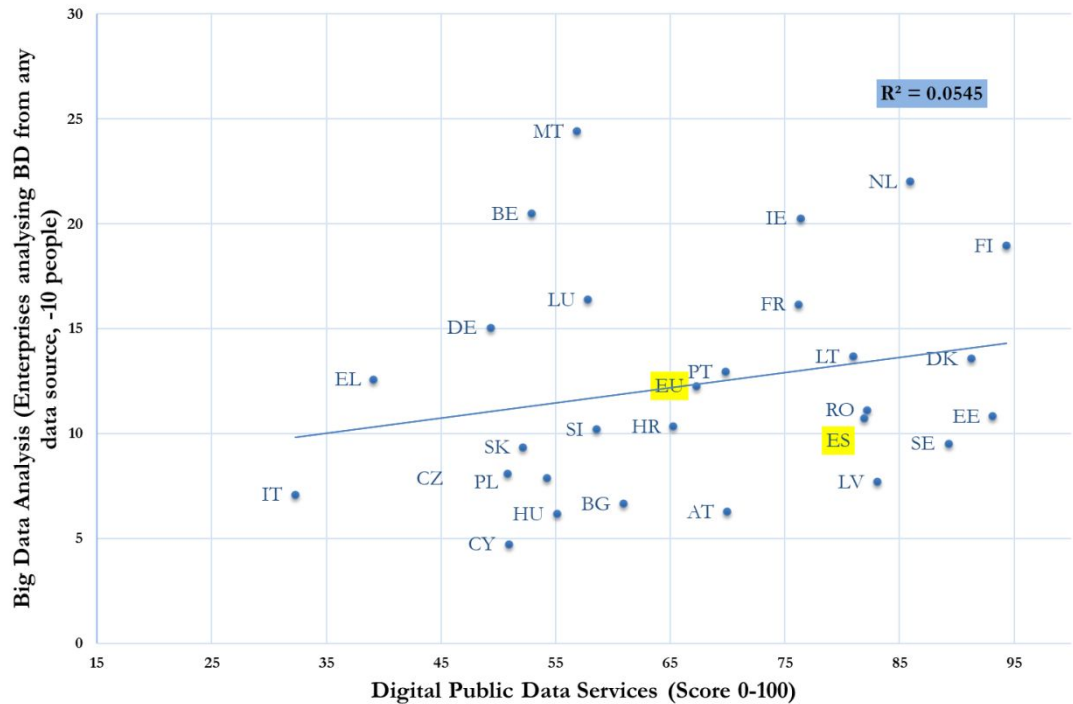
Source: Own elaboration with Data from Eurostat (2020, 2021) and European Commission (2020b)

Figure 5. European Funding Opportunities. For Spanish SMEs willing to implement Big Data

INFORMATION, NETWORKING AND MENTORING	EUROPE DIRECT https://n9.cl/eudirec	EUROPEAN ENTERPRISE NETWORK https://n9.cl/enterpriseeu	BIG DATA VALUE PUBLIC-PRIVATE PARTNERSHIP https://n9.cl/bigdatappp
TRAINING	DATA TRAINING WITHIN A EUROPEAN SCOPE WILL ONLY BE PROMOTED THOUGH DATA HUBS, OTHERWISE, TRINING PROGRAMS WILL BE DELIVERED AND FINANCED AT A NATIONAL/REIGONAL LEVEL		
OPEN DATA AND CLOUD SERVICES	EUROPEAN DATA PORTAL https://data.europa.eu/es	BIG DATA VALUE PUBLIC-PRIVATE PARTNERSHIP https://n9.cl/bigdatappp	EUROPEAN CLUD ALLIANCE https://www.europeancloudalliance.com/join/
PROMOTION OF INNOVATIVE TECHNOLOGIES AND ACESS TO FINANCE	HORIZON EUROPE https://n9.cl/upcomingbdfunding	LOAN GUARANTEE FACILITY https://www.eif.org/generic/contacts/index.htm	

Figure 6. Spanish Funding Opportunities. For Spanish SMEs willing to implement Big Data

INFORMATION, NETWORKING AND MENTORING	MINECO https://n9.cl/minecoquestions	ACELERA PYME info@acelerapyme.gob.es	DATA INNOVATION HUBS Appendix 1	
TRAINING	ACELERA PYME https://acelerapyme.gob.es/suscribete	DIGITALX BORDER https://n9.cl/digitalxborder	ACTIVA CRECIMIENTO industriaconectada4.0@mincotur.es	DIGITAL TOOLKIT To be dertermined, contact Mineco or Acelera Pume
OPEN DATA AND CLOUD SERVICES	DATOS.GOB https://datos.gob.es/es/catalogo	CLOUD SPACES WILL ALL BE PROMOTED WITHIN A EUROPEAN FRAMEWORK		
PROMOTION OF INNOVATIVE TECHNOLOGIES AND ACESS TO FINANCE	CDTI https://n9.cl/funding_cdti	COWORKING SPACES https://n9.cl/coworking_calls	NATIONAL CONTACT POINTS https://n9.cl/nationalcontactpoint	