



Business Innovation Observatory



Big Data

Analytics & Decision Making

Case study 8

*Enterprise
and Industry*

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Big Data

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Business Innovation Observatory
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Table of Contents

1. Executive summary	2
2. Big data: analytics and decision making	3
3. The potential of big data and socio-economic relevance	4
3.1. The benefits of data-driven analytics and decision solutions	4
3.2. Understanding the big data market	8
3.3. Exploiting the potential of big data analytics and decision making	10
3.4. Market adoption	11
3.5. Client perspectives related to the uptake of the analytics and decision making trend	12
4. Drivers and obstacles	13
4.1. The importance of access to finance	13
4.2. Spatial concentrations of ICT activities	14
4.3. Transferability and access to different markets	14
4.4. Entrepreneurial culture and a skilled labour force	14
4.5. Big data, a knowledge-intensive industry	15
4.6. Data privacy and security	15
4.7. Public support helping drive the trend	15
5. Policy recommendations	16
5.1. Policy gap analysis	16
5.2. Promoting the uptake of the trend across the EU	17
6. Appendix	18
6.1. Interviews	18
6.2. Websites	18
6.3. References	18



1. Executive summary

Data generated by financial transactions, different types of sensors and meters, social media networks and numerous other sources are increasing exponentially in terms of their **volume, variety** and **velocity**. These “3 Vs” are making datasets increasingly difficult to capture, manage and process through conventional means. This phenomenon is known as “big data”.

Deriving value out of the huge volumes of data created by users on a day-to-day basis has become popularised by companies like Google and Facebook that are increasingly applying analytics and decision making solutions to capture, manage and process data. In doing so, companies benefit from **real-time market intelligence that empowers company decision-making** which, in turn, may result in increased revenues and reduced costs.

The speed at which management decisions are made is increasing in line with the speed of business and the spread of advanced communication technologies. Big data analytics can provide detailed business intelligence on the behaviour of customers or consumer profiling. This information is provided in real-time, enabling companies to react quickly. Yet the speed at which Europe is realising the socio-economic potential of big data is hindered by both the lack of necessary infrastructure and the lack of skilled labour to analyse it. As a result of these hindrances, there has been growing demand for specialised hardware, software and services solutions for big data. So much so that **market demand for big data is currently estimated at over EUR 56 billion**, is growing at almost 10% a year, and has triggered the rise of businesses capitalising on big data’s market opportunity.

Businesses benefitting from the double-digit growth in the big data market are currently taking advantage of low barriers to entry for start-ups, whether in terms of infrastructure and capital requirements or the reduced need for big data firms to be located in close proximity to their clients.

Yet the greater flexibility in workplace location is somewhat offset by big data firms’ need for a critical mass of knowledge institutions in the IT and data science fields, as well as a specialised labour pool. In addition, the uptake of the trend is slowed by the reluctance of customers to implement solutions because of the **potentially disruptive impact** they might have, whether it be in terms of rendering employees’ views, current IT analytics or even current business practices obsolete.

In spite of there being few barriers to entry, businesses operating in the big data space continue to face obstacles in accessing finance and skilled labour. In the case of the latter, big data firms are encountering difficulties in recruiting personnel with appropriate skill-sets for the analysis of big data, as such work entails a combination of sector-specific know-how and a high level of proficiency in ICT. Furthermore, there are **shortages in the labour supply of experienced data scientists** who, as a result, command high salaries. Finally, there are privacy and security considerations for personal data, and clear concerns about the violation of user trust and confidentiality, especially in the medical and financial sectors.

In order to overcome these obstacles, policy recommendations have been made in relation to the trans-European supply of skilled labour, as well as the development of regional environments conducive to innovative big data start-ups. In relation to the former, there is a need to address the long-term demand for data scientists through the development of dedicated university and professional courses. While in the case of nurturing innovative big data start-ups, there are potential quick wins in developing coaching and mentoring programmes for business plan development or intellectual property strategies. Finally, it is recommended that an analysis is performed on how financial mechanisms may be used to stimulate the growth of firms active in the big data market.



2. Big data: analytics and decision making

*Big data is high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making.*¹

The term 'big data' refers to data that cannot be stored, processed and analysed for timely and accurate decision making by traditional means. The reason for this is that this data is of such a large volume, velocity and variety that it exceeds IT capacity. As a result, developments have been made in order to measure variables through ever-improving digital sensors, communications and computational power. Moreover, increasing data-storage capacity has created huge collections of data. This current situation is best exemplified by the fact that 90% of all data that exists today was created within the last two years².

Our society and economy is entering a time when dealing with large amounts of data, from a variety of sources, plays an increasingly important role. The following statistics highlight the underlying developments that are driving the big data trend³:

- There were 5 billion mobile phones in use in 2010;
- 30 billion different pieces of content are shared on Facebook every month;
- It costs around €450 to buy a hard-drive that can store all of the world's music;
- Global growth of data is projected to increase by 40% per annum while the growth in IT spending is projected at 5% per annum.

Ever-increasing processing power has enabled the analysis of growing amounts of data, as well as the extraction of hidden layers of information from masses of "ordinary" data. The coupling of these can result in completely new insights, applications as well as products and services. This potential for increased insight has provided business opportunities for companies providing big data analysis and decision making solutions.

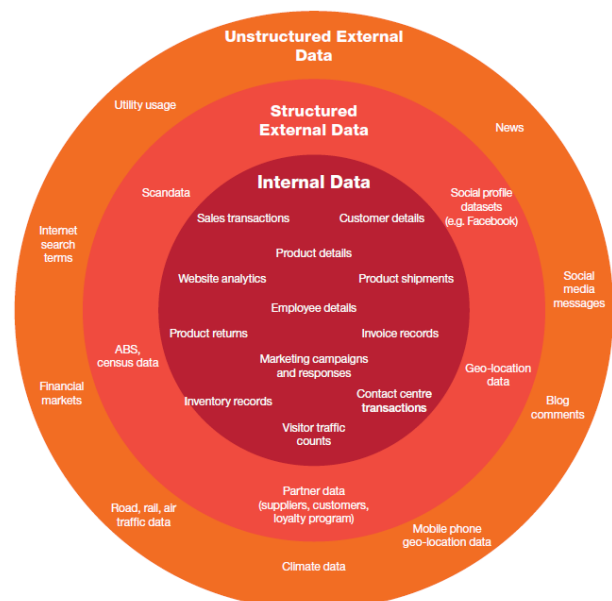
Historically, data was captured by businesses in a structured manner and extracted for analysis when needed. This included, for example, customer records, shopping histories and credit scores. Yet the rapid adoption of social media and smart devices has led to unprecedented growth in unstructured data, such as audio and video files, images, text from e-mails, blogs and traffic information. Tools and techniques based on big data are needed to analyse these forms of unstructured data.

There is a growing belief among companies that remaining competitive requires the integration of ever-larger amounts of data into their decision-making process⁴. 'Big data analytics and decision making' refers to the process of examining big data assets through novel and powerful tools in order to observe trends or derive insights for meaningful decision making⁵.

There are now hardware solutions, software solutions and services that can help organisations to gain significant value from big data by extracting relevant data, processing, organising and analysing them and finally presenting them through intuitive visualisation tools for the organisation decision makers to use. Providing insights and business intelligence can help businesses optimise their decision making processes with the aim of improving business performance and ultimately obtaining a competitive advantage.

Analytic and decision making tools for big data can allow companies to discover trends and characteristics about their customers that might otherwise remain hidden, from data that were never apparent or intended in the source information. There are many facets and channels for analytics and decision making solutions within the realm of big data (see Figure 1).

Figure 1: Examples of the different types of exploitable data by businesses



Source: PwC Australia (2012): *Big Data – The next frontier for innovation*



Data that can be exploited by businesses can broadly be classed into the following three categories⁶:

- **Internal data** consists of information that a business collects through its own systems and processes. It can consist of both quantitative and qualitative information and is typically data type that provides the greatest insights for a business. For example, Walmart handles more than one million customer transactions every hour, which it imports into databases estimated to contain more than 2.5 petabytes of data. This information enables the retailer to map out buyer behaviour as well as merchandising and operational strategies.
- **Structured external data** is provided by third-party sources. It often requires processing in order to be coupled with existing internal information to yield even greater insights. Facebook, for example, processes 2.5 billion pieces of content and 500+terabytes of data each day. The social network also pulls in 2.7 billion Likes, 300 million photos per day, and scans approximately 105 terabytes of data each half hour. This data provides a significant amount of information about user behaviour.
- **Unstructured external data** comes from sources outside of the control of a business but with a potential impact on it. As with structured external data, it can provide concise and targeted business insights when coupled with internal data. For example, when a search is conducted on Google, the search engine's algorithm takes into account over 200 factors, such as relevance, social media, geography, advertising, collective popularity and so forth. This essentially makes sense of unstructured data in order to deliver the most relevant results to its users.

The latest developments in data analytics suggest that there is great value in capturing and processing information with

the appropriate cutting edge tools. Possible applications areas can be found in business, science, government and society. This includes structured data that is traditionally collected by organisations internally, as well as external data sources, whether structured or unstructured.

Future demand for analytics and decision making solutions will be driven by the continuously increasing volume of data. A 2012 report by the Economist Intelligence Unit⁷ suggested that there is a strong link between an effective data management strategy and financial performance. Businesses that understand the potential of big data can use their data in strategy development, product direction, market development and operational efficiency, all of which may lead to competitive advantages.

The key characteristics of big data are:

- Large volumes of data can easily be amassed, whether in terabytes, petabytes or exabytes;
- A wide range of data can be collected in a variety of data types (e.g. numerical or text-based) from a variety of sources;
- Data can be collected in real-time. Datasets can arrive at a very high velocity but the flow of data can be highly variable over time;
- New powerful algorithms are programmed to enable the processing of huge amounts of data in short periods of time;
- Companies are able to build predictive models in a wide range of domains, whether it be: energy consumption patterns; inflation prediction; internet web-traffic optimisation; traffic optimisation; pr e-commerce sales predictions.

3. The potential of big data and socio-economic relevance

The big data market is at a nascent stage and is expected to develop as organisations seek to enhance their competitive advantage. In doing so, firms seek to better understand the ever-growing amounts of data, through analytic and decision making solutions. Employing this software may involve a variety of techniques, technologies and visualisation tools. Today, there is a growing market of companies offering hardware, software and professional services solutions. The applications of analytics and decision making solutions for big data are widespread, and as part of the case-study,

examples of how different companies offer various solutions in different sectors have been provided.

3.1. The benefits of data-driven analytics and decision solutions

Business intelligence is an umbrella term that includes the applications, infrastructure and tools, and best practices that enable access to and analysis of information to improve and optimize decisions and performance.⁸



As the pace of business increases with globalisation and the spread of communication technologies, important management decisions need to be taken more quickly. Detailed big data analytics can provide **critical business intelligence** on customer behavioural trends or consumer profiling to a level of detail never before imagined. As a result, analytics for decision making is becoming a valuable tool for both private and public entities. There is an increasing demand for business intelligence to be provided in

real-time in order to be able to react to it as rapidly as possible.

In order to better understand and assess the market and the applications of this new business innovation, seven SMEs were interviewed (Table 1). These firms offer a wide range of services in analytics and decision making to their customers. By showcasing their products and services we will demonstrate how this novel business innovation can lead to successful business development and growth.

Table 1: Company case studies

Company	Location	Business innovation	Success signals
AiRPX	France	Advanced highly innovative services based on flight data processing	Winner of the 13th French national competition for the creation of innovative technology companies
DigitalRoute	Sweden	Mediation and data integration solutions	Winners of several awards including the Red Herring Top 100 Europe, The Ahrens Rapid Growth List and the Gasell Enterprise awards in 2012
Xilopix	France	Digital Asset Management Software	Received several R&D awards in France
Neodata Group	Italy	Real-time digital content delivery platform for new-media players	Recently acquired a Belgrade-based start-up called "Newscurve", Winner of 3 publicly financed tenders: SIGMA, GAP and MATRICS (Italy).
Trendiction	Luxembourg	Online Media and Social Media data crawling	Winner of the 2010 PaperJam ICT award and creative young entrepreneur award in 2012
Wipro Promax Analytics Solutions Pty Ltd (A Wipro Group Company)	Australia	Trade Promotions Management and Optimization solutions	Received several awards and were recently acquired by WIPRO
Quiterian	Spain	Visual data mining, social media analytics and predictive analytics	Acquired by Actuate

The innovative solutions developed by the case study's companies address a variety of demands and market gaps for big data analytics applications in different sectors. Their solutions help **improve business performance** through a better understanding of data and the ability to make more relevant and timely decisions. Wipro Promax Analytic Solutions, DigitalRoute and AiRPX help their clients improve their business performance by providing analytic solutions of their customers' internal data. Trendiction, Neodata and Quiterian offer their customers the benefits of analytics services from structured or unstructured external data.

Monitoring aircraft systems to reduce maintenance costs – The global economic and financial crisis coupled with continued high fuel prices has accelerated the need for consolidation in the already struggling airline industry. Many passenger and cargo carriers have either gone out of

business or have been taken over by other airlines. The industry outlook is characterised by pressure on cash flows, increasing international competition, oil price surges fuelled by monetary expansion, and rising travel costs due to increases in taxes in Europe. In this difficult business environment, airlines companies have to monitor their operating costs. One important cost relates to the maintenance of aircraft and their unscheduled grounding.

Innovative solution – The company provides innovative aerospace services to assist aviation operators worldwide. It does this through its patented technology, which provides real-time specific analytics tools that minimise cost and maximise aircraft mission success. This technology is based on predictive mathematical algorithms that monitor the aircraft systems from a myriad of onboard and landside data sources.



AiRPX is a French cutting-edge technology company, founded in 2010 and headquartered in Suresnes near Paris, France. AiRPX also has an office in Silicon Valley, USA.



Enhancing data processing in the telecommunications industry

– Within the telecoms industry, billing mediation platforms are systems that are used to record important data regarding the usage of telephone services, to be used for billing purposes as part of the revenue management process (as well as other important tasks such as fraud management, partner reconciliation etc). This process relies on the seamless flow of data from serving networks to the company's data hubs. It is critical to business that these billing records are not lost, corrupted, duplicated or rejected during this process.

Breakdowns in this system are not uncommon and correcting and recycling of the un-processed data can be demanding. The increasing use of real-time billing places greater demands on both the performance and reliability of mediation solutions used by these companies and their service providers. Today, mediation solutions need to manage increasingly large volumes of data and have become more complex to allow for new business models in the telecoms sector (e.g. 4G). This has resulted in the increase of the cost for licensing, hardware and maintenance, as well as resources, given the need to regularly update and implement new systems.

Innovative solution – DigitalRoute through its proprietary product “MediationZone” provides a novel software solution for billing mediation that uses advanced enrichment, consolidation and usage-counting features which reduces the amount of downstream data all while preserving the integrity of the information. It provides a horizontal data integration layer that extends beyond billing and revenue management, and protects the system from disruptions.

Founded in 2000, DigitalRoute originated in Stockholm, Sweden, and today has regional offices in Gothenburg, Atlanta, and Kuala Lumpur



Improving the management and accessibility of image databases

– The most popular internet search engines have developed very sophisticated algorithms to analyse alphanumeric website content. They have become

increasingly effective at displaying relevant search results to customers. These search engines are, however, less effective when customers are searching for images.

Current solutions are inadequate in the way in which they process the description of the image being searched for. On average, 6 words are used in a search, but this is insufficient to obtain the required results using conventional search engines. In addition, the keywords used in searches are used in succession, rather than in combination. If the search result is not what the user wants, the user must backtrack, modify your search parameters and perform a new one.

Innovative solution – Xilopix has developed a fully patented new generation search engine that can perform queries iteratively by combining multimedia objects of different types. Through this it increases the search precision and empowers the decision making process. Notably, the technology is visual and tactile, and so is compatible with all new multimedia devices (e.g. smartphones, tablets, Connected TV).

Founded in 2008, Xilopix is an innovative company specialised in media analysis and semantic technologies.



Matching editorial content and online advertising

– Publishers and media companies increasingly rely on online publications to disseminate content and get their messages across. Newspapers and magazines are placing a high importance on making their articles accessible over the internet, either freely or by subscription. By understanding the preferences and habits of their readers, the industry can engage more effectively with them by providing tailored content and website design.

As with many internet business-models, advertising plays an important part in the revenue generation of websites. Advertisers are interested in having their advertisements placed next to frequently read articles or sections of the publisher's website in order to increase exposure as much as possible.

Innovative solution – Neodata offer an editorial suite that utilises text-mining, semantic analysis and real-time web metrics to provide actionable recommendations to editors, as well as a customisable ad-serving solution that allows



the matching of advertising and editorial content to deliver highly specific advertisement campaigns. Their solution is compatible with non-standard advertising formats like mobile, smart TV, set-top boxes and other new media.

Founded in Italy in 2004, Neodata offers analytic and decision making solutions to online editors and online advertisers. Today the firm employs 42 people, and has an office in Los Angeles to serve the US market. They also acquired a Belgrade based start-up called Newscurve, which provides a decision support system for editors that complements Neodata's growing editorial suite.



Social media monitoring to analyse and respond to consumer behaviour

– Social media has become an enormous source of unstructured data where the views and opinions of its users are made public through the various sites and applications. As a result of the speed at which trends come and go, it becomes increasingly important for players in the big media industry to understand what is happening online including what is being said on social media about their brand, their competition or their industry. Identifying how these are portrayed, whether positively or negatively, as rapidly as possible, and responding accordingly is crucial in the media industry.

Innovative solution – Through their proprietary technology, Trendiction trawls websites from an index of over 20 million sources everyday identifying new articles, extracting key information and adding the articles to their system. New sources can be added to the index automatically or by request of a client. The algorithm developed can automatically detect the structure and extract key information from articles (title, author, date published ...). Following identification and extraction, data analysis automatically ranks articles and saves information relating to their number of shares on Twitter, Facebook and other social networks. It is able to draw conclusions based on the content and characteristics of the articles. The end user can personalise their Trendiction interface based on the type of information that they want to follow.

Trendiction is a Luxembourg-based company founded in 2008 that specializes in data collection, data aggregation and search technologies on the Social Web.



Maximising returns on trade promotion investments

– Companies rely on trade promotions to help improve sales. Trade promotions are an integral part of the supply chain management of any company. Trade promotion consists of a discount of some sort and is typically funded by the manufacturer rather than the retailer.

Trade promotion management is an important task given that trade promotions are expected to result in an uplift in sales. Conventionally used tools, like excel spreadsheets, are often not well suited to this task. They are firstly unable to take into account the variables that influence the performance of trade promotion, such as the impact of advertising. Secondly, they have no audit trail of what numbers and formulae have been changed and it is not easy to test whether they are still working and can become fragmented when written and amended by multiple contributors, resulting in inaccuracies. As such trade promotion management requires dedicated tools for the task.

Innovative solution – Wipro Promax Analytic Solutions offers software solutions and services to replace conventionally used methods by marketing managers and help them identify trade promotion on sales, volumes, market share, and other key performance indicators. Most companies use their services to reduce costs, increase sales and increase profitability. The company records its client's baseline scenario for key performance indicators and then provides the client with a real-time reporting system that indicates any fluctuations from this baseline.

Wipro Promax Analytic Solutions is an Australian company specialising in Trade Promotion Management & Trade Promotion Optimisation. It is located in Taylors Beach (New South Wales) and was founded 24 years ago. The company has offices in the UK and US, and was recently been acquired by WIPRO. Prior to their acquisition, they employed 85 people.



Integrating large data streams to optimise company resources

–The amounts of data generated, stored and analysed for business intelligence from public health records, police and crime statistics, government records, industrial data, in telecoms and in retail are constantly increasing. As well as driving up operational costs, the solutions required to rapidly capture, process, analyse and report data need to become more powerful.



Innovative solution – Quiterian – An Actuate Company offers a software solution that is fast; with an engine that unloads at 60GB/hr and capable of performing advanced analytics on a million records in under a minute. The solution is capable of handling very large quantities of data, unifying multiple formats with no need for cubes, metadata or aggregates. The software also provides easy-to-use analytic tools and reports, in real-time, all while ensuring data security and integrity.

Founded in 2003, in Barcelona, Quiterian was recently acquired by Actuate. The solution offered, now known as BIRT Analytics, helps deliver enterprises more value from more data. Prior to their acquisition by Actuate, the company employed around 26 people, with customers in the Latin American, European, US and Asian markets.



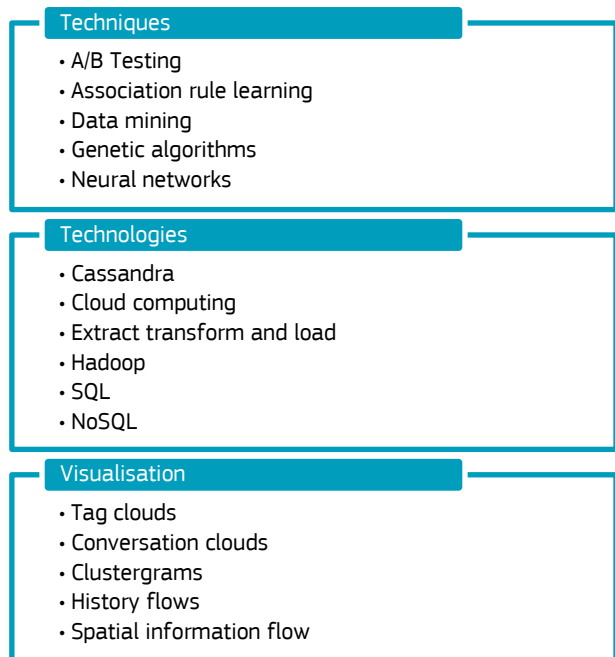
3.2. Understanding the big data market

Quantifying the exact size of the big data analytics and decision making market is difficult and the estimates vary amongst recent reports. According to the International Data Corporation (IDC), the global revenue of players involved in big data grew by 35% to €6.1 billion in 2012 and is expected to continue rising at a similar rate until 2016⁹. Whilst, according to the Economist, “In recent years Oracle, IBM, Microsoft and SAP between them have spent more than €11.3 billion on buying software firms specializing in data management and analytics. This industry is estimated to be worth more than €56 billion and growing at almost 10% a year, roughly twice as fast as the software business as a whole”¹⁰.

The application of big data analytic solutions is also believed to offer €250 billion in annual savings to Europe’s public sector administration, as a result of improved productivity and increased efficiency and effectiveness¹¹.

Applications of big data analytics tools can already be found **across a wide range of sectors** including retail, utilities, health care, media and telecoms¹². A wide range of different techniques and technologies have been developed to collect, process, analyse and visualise big data in all these industries. These solutions are multidisciplinary in nature and derive from fields like information technology, mathematics, statistics and economics. Some of the techniques and technologies have origins in academia, whilst others come from private companies with online business models for analysing data. Examples of these different techniques, technologies and visualisation tools are shown in Figure 2.

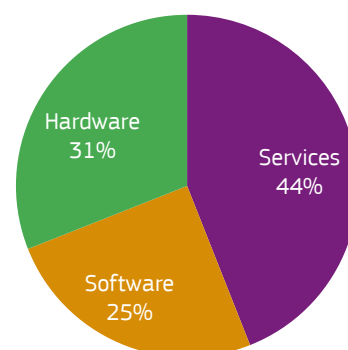
Figure 2: Different types of big data techniques, technologies and visualisation tools



Visualisation is an important part of the analytics and decision making process. The use of visual tools removes the need for the reader to process large quantities of numerical or textual data, and instead conveys information through visual tools. The benefits of this approach are similar to how a graph can be easier to interpret than a large table of values. Hence, **an important part of the big data industry lies in its creation and development of visualisation tools.**

Overall, the market can be broken down amongst companies offering Infrastructure, Software, or Professional Services. Market data is limited, but it is estimated that the segmented revenue generation in the big data market in 2011 was of a total value of around €3.5 billion¹³. The relative shares of the market segments are shown in Figure 3.

Figure 3: Segmentation of the big data market, 2011



Source: Kelly, J. 2013. *Big Data Market Size and Vendor Revenues*. Wikibon Article



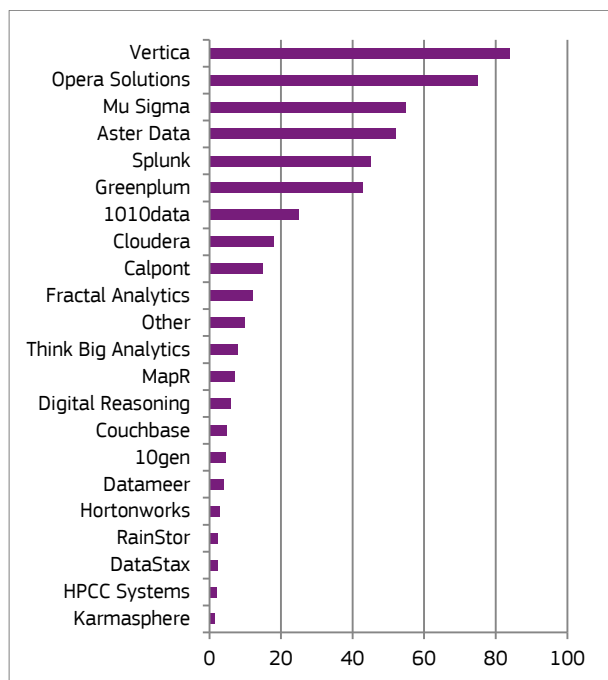
The bulk of revenues from big data can be attributed to large companies, like Google and IBM. So-called big data pure-players, which make the largest share of their revenues from big data, account for around €360 million in revenues and only around 5% of the overall big data market. Yet a large share of the latest innovations and approaches to analytics is attributed to these companies. For instance, Vertica, Splunk and Cloudera, all offer their own novel analytic solutions and have become sizeable players amongst the current big data pure-players (Figure 4).

The majority of the companies that were interviewed have revenues in the lower quartile of the graph below. The deployment and management of analytics and decision making technologies require multidisciplinary and highly skilled specialists. This includes:

- Engineers to deploy infrastructure;
- Data scientists to perform the programming and statistical analysis; and
- Individuals who understand the business and target sector to interpret results.

At present there is a shortage of the skilled labour for big data analytics, and as a result, companies offering professional services help fill the gap with consulting services and trainings. This is coupled with a scepticism within the market about the merit of the data-driven process, which would empower senior executives to make decisions without the need for a dedicated analytics team.

Figure 4: Annual revenues of big data pure players, 2011 (in US\$ million)



Source: Kelly, J. 2013. Big Data Market Size and Vendor Revenues. Wikibon Article

The specific innovative solutions developed by the companies interviewed for the case study have applications across a multitude of industries (Table 2). It is important to mention that these firms are often highly internationalised because of the low entry barriers into international markets, often without the need for a physical presence in them through regional offices.

Table 2: Examples of the various sectors for big data analytics

Company	Sector of Big Data Market	Client Sector
AiRPX	SAS / Software / Services	Aviation
DigitalRoute	Software	Telecoms
Xilopix	Software	Digital asset management, and advertising
Neodata Group	Services/ Software	Advertising sales agencies, online publishing, defence, intelligence services
Trendiction	Services/ Software	Media, public relations
Wipro Promax Analytics Solutions Pty Ltd (A Wipro Group Company)	Software	Trade Promotion - Food & Beverage, Pharmaceuticals OTC, Household, Personal Care.
Quiterian	Services/ Software	eCommerce, Government, Finance, Insurance, Public Transportation, Retail, Telecom, Education, Utilities

The company case-study indicated that it is not uncommon for start-up companies that have developed a novel solution to be acquired by a larger group. This is because the flexibility of SMEs allows them to more closely tailor a solution to meet market demand than larger organisations. Thus, the incorporation of an SME is often a better strategy for a large company than developing in-house. This was the case with ProMax, who were acquired by WIPRO, providing the latter new sector verticals for its products and services. Similarly, Quiterian was acquired by Actuate to complement their analytics services.

Whilst the market is dominated by companies such as IBM, Intel, HP and Google, it is likely that they will be pushed to respond to novel and innovative solutions developed by smaller big data pure-players that are potential acquisition targets. Thus, it is quite possible that start-ups in this industry will be faced with having to choose a specific model through the: licensing of their software; the offering of professional services; the sale of their products; or their acquisition by a larger company.



3.3. Exploiting the potential of big data analytics and decision making

Analytics and decision making solutions offer a variety of benefits, but these fundamentally can be boiled down to the provision of business intelligence. Clients can benefit from analytic solutions of their internal data and benefit from reductions in costs or help themselves reduce inventory. Certain clients benefit from analytics solutions which take into account external data which can, for example, help retailers tweak their offerings based on newly discovered trends in consumer behaviour, adjust advertising strategies to suit identified consumer profiles, or even discover new market niches.

The predictive analytics offered by AIRPX benefitted its client airline companies in that it allowed them to **reduce their costs** through multiple avenues. Its top-down approach gave users an overview of the plane in its entirety providing a complete evaluation of the plane's status in real-time and in-flight. The solution is compatible with planes of different brands, allowing the consolidation of plane statuses for their entire fleets rather than per-brand. The system also being predictive, allows for a reduction in both maintenance equipment and staff, as plane maintenance can be foreseen and resources allocated in advance. It also improves aircraft availability and increases schedule reliability.

The companies using the mediation services of DigitalRoute benefit from a reduction in both operational and maintenance costs because of the superior software solution and the more effective management of current services it offers. When rolling out new services, especially complicated ones like new 4G networks, clients benefit from **a reduced time-to-market** through the more powerful solution which reduces the effort with which new services and processes are introduced by service providers.

"The planned introduction of 4G, enabling high speed mobile broadband for all our subscribers and visitors makes a flexible and high performance mediation solution such as MediationZone a necessity"
– Testimonial from telecoms company BTC

The platform provided by Xilopix serves firstly as **an improved data-asset management service** which empowers decision making of companies that store and deal with image databases such as libraries, museums, retailers and other image processing groups. According to the company the digital asset management market is estimated at around EUR 620 million. The platform offered by the company also empowers decision making for users in the general public that use the service as a search engine, whereby they will have the possibility to refine their search criteria mid-search.

The suite of services offered by Neodata Group empowers decision making for online publishers and editors by providing them with **detailed real-time reports on website traffic**, as well as the number of hits on each article and how these differ from their baseline traffic. This helps publishers identify in real-time what articles are popular in order to expose them more by bringing them forward on to the website homepage for example. For advertising agencies, the company's services can help them identify consumer types based on the behaviour website visitors. They can be categorised into different clusters which allows targeted advertising campaigns for the reader. Such campaigns aim to maximise the number of persons clicking on the advert, thus **increasing the revenue** of the advertising company.

The solution offered by Trendiction empowers decision making of its clients in big media. A radio station's programmer can benefit from knowing in real-time what people online are saying about a program they are running as it is happening, on the go via the mobile applications for example. From the insight provided by the service, the programmer can have the show altered to respond to a dip or increase in interest for example. The service allows PR campaigners to understand better how effective their campaign has been, or for a PR agency to evaluate how popular an actor is at the moment in order to determine if they will help promote or hinder a project or film they may become involved in. The benefits provided by these insights ultimately result in an **increase in revenue**. Similar tools have also been used during political campaigns to develop engagement strategies based on user generated content on social media.

The trade promotion management solution offered by Wipro ProMax Analytics Solutions empowers decision making for clients, who rely on trade promotions to help improve sales, and thus increase revenue. Pernod Ricard, New Zealand's largest wine company, transformed their trade promotional planning and trade spend management process and systems using solutions implemented by Wipro ProMax Analytics Solutions. As a result, Pernod Ricard benefitted from the **real-time visibility and measurements of trade promotions** and expenditure, as well as reduced costs and increased revenue.

Customers of Quiterian benefit from a software solution that can process data in large volumes, benefit from business-user friendly report systems which empower decision making and provide them with competitive advantages. La Caixa bank in Spain benefitted from Quiterian's services, with the aim of helping them in tasks

"With Quiterian DDWeb, the analysts of La Caixa interact with data self-sufficiently and with independence from the IT department, responding this way to unpredicted questions, identifying opportunities,... Always in real time and with no need to have technical skills " – Testimonial from Spanish bank La Caixa



such as campaigns with the aim of better understanding their customer data (research of responses), promotions research (detecting overlaps in campaigns, evaluating promotions, etc.), products research (characteristics of customers who consume specific products), and in the segment of revolving cards (identifying behaviours and profiles of users of this kind of card). As a result La Caixa benefitted from the capability to optimise its marketing campaigns' segmentation and customisation, reducing the time and logistics of promotions and results analysis.

3.4. Market adoption

The interviewed companies were for the most part created to capitalise on a wide variety of demands and applications in different sectors. What their solutions have in common is that they help improve business performance through a better understanding of data and the ability to make more relevant and timely decisions. Wipro Promax Analytic Solutions, DigitalRoute and AiRPX help their clients improve their business performance by providing analytic solutions of their customers' internal data. Trendiction, Neodata and Quiterian offer their customers the benefits of analytics services from structured and unstructured external data.

These analytics and decision making solutions offered by these companies allow for the analysis of large quantities of data and provide relevant and timely insights to inform business critical decisions:

- **Analytics** – The analytic solutions offered by companies identified as part of this case study are almost always complex, algorithm-based, and have the ability to automatically update themselves. They allow the customer to collect large amounts of data, process these so as to remove unimportant data or “noise”, and then perform analyses more rapidly compared to conventional methods, such as excel spreadsheets.
- **Decision making** – The second business innovation solution is the empowerment of decision making following the analytics of big data. Often the clients benefitting from the analytics services do not have the tools, the resources, the skills or the time to analyse the collected and processed data themselves. Consequently, companies present their results to clients in easy to digest reports, so as to allow the client to easily understand and act upon the findings of the analytics process.

When considering the clients of these interviewed companies, the following indicators were deemed to demonstrate success criteria when leveraging on big data analytics and decision making solutions:

- **Empowered decision making:** As a result of the new business intelligence delivered through fast and intuitive reporting systems. Clients that implemented these

solutions or users of the solutions have benefitted from empowering their key decision makers.

- **Increased revenue:** Through the new insight provided by the use of analytic and decision making solutions, sales strategies could be adapted in order to increase revenue by targeting identified consumers.
- **Reduced costs:** Through new insights, cost savings can be achieved through reduced maintenance costs, re-allocation of resources, more efficient promotions targeting. For instance, big data analytics will lead to fuel savings in the aviation and power industries, capital expenditures reduction in the Oil and Gas industries, and system inefficiency reduction in the healthcare and railway sectors.

Application areas for big data analytics can be found in all sectors. It is a **horizontal, non-sector-specific trend**.

Even if solutions are initially developed for and within a particular target sector, there is significant potential for transfer into other sectors. This can be illustrated by the experience of DigitalRoute, a company which develops billing mediation platforms and policy control services for clients in the telecoms sector. They have identified market gaps for their powerful IT solution, e.g. including transport and online gaming. Whilst the firm estimated the market size for the mediation and policy control in the telecoms market at around €3 billion. The overall value of the market for big data solutions according to them is more difficult to estimate given all the different possible applications of their IT solution.

“The emergence of machine-machine-communications technology, process automation and a growing number of new data generating sources has resulted in the creation of large data assets that contain vital information about consumption of services, service quality, personal preferences and more. This data has the potential to enhance all aspects of both business operations and processes.” – DigitalRoute

Nevertheless, nearly one in four survey respondents in the report by the Economist Intelligence Unit having **said the vast majority of company data remains untapped**, and 53% stated that they only use about half of their valuable data. Whilst 73% say that data collection in their organisation has increased over the last year. As a result, demand can be expected to increase for big data analytics, software solutions to manage the data as well as the hardware solutions (e.g. servers) to store the data in.

3 companies role in big data have been identified with different maturity levels:

- The Innovators: are at the forefront of the sensors, analytical tools and new business models and aim to create added value for their customers or for themselves. This includes search engines, social



networks and e-commerce companies as well as many small companies developing innovative solutions.

- The Supporters: The large hardware and software companies embracing and fostering the Big data trend as a very large new business avenue for them. They adapt and develop new products and solutions to meet new market demand and technological challenges.
- The Market Adopters: While the Innovators and the Supporters are pushing hard big data solutions, the large companies and multinationals in most industries have not put in place the systems and procedures to extract the value of big data analytics. The IT Changes are so fast and important that large companies are finding it difficult to keep track. However IT or retail oriented companies are making quick progress to better understand client patterns or cost patterns for better efficiency.

Furthermore, there is going to be an **increasing demand for skilled labour** and 'data scientists'. Most companies do not have the appropriate infrastructure to capture the amount of data they are generating, let alone deploy techniques to analyse it. The demand for statisticians and data scientists to ask the right questions and correctly interpret results is going to be the biggest issue in the adoption of big data solutions.

In a recent publication, the Harvard Business Review dubbed the position of data scientist as the 'sexiest job of the 21st century', citing a 15,000% increase in job postings from 2011 to 2012¹⁴. The McKinsey Global Institute estimates that 1.5 million more managers with data analytics skills are needed to take full advantage of big data in the United States¹⁵.

Ultimately, the economic impact of the big data analytics and decision making trend is more to do with its application and the competitive advantage it brings to users. Consequently, the development of big data in Europe will help foster improved business performance and competitiveness of European firms through improved business intelligence and real-time analysis for decision-making. In summary, the uptake of big data analytics and decision making solutions can be thought to have the following socio-economic benefits:

- Improved competitiveness of European companies within the global market;
- More sustainable and stable businesses and business models, based on new visions and higher standards for entrepreneurs and community users;
- Improved efficiency in the public sector (e.g. healthcare, policing);

- The creation of jobs, particularly skilled jobs to meet the demand for data scientists; and
- The internationalisation of European firms.

3.5. Client perspectives related to the uptake of the analytics and decision making trend

There is still a cultural barrier to be overcome before the trend becomes widespread. This is because embracing data-driven decision making involves moving away from conventional decision making processes. These conventional processes involve the preparation of reports provided by IT staff after their own analytics process. On the one hand there is a degree of scepticism from the decision makers themselves about this new data-driven decision making. On the other hand, these new solutions would effectively cut out the "middle-man" and empower company management to make decisions themselves. Obviously such a disruptive change in process takes time before the market accepts it.

There is also a fear that the implementation of the new solutions offered within this trend might be highly disruptive. A company that invested in software to provide their decision makers with both the means to analyse big data and to present the salient results in real-time may mean that it would make their current analytics system obsolete. This would effectively make a prior investment worthless, and is a contributing factor to the reluctance of companies to uptake the trend.

AirPX for example faces a resistance by plane manufacturers about their product. Airlines are reliant on each different plane manufacturer for the maintenance requirements for each individual plane in their fleet. This is because each manufacturer will have their own solution for maintenance-prediction that is applicable to their planes, but not others. With AirPX's new solution, airlines would be able to centralise all plane maintenance in their fleets, regardless of the manufacturer, and make the conventional system obsolete.

Even more of a barrier from a cultural perspective is the possibility of the analytics and decision making solution forcing a change in the business process itself of the customer. For example, a company might implement an analytics process and then be told by this process that a factory that they previously thought profitable was in fact losing them money. The company would then be placed in a difficult position as to whether it should act upon this information and close down the facility, resulting in a large number of redundancies. Since there is still an element of doubt as to the merits of analytics and decision making solutions, making important decisions based on the technology might be seen in a poor light.



Another barrier to the uptake of the trend are the technical limits faced by any company that attempts to store and process the enormous volume of data themselves. Storage space for a company wishing to store data in such quantities requires a sizeable investment in space and hardware in which to store the servers. Not only do servers require space but they are also energy demanding in terms of electricity consumption and cooling. Thus, when maintenance costs are added, this adds up to a sizeable investment. As such, companies are often put off by the thought of employing analytics and decision making solutions if they must install servers to do so.

Finally, there are legal concerns big data analytics solutions that act as a barrier to the widespread uptake of analytics and decision making¹⁶. The concept that the more data available the better and more accurate the results of the analysis can be, requires an increase in openness and the promotion of data sharing. This data sharing would have to be occurring amongst people and companies, and so some might not be comfortable with openly sharing their information. This is especially the case if the information is sensitive, like health or financial data.

4. Drivers and obstacles

There are a number of drivers encouraging the scaling up of the big data analytics and decision making trend. These drivers impact on both the companies developing innovative big data solutions and the adoption of these solutions by users in a range of different target sectors. Further detail on such drivers, as well as obstacles, are provided in this section.

From the user's perspective, there are also some fundamental obstacles to an increased uptake of big data solutions. For instance, potential beneficiaries of big data are unaware of the trend's existence and/or the advantages it brings. Furthermore, there may be a reluctance to incorporate tools into business processes that may yield unpredictable results. Big data analyses might unveil a crude reality that is difficult to digest. In addition, there is the concern that big data could disrupt existing decision making processes, either diminishing the powers of management or countering their arguments.

4.1. The importance of access to finance

Access to finance is the single most important factor for the development plans of firms interviewed for this case study. Private equity or loans through venture capital or business angels were the most common ways to raise funds for the companies in their start up phases. Venture capital is a common source of investment for start-ups in this industry, although recent market data suggests that these are decreasing (along with venture capital investments in general)¹⁷. DigitalRoute and Neodata for example started up through venture capital investment.

Some of the firms benefitted from financial subsidies, grants or awards (Table 3). This depended on the regions they were located in. Neodata for example relied solely on private investment given that there was no access to public funding

in Sicily, where the company was founded. On the other hand, companies like Xilopix and AiRPX benefitted from research grants and awards, as well as certain tax-credits. Trendiction has received direct governmental subsidies. Wipro ProMax Analytics Solutions began as a self-funded organisation 24 years ago in Australia and stated this as an advantage.

Table 3: Source of funding for company cases

Company	Source of funding
AiRPX	Self-funded & Venture Capital
DigitalRoute	Venture capital
Xilopix	50% self-funded 50% from French public funding (crédit impôts recherche, OSEO)
Neodata	Venture capital from Principia Sgr who specialise in investment in Southern-Italian start-ups with combinations of public and private funding
Trendiction	Private investment backed up with Luxembourgish government subsidies by LuxInnovation.
Wipro Promax Analytics Solutions Pty Ltd (A Wipro Group Company)	Self-funded
Quiterian	Self-funded

The majority of companies offering big data analytic and decision making solutions are in their nascent stage. The lack of companies with a successful track record suggests that investors, which in general have a preference for investing in more established industries, are also in limited supply and are excessively prudent.



4.2. Spatial concentrations of ICT activities

The presence of other companies in their industry or related industries, or of established support structures, was not indicated as a primary factor in determining the choice of location for firms. Most of the companies did, however, start up in a city or region with a critical mass of companies and/or expertise in the information and communication technologies sector (Table 4). DigitalRoute is based in Stockholm and Gothenborg, Trendiction in Luxembourg and Quiterian in Barcelona. Proximity to a technical school and other IT companies are thus important to facilitate the development of big data companies.

Table 4: Regional industrial factors for company cases

Company	Industrial framework conditions
DigitalRoute	Set up in Stockholm with 9 founding members with extensive prior-working experience in billing mediation solutions.
Xilopix	Originally set up in Paris. The firm then later moved to Lorraine so as to reduce its overhead costs in order to employ more staff.
Neodata	The company set up its commercial offices in Milan because of the critical-mass of businesses in the city compared to the rest of Italy.
Trendiction	Set up in Luxembourg where there has been a recent influx of IT companies. Albeit, the company does not benefit much from this.
Wipro Promax Analytics Solutions Pty Ltd (A Wipro Group Company)	Established themselves 2 hours away from Newcastle, the 2nd biggest city in New South Wales.
Quiterian	Set up in Barcelona where there was an already well-established software development industry.
AIRPX	Set up in the south of Paris in incubator for innovative technologies then moved to downtown Paris for a better access to clients and staff.

Founding members have commonly worked in IT or programming or in client industries. One exception to this trend was Neodata, which was originally established in Catania, Sicily, but also set up offices in Milan to increase its accessibility to businesses and finance.

4.3. Transferability and access to different markets

The presence of a large consumer driven market is an important factor for the success of a start-up in any

industry. The firms that develop big data analytic and decision making solutions have a tendency not to solely rely solely on a regional or national market but to internationalise rather rapidly (Table 5).

Table 5: Market distributions for company cases

Company	Target markets
AiRPX	Began with clients in France (air force and airlines). Looking to enter the European, US and Asian markets (in that order of priority).
DigitalRoute	Despite being based in Sweden, their first client was Argentinean. The company is internationalised, covers the global market and has set up regional offices or appointed representatives in different markets.
Xilopix	First target clients will be in the French market.
Neodata	The company began by selling its services on the Italian market. It then moved into the US market.
Trendiction	The company initially concentrated on the German market and is today well positioned in it. It also caters to the French, Dutch, Belgian and Luxembourgish markets. The company aims to enter the UK and US markets in the future.
Wipro Promax Analytics Solutions Pty Ltd (A Wipro Group Company)	Originally, the company catered to the Australian and New Zealand markets, but has since moved into the European, US and Asian markets.
Quiterian	Established a good position in the Spanish market (with 70% of the public sector market), the company then internationalised into the Latin American, then European markets. Followed then by the North American, Indian and Chinese markets.

Several of the interviewed companies internationalised very early, catering to a clientele with a wide geographic distribution. For example, despite being based in Sweden, DigitalRoute secured its first contract with an Argentinean telecoms company and now caters to clients all over the world. Other companies such as Neodata and Xilopix began by focusing on the Italian and French markets respectively. In these cases, the aim was to cater to markets where services were required in languages other than English.

4.4. Entrepreneurial culture and a skilled labour force

The companies that originated in France (AiRPX and Xilopix) stated that the general culture in the country is not particularly conducive to the development of SMEs, as private investors are reluctant to engage with start-ups due to changing public policy. Whilst companies like Trendiction



(Luxembourg) and DigitalRoute (Sweden) were more positive about the general entrepreneurial culture in their region, indicating that they did not struggle to secure public and private investment.

The presence of a strong qualified labour force was a topic of note for most companies. The demand for skilled labour, notably data scientists, is an underlying trend in the field of big data analytics. All companies stated that it was important to get the 'right people' as it were. Often firms looked for specific profiles. In the case of Trendiction, given that their business deals with social media they looked for people with the right profiles in their twenties. On the other hand, AiRPX required very experienced staff in the aviation industry. In addition, firms commonly had to look for suitably qualified staff further afield given their needs for very specific skills.

4.5. Big data, a knowledge-intensive industry

An important criterion for the development of successful firms offering analytics and decision making solutions is the regional knowledge infrastructure. This includes the presence of higher education and research institutions in fields specific to the industry, technology transfer organisations and shared technology platforms, as well as sector specific courses or training in the region.

The solutions offered for analytics and decision making are knowledge intensive. Most of the founding members of the companies interviewed had previously been involved in high-tech business and IT, or in academia. Often these companies started to commercialise an innovative idea developed by persons with experience in industry who identified a market gap. In other cases, for instance with Neodata Group, the company has a strong relationship with higher education institutions.

Given the knowledge-intensive and multidisciplinary nature of this new industry, it is of great importance for companies that offer analytics and decision making solutions to engage in knowledge transfer and exchange. This is illustrated by Neodata maintaining their links with the University of Catania to hold annual conferences to promote knowledge transfers. Wipro Promax Analytics Solutions benefit from their links with nearby Newcastle University in Australia to hold training courses for staff.

The Neodata Group was founded in 2004 by Giovanni Giuffrida and Tommaso Giola. They initially offered a solution (ad.agio) for big online advertising brands through a flexible, customisable ad-server. Today the firm employs 42 people with an office in Los Angeles to serve the US market. They also acquired a Belgrade based start-up called Newscurve, which provides a decision support system for editors that complements Neodata's growing editorial suite.

In addition to being Neodata's CEO, Giovanni Giuffrida holds a permanent position at the University of Catania. This link with academia has facilitated the identification and recruitment of the most suitable talents for the company. The company regularly holds conferences and events at the University of Catania in order to promote knowledge transfer and networking between academia, business and the local community.

4.6. Data privacy and security

Regulation does not appear to be a significant obstacle for companies in the analytics and decision making field of big data. This could be due to the fact that sensitive data processed for clients is internal data. One company, Quiterian, did state that there are important regulations related to the European Data Protection Act which apply to the services they offer to clients in healthcare or policing. However, this was seen as a driver rather than an obstacle, as the security of their software served as a promoting factor.

Personal data, such as credit-card details or public health records, must be kept secure according to national and European law. Leaks of personal data or breaches of files where personal data is stored, according to most legislation, must be followed by public announcements by the impacted company as well as contacting the affected persons directly. Such an incident would obviously impact upon the reputation of the company. As such, it is worth noting that whilst possessing highly secure software can be a selling point, a breach of security can have significant business implications.

It is important to note that according to European Digital Rights (EDRI), nearly all large organisations experience security breaches or data leaks, sometimes with disastrous consequences. Information from the UK Information Commissioner's Office shows that local government data leaks increased by 1609% over the last five years, while other public organisations showed a 1380% rise. In addition, private organisations recorded a 1159% surge in data leaks¹⁸.

4.7. Public support helping drive the trend

Trendiction benefitted from Luxembourg government policy which directly supports the development of innovative companies. The company was supported by business incubation services, government subsidies and other general assistance from the country's national agency for innovation and research. Neodata, despite originating in Sicily, benefitted from backing by a venture capitalist fund called Principia Sgr.

DigitalRoute did not seek any public assistance and instead raised the necessary funds to develop through venture



capital. An interesting example of support measures was in the case of Wipro Promax Analytics Solutions as the company took advantage of a support scheme by the Australian government which helps financially reimburse activities that seek to internationalise small firms. The

companies interviewed benefitted from a range of support measures including business incubation services, government subsidies, tax credits for private investors, and tax credits for R&D activities, and research grants (Table 6).

Table 6: Support Measures for Company Cases

Company	Country	Support Measures
AIRPX	France	Business incubation (Aerospace cluster : ASTech Paris Région) Research grants Tax credits for R&D (Crédit Impôt Recherche)
Xilopix	France	Government subsidies (OSEO) Tax credits for R&D (Crédit Impôt Recherche) Tax credits for investors
Trendiction	Luxembourg	Government subsidies (LuxInnovation) Business incubation (Jeunes Entreprises Innovantes)
Wipro Promax Analytics Solutions Pty Ltd (A Wipro Group Company)	Australia	Financial assistance for internationalisation (Austrade Export Market Development Grants)
Quiterian	Spain	Benefitted from a government-loan (ENISA) when the firm was raising firms to internationalise

5. Policy recommendations

Big data analytic and decision making solutions have the potential to have a significant impact in a wide range of application areas horizontally across both the public and private sectors. The uptake of the trend would ultimately provide a competitive advantage to European companies by improving business-critical management through more data-driven decision processes. The public sector would benefit from an increase in efficiency through greater insights on socio-economic developments at different scales.

The big data market is growing as the technology and process of data-driven decision making is increasingly accepted as a solution. Although the accessibility of relevant data and the acceptance of more automated decision-making are obstacles facing the industry as a whole, these are progressively being overcome. In addition, there is the need for human capital to meet the growing demand for skilled workers. The main obstacles to a greater uptake of the trend are, however, the familiar obstacles faced by young innovative SMEs offering analytics and decision making services.

5.1. Policy gap analysis

The big data analytics and decision making trend currently faces more of a technical challenge related to data storage capacities rather than challenges related to regulatory issues. The development of emerging companies in this industry is not significantly affected by a particular

regulation and does not depend on specific policy measures that may be lacking or would jeopardise current development. There are, however, two kinds of broader challenges related to regulations and policy. The first challenge is linked to transversal issues, namely:

- **Education:** there is a need for more interdisciplinary training and the development of specialists with complementary areas of expertise and skill sets, e.g. programmers with a profound understanding of how a particular business sector operates; and
- **Data Protection:** it is highly important that sensitive data (public health records, policing data, finances) is handled securely and is not leaked in accordance with the Data Protection Directive (95/46/EC).

The second challenge is related to European and national policies linked to the development of SMEs and the development of innovative start-ups. The reason for this focus is due to the fact that most of the emerging companies that offer analytics and decision making solutions are highly specialised and innovative SMEs. All EU Member States need to further improve regulations and public support to help SMEs and innovative start-ups develop and internationalise.

When considering access to finance, such regulations and support may correspond to the creation of public investment banks, funds and specific tax credits to incentivise research



and innovation. Policies should also focus on **improving the overall business environment and favouring entrepreneurship** by addressing the legal status of entrepreneurs (limited liability, specific fiscal measures, facilitated procedures for business creation, support for second opportunity and delivery of educational contents to start an activity).

Improvements regarding bankruptcy policies would also provide entrepreneurs with a second chance to start a business, along with specific mechanisms to partially maintain employment and activity in case of bankruptcy. Business mentorship towards young entrepreneurs could also be provided to foster the entrepreneurial spirit in Europe. Measures concerning administration simplification and support to internationalisation could be developed with the set-up of specific agencies and growth accelerators. Finally, policies favouring life-long learning and training are to be supported and adapted to the big data environment, which require a fine-tuned combination of expertises.

Several of the case companies considered EU or national programmes too complex to be of interest to them and chose to not request public assistance as a result. In that sense, they would favour a more bottom-up approach, leveraging the current needs of companies to help tackle them directly. It was also made apparent that the availability of support measures varied across Europe, with limited support available in some regions. Whilst the likes of Luxembourg have multiple support systems for start-ups in this emerging industry.

5.2. Promoting the uptake of the trend across the EU

Europe is currently experiencing a competitiveness deficit which, together with an economic disparity between different regions of the EU, has led to stagnant growth, rising unemployment and fiscal instability. The development and adoption of big data analytics solutions has the potential to improve the performance and competitiveness of European firms through improved business intelligence and real-time analysis for decision-making. The core added value of big data analyses is new substantiated knowledge which can support decision-making processes across Europe.

In order to facilitate the uptake of the trend, different regions and countries should focus on the following:

- Ensuring appropriate **access to finance** for big data companies that have a financing shortfall when raising funds to commercialise new analytic solutions. This can be done through the use of dedicated financial solutions such as loan guarantees through public institutions or intermediary bodies to promote private lending, through debt financing, or through equity financing.
- Establishing an **enabling business environment** for data storage (and consequently securitisation), data transfers and communication networks. This could be done through the establishment of favourable financial environments for IT companies (such as tax-breaks).
- Supporting **entrepreneurship**, leading to the creation of start-ups and SMEs that offer big data analytics and decision making solutions. This could be achieved through the promotion of research grants or tax-credits for organisations involved in research and development.
- Fostering **administrative simplification**, such as a “tell us a single time” principle to enable companies to submit information to a single public administration, who passes on the submitted information to other administrative bodies. In addition, finding ways to reduce the administrative burden should be considered, as start-ups with their small number of employees can rarely dedicate the necessary amounts of time required to fulfil their administrative obligations for public support.
- To support big data SMEs in their **internationalisation** process, e.g. by using schemes that reimburse young companies when they move to internationalise. This approach mirrors that of Austrade Export Market Development Grants, which helps Australian SMEs internationalise. In addition national governments can create public bodies tasked with the promotion and attraction of foreign investment.
- To develop and promote an **education system** able to answer the specific needs of big data companies. This can be done through the promotion of higher education in mathematics, IT and the sciences. In addition, the promotion of life-long learning should be addressed. These would provide opportunities that would enable persons to acquire or update their IT skills, or other inter-disciplinary skills required of data-scientists.



6. Appendix

6.1. Interviews

Company	Name	Designation
AiRPX	Jean-Hugues Pettré	CEO
DigitalRoute	Tomas Vasen Keith Brody	Vice-President - Product Management Director - Global Marketing
Xilopix	Eric Mathieu	CEO
Neodata Group	Giovanni Giuffrida	CEO
Trendiction	Robert Glaesner	CEO
Wipro Promax Analytics Solutions Pty Ltd (A Wipro Group Company)	Karen Thomas	Marketing Manager
Quiterian (an Actuate company)	Josep Arroyo	VP

6.2. Websites

AiRPX	http://www.AiRPX.com/
DigitalRoute	http://www.digitalroute.com/
Xilopix	http://en.xilopix.com/
Neodata Group	http://www.neodatagroup.com/
Trendiction	http://www.trendiction.com/en
Wipro Promax Analytics Solutions Pty Ltd (A Wipro Group Company)	http://www.promaxtpo.com/
Quiterian (an Actuate company)	http://www.quiterian.com/

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¹⁷ <http://www.forbes.com/sites/gilpress/2013/03/18/top-10-most-funded-big-data-startups/>

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