Factors influencing big data analytics adoption in Algerian companies: An empirical study

العوامل المؤثرة على تبني تحليلات البيانات الضخمة في المؤسسات الجزائرية: دراسة احصائية

Soraya Sedkaoui*

Senior Lecturer, Treatment and research of Information and Statistics laboratory (TRIS, University of Montpellier, France), University of Khemsi Miliana, Algeria.

Mounia Khelfaoui

Senior Lecturer, Organizational development and innovation Laboratory, University of Khemsi Miliana, Algeria.

Received: 29.07.2018 ------ Accepted: 19.09.2018

Abstract:

BDA helps organizations to acquire new knowledge that leads to business efficiency. This new analytics tools have raised motivation for experts and researchers to study its impacts to business values and challenges. However, studies which help to understand factors towards the applications of BDA are lacking. Especially in Algeria where the application of such analytics tools is an emerging trend despite its

* Correspondent author's E-mail; soraya.sedkaoui@gmail.com

importance. This paper focuses on BDA and aims to examine the factors that influence the adoption of BDA in Algerian enterprises. Structured questionnaire was used to collect data from selected enterprises. The major findings of the study indicated that, the adoption of BDA requires the relevant tools and software to extract knowledge “data mining”. In addition, the existence of skills (for analytics) and the level of development of digital area in our country will undoubtedly encourage the use of such techniques.

Keywords: Analytics; big data; data mining; Algerian enterprises.

Jel Classification Codes : C01 ; C55, C80, C82 ; C88.

Abstract in Arabic:

تساعد تحليلات البيانات الكبيرة المؤسسات على اكتساب معارف جديدة تؤدي إلى كفاءة الأعمال. وقد شكلت هذه الأدوات التحليلية الجديدة حافزًا للخبراء والباحثين لدراسة تأثيراتها على قيم الأعمال. هذه الدراسات تساعد على فهم الاطار العام لتحليلات البيانات الكبيرة دون تحديد العوامل التي تحفز المؤسسات على تبني مثل هذه الاساليب. خاصة في الجزائر حيث يعتبر تطبيق أدوات التحليلات من الاتجاهات الناشئة على الرغم من أهميتها. لذا تركز هذه الورقة على هذا الجانب وتهدف إلى دراسة العوامل التي تؤثر على اعتماد تحليلات البيانات الكبيرة في المؤسسات الجزائرية. من اجل ذلك قمنا باستخدام استبيان لجمع البيانات من مؤسسات مختارة. وتشير النتائج الرئيسية للدراسة إلى أن اعتماد هذه تحليلات يتطلب الأدوات والبرامج ذات الصلة لاستخراج المعرفة "حلق القيمة". بالإضافة إلى ذلك ، فإن وجود المهارات ومستوى تطوير المجال الرقمي في بلادنا سيشجع بلا شك استخدام مثل هذه التقنيات.

Keywords (in Arabic): التحليلات، البيانات الكبيرة، التنقيب عن البيانات، المؤسسات الجزائرية

Jel Classification Codes : C01 ; C55, C80, C82 ; C88.

Introduction

With the advent of IT technology and smart devices, a huge amount of digital data is generated every day. Individuals are putting more and more data publicly available on the web. Thus currently, not only is the quantity of digitally stored data is much larger, but the type of data is also tremendously diversified, due to various new technologies (Sedkaoui and Monino, 2016). These data presently represent the new strategic resource for many companies.

Their Volume, Variety, and Velocity, or what we call now the '3 Vs', have increased considerably, so that a term is born: "Big Data", which will be defined according to the three mentioned Vs. For Cukier and Mayer-Schönberger (2013a) big data is a challenge for our way of life and changes our relationship with the world. The authors argue that, "*What matters is not why but only what"*. They also noted in their book that "*The real revolution is not in the machines that calculate data but in data itself and how we use it"*.

The current data potential brings us back to the early days of the oil boom. The data was compared to oil in 2006 when Clive Humby, a mathematician has developed Tesco's loyalty card. It was taken over and developed by Michael Palmer (The Guardian, 2013), who also compared data to crude oil that needs to undergo transformation before generating value. As Verdier (2013) points out, "*data is both much more complicated, and in the economy it is both much less and much more than oil*".

Data presents also a wealth for companies and exploit them provides a competitive advantage in an increasingly competitive environment. In this context, there is evidence that companies with analytical advanced tools can incorporate better strategies to use their resources more effectively (Ngai et

al., 2009). Data operationalization will pave the way for innovative strategies, aimed at creating new sources of value. But, the real value occurs when the data is transformed into information that leads to knowledge (see Ackoff, 1989) and this is achievable through '*data analytics*'.

The gains of joining the great revolution of big data analytics are no longer in doubt. There are many success stories that show that companies that inject large amounts of data into their operations achieve higher productivity and profitability rates. Data is collected and analyzed to support effective business processes and to create significant additional value. In fact, technical competence in data processing is now a reality.

The application of big data analytics in Algerian companies is an emerging trend. Despite the shift from a planned economy to a market economy, many experts and researchers believe that business practice in the field of data management and analysis is still weak and affects their competitiveness. In addition, these companies are also exposed to the big data universe. This raises the question of why the Algerian companies are lagging behind in the adoption of big data analytics tools and the factors likely to influence their adoption.

These questions make the present research one of the first studies analyzing this point with, of course, a particular attention to the selected companies. This article seeks to study the issues related to the adoption of analytical methods for strategic purposes by Algerian companies. In particular, it focuses on the factors that affect a need for these methods in Algerian companies. It is based primarily on existing research and develops a conceptual framework to understand why companies are adopting big data analytics or not. A questionnaire has been designed to collect the necessary information that will enable us to achieve our research objective.

Literature review

One of the consequences of technological advances in the business world is the "massive amounts of data produced by and about individuals, objects and their interactions" (Boyd and Crawford, 2012). Beyond these interactions, large amounts of data are created through Internet searches, social networks, GPS systems, and stock market transactions. In these circumstances, it is clear that companies are particularly concerned by the advent of big data, because of its function within the company. Although big data is considered a new form of capital on the current market (Mayer-Schönberger and Cukier, 2013; Satell, 2014), many companies are failing to capitalize on it (Mithas, Lee, Earley and Murugesan, 2013).

Big data draws the attention of the whole world and can best be described using the 3 Vs: volume, variety and velocity. These three dimensions are often used to describe the phenomenon. Each dimension presents both challenges for managing and analyzing data and opportunities for advancing decision making (Sedkaoui, 2017). These 3 Vs provide a challenge associated with working with big data. The volume focuses on storage, memory and calculates the capacity of a computer system and requires access to a 'cloud computing'. Velocity highlights the speed at which data can be absorbed and the significant responses produced. Variety makes it difficult to develop algorithms and tools that can handle this wide variety of data (Sedkaoui, 2018b).

Faced with this huge amount of data, companies need to adopt analytics tools that can generate value by analyzing that data. Companies may need to modify organizational and business processes to act on big data information (Viaene, 2013). The application of big data analysis in the different processes is accelerated by computer tools. For now, the challenge is not to

stick to the traditional methods of research but to seek new paths. Only through these methods we will achieve a more complete understanding of how people, products and processes interact with each other. The ability to trace data quickly into business decision-making transforms business disciplines and practices.

Big data analytics combines predictive and prescriptive analytics to predict what will happen and how to get there. It marks a major turning point in the use of data and is a powerful driver of growth and profitability. A complete understanding of a company's data, its potential and the methods of analysis can be a new vector for value creation process. So, before breaking the process of data analysis and understanding big data analytics, it is necessary to look at what it is and in what literature context it has developed. Many terms in the literature are often related to each other: '*Analytics*', '*Business Analytics*' and '*Business Intelligence*'.

Davenport and Harris (2007) define analytics as: "*the extensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to drive decisions and actions*". An analytics team often uses their expertise in statistics, data mining, machine learning, and visualization to answer questions and solve problems that management points out. Analytics can be defined also as "a process that involves the use of statistical techniques (measures of central tendency, graphs, and so on), information system software (data mining, sorting routines), and operations research methodologies (linear programming) to explore, visualize, discover and communicate patterns or trends in data" (Schniederjans and al, 2014).

Business analytics begins with a data set or commonly with a database. As databases grow, they need to be stored somewhere. Technologies such as

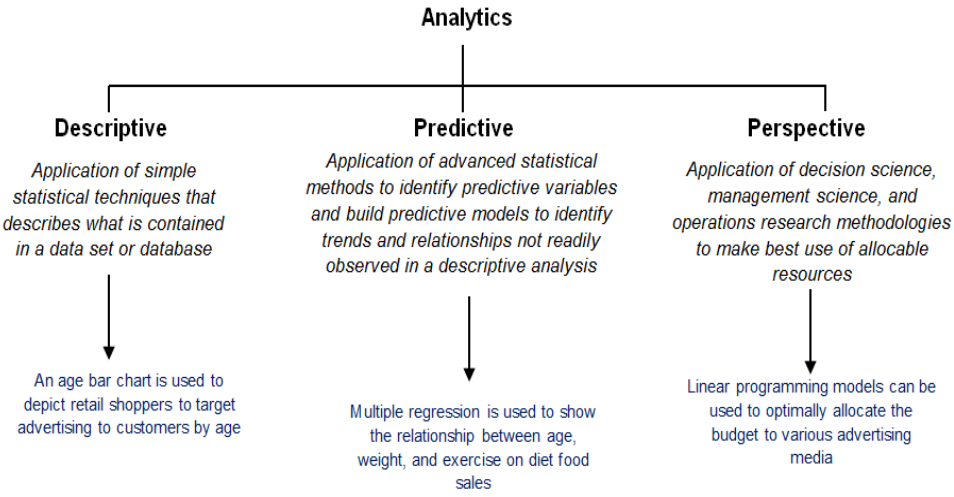
computer and data warehousing, store data. Database storage areas have become so large that a new term was devised to describe them. Stubbs (2011) believes that Business Analytics goes beyond plain analytics, requiring a clear relevancy to business, a resulting insight that will be implementable, and performance and value measurement to ensure a successful business result.

Business analytics traditionally covers the technologies and application that companies use to collect mostly structured data from their internal legacy systems. This data is then analyzed and mined using statistical methods and well established techniques classed as data mining and data warehousing (Chen et al, 2012). Such type of analytics allows businesses to perform two main types (Delen and Demirkan, 2013):

- *Descriptive:* which focuses on reporting on what happened in the past, and;
- *Predictive:* which uses past data to try and predict future events.

Delen and Demirkan (2013) noticed that big data adds the ability to perform a third type of analytics, called perspective analytics, which combines data from the two previous types and uses real-time external data to recommend an action that must be taken in certain time to achieve a desired outcome. So, there are many types of analytics, (see Figure 1), and there is a need to organize these types to understand their uses.

Figure 1: Analytics type



Source: Sedkaoui, 2018a

Different researches in the literature have recognized the benefits of adopting big data analytics and its dissemination and applications in business area. But in parallel studies have categorized the factors hindering the adoption of tools and techniques of analytics by companies. A number of researchers point to firm size, firm characteristics, product, sector, market access, policy changes, and economic conditions as factors influencing the degree of adoption and development and exploitation of large data (McConville 2008, Shiels et al 2003).

Also, adopting advanced technology, as mentioned before, to support big data analytics is essential for the business. ICT Investments are also seen as barriers, in addition to cultural shortcomings, lack of cooperation, poor adoption and e-business design, and so on. (Luccehetti and Sterlaccini, 2004). Legal and regulatory issues, weak strategies, lack of research and development, excessive reliance on foreign technology are seen as a challenge to the adoption of big data analytics applications (Matambalya

and Wolf, 2001). The various factors that may hinder the adoption of Analytics tools in the era of big data are best developed in the next section.

Research hypothesis

Analytics and big data are more than buzz; they define the modern enterprise in a different way than the one we know about ten years ago. Companies can now tap into “vast oceans of internal and external data, and even structured, semi structured and unstructured data” to better understand, and develop new products to be more competitive. Learning new ways to leverage data, perform effective analytics, and developing new technologies through data science is essential to business growth.

Data analysis, before using the word ‘big’, refers to the discovery and communication of useful and effective models. By adopting a mixture of analytical methods such as: statistics, data mining, visual analysis, machine learning algorithms. It addresses a wide range of application tasks, including a summary of data, classification and prediction, correlation...

The mastery of processing techniques is becoming a real strategic and useful issue for the competitive differentiation of companies (Bughin et al., 2011). The analysis of these masses of data plays a key role for the society of tomorrow because it finds applications in fields as diverse as science, marketing, customer services, sustainable development, transportation, health, and even the educational world. We can then see that big data involves a number of components that work together to provide a rich ecosystem and provide more powerful analysis.

The main objective of this study is to identify the factors influencing the adoption of analytical methods to support the analytical approach within Algerian companies. The empirical study carried out asserts that the

attention given to the adoption of analytical tools depends on the internal context, the external context, culture, training in the field, and the degree of investment in ICT and the use of analytics support technologies. The constructions and hypotheses proposed in this are supported by previous studies in the field of big data and business.

To better analyze the factors we proceeded to a categorization of the various factors into three frames as it was used in previous research. These are the factors used to identify who has the greatest influence on adoption of the BDA, so the "TOE" (Technology-Organization-Environment) framework was adopted for this study. This framework (see Table 1) is used to construct the theoretical framework for this study and to identify the different factors in the adoption of the BDA.

Table 1: The different factors influencing the adoption of the BDA

Framework	**Factor**	**Definition**
Technology	Cost	Potential expenses related to the adoption of Big Data. (For example, costs related to the use of BD technology, a significant initial investment required to adopt BDA).
	Complexity (related to the 3Vs)	BD characteristics are perceived as difficult to understand and use (for example: The difficulty of learning related knowledge for employees who

		will use BD applications).
	Scalability	Refers to the ability to adapt to an order of magnitude change in volume. in particular its ability to maintain its functionality and performance in the event of strong growth of BD.
	ICT Infrastructure	The technological resources of the company are adequate for the adoption of BDA. (for example, hardware, software, storage infrastructure ...).
	Security	Collecting data from customers leads to customer security, privacy issues ...
Organization	Firm size	The annual turnover of the company and the number of employees who could support the adoption of BDA.
	Inadequate skills for BDA	The human resources that are adequate for the adoption of BDA (example: Analysts, Data Specialists, Data Science Experts ...).
	Technology Needed for BDA /	Is related to the extent to which companies have the ability to

	(Technological Capability)	exploit BD in terms of technological availability.
	Resources Availability	The BDA requires strong financial resources and a robust infrastructure to consolidate data for analysis.
	Management support	Managers and decision-makers are willing to allocate sufficient resources and encourage the adoption of BDA (for example, those responsible for data management, the willingness of CIOs to adopt the BDA).
Environment	Competitive pressure	The extent of the pressure of competitors of a company that can be combated by the adoption of BDA (for example: competitive market, external threats of competitors ...).
	Government Policy and Regulation	The various strategies that the government is demonstrating in favor of technology development and application of BDA technology and which can encourage companies to adopt it by providing political support.

Using the definitions given in Table 1, and based on the TEO framework in the different literatures, we have suggested the following hypotheses.

- **H1:** *The overall cost of using the different BD technologies has a positive effect in terms of adoption of the BDA.*
- **H2:** *The complexity of large data has a positive effect in terms of adoption of the BDA.*
- **H3:** *The scalability of BD has a positive effect in terms of adoption of the BDA.*
- **H4:** *Existing technological resources have a positive effect in terms of adoption of the BDA.*
- **H5:** *Data security considerations have a positive effect in terms of adoption of the BDA.*
- **H6:** *The size of the company has a positive effect in terms of adoption of the BDA.*
- **H7:** *Existing skills have a positive effect in terms of the adoption of the BDA.*
- **H8:** *The technological capacity of companies has a positive effect in terms of adoption of the BDA.*
- **H9:** *Available resources have a positive effect in terms of adoption of BDA.*
- **H10:** *Commitment of managers has a positive effect in terms of the adoption of the BDA.*
- **H11:** *Competitive pressure has a positive effect in terms of the adoption of the BDA.*
- **H12:** *Policy and regulation has a positive effect in terms of adoption of BDA.*

Methodology

Although the factors influencing the adoption of the BDA are numerous with regard to the companies, the studies on the adoption and the successful implementation of the BDA in Algeria are relatively rare. Given that companies are often recognized as the engine of national economic growth, it is important to investigate why they did not seize the many opportunities of BDA given the rapid growth of analytical tools in developed countries. In order to meet the objectives of the study and to better understand the points discussed above, a questionnaire survey was deployed and data were obtained from a convenience sample of 30 Algerian organizations.

The survey focused on companies from different sectors and located in different parts of the country. In addition, our sample falls to 30 companies that found interest in the survey. The questionnaire was developed based on the objectives of the study and analyzes the relationship between certain components of the business environment and their attitudes towards the adoption of the BDA.

The questionnaire was designed to include several questions about the factors that may or may not influence the adoption of the BDA. This questionnaire contains two parts. A part that concerns the information relating to the characteristics of our sample (such as: size, business activity...). And another part that was developed from the information on the state of perception of big data, data mining and their use within companies before moving on to a series of questions about the adoption of the BDA and the factors likely to influence this process.

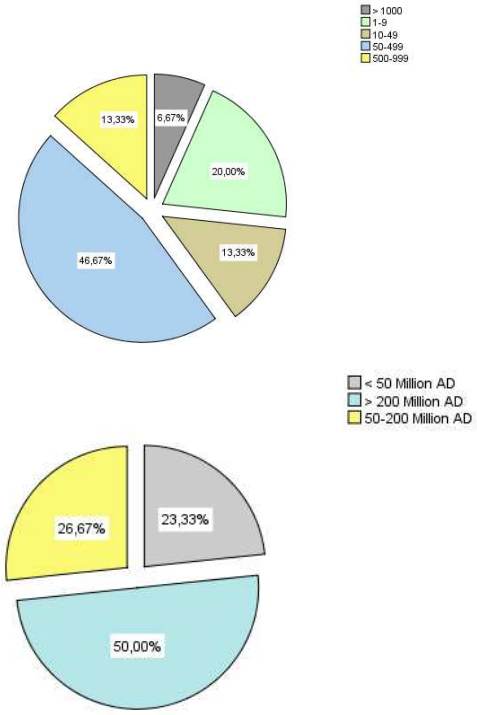
In the end, 30 companies answered the various questions. Participants were asked to select their most significant factors in adopting BDA for their businesses. The questionnaire includes twelve factors, grouped under 3

headings with a 5-point Likert scale ranging from 1: “strongly disagree” to 5: “strongly agree”. For other questions, responses are coded from 1 to 2 or even to 3 in some cases.

As a result, the validity of the questionnaire content has been confirmed. The collected data were tested, analyzed and interpreted using SPSS software version 22. Data analysis was performed using descriptive statistics, specifically standard deviation, correlation analysis and multiple regression analysis. Cronbach’s alpha (a measure of internal consistency or the proximity of a set of items) was also used to assess the inter-item reliability of each variable (see Appendix).

This study conducted an online survey to overcome time and place constraints, thus helping our study to reach respondents more easily than using other survey methods (personal and telephone interviews and other self-administered surveys). An email is then sent to 220 companies to invite them to complete the questionnaire. This email indicated the purpose of this study and provided a hyperlink to the survey form. This online survey was conducted for two months, which resulted in a sample of 30 companies for an overall response rate of 13.63%.

Figure 2: Surveyed companies by size



Regarding the profile of the surveyed companies in this study, they are all interested in the development of data analysis services to take advantage of the opportunities offered by big data. But before moving on to the analysis of the hypothesis, we will first try to know better our sample by analyzing some characteristics such as size and business activity.

In terms of turnover, 50% of the companies surveyed achieved a turnover of more than 200 million (DA), and almost 27% realized a turnover varying between 50 and 200 DA and the rest received less than 50 DA. Similarly, for respondents, the overwhelming majority had 50 to 499 employees (46.67%). While, the companies with less than 10 employees and between 10 and 49 employees represent respectively 20% and 13.33% of the sample. The other two categories represent 13.33% (for the employee category of 500 to 999 employees) and 6.67% (for more than 1000 employees) (as shown in figure 2).

Similarly, the 30 selected companies are engaged in the different business sectors as shown in Figure 3.

Figure 3: Distribution of sample by Business activity

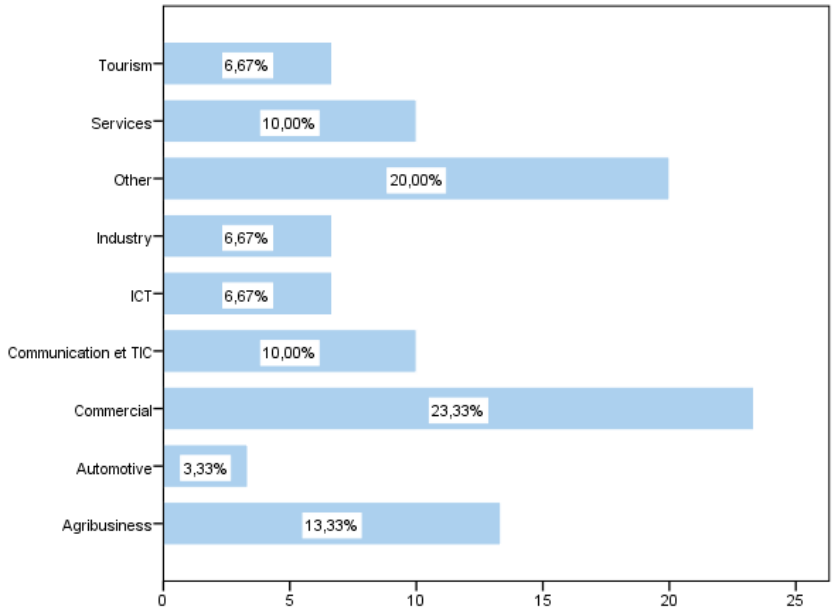


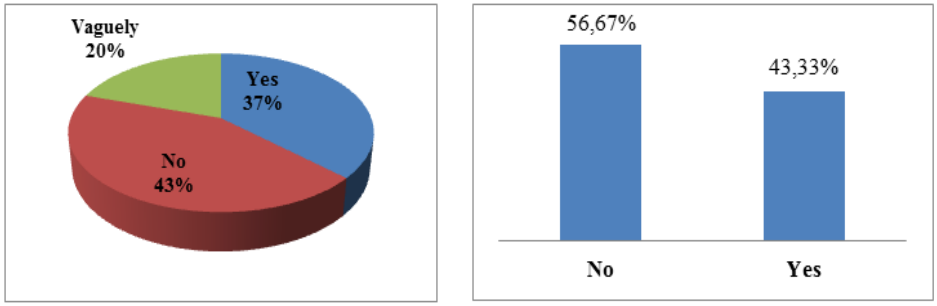
Figure 3 indicates that the sample came from different industrial sectors; the commercial sector led the way with 23.33%, followed by agribusiness with 13.33%, then services with 10%. It should be noticed also that several companies provide activities in various sectors such as telecommunications, health, construction, automotive, industry, construction...

Results and discussion

Algerian companies can no longer ignore the power of analytics in a large data environment if they want to maintain their competitive advantage in a rapidly changing environment. They need to know the benefits of using their data more efficiently, from improving process efficiency to strategic decision-making and accurate prediction, to creating new business models.

This is why we will analyze in the following, the perception of big data and practices of tools and analysis techniques. This will help us in our approach to answer some questions such as: Are companies aware of the benefits of big data and data mining? What about the perception of these terms? The answer to this question is summarized in Figure 4 below.

Figure 4: The perception of the term BD and DM



Big Data **Data Mining**

The results show that the concept of 'big data' is unfamiliar since less than 44% reported knowing it. As against more than 56% have any idea despite its importance to the universal scale especially with the digitalization of customer data processing tools. Similarly to the term 'data mining', the results indicate that only 37% of enterprises have heard about this concept, while 43% unfortunately not familiar with it although their importance in the customer behavior analysis. This illustrates that Algerian companies do not have a global perspective about this practice, so it is difficult to trace the profile of its applications. So, are these companies ready to adopt the advanced tools of analytics in the era of big data? The results in the following table can answer this question.

Table 2. BDA adoption

Question	Yes	No	No idea	Total
Are you ready to adopt BDA?	**53.33%**	**10%**	**36.67%**	**100%**
BDA will revolutionize the business strategies?	**70%**	**6.67%**	**23.33%**	**100%**

53.33% of enterprise confirmed that they are ready to adopt BDA techniques, compared with only 10% who said no. Another question was posed to these companies about the effect of BDA on the business strategies and 70% agree that this concept will revolutionize their strategies.

In addition, another question arises at this level, it is indeed the subject of this study which consists in the identification of the various factors which can encourage the company to adopt, or not, the different techniques of BDA. So we will now go to the analysis of the hypotheses of this study. But first we will look at the effect of each factor on the adoption of the BDA by calculating the coefficient of correlation.

Table 3. Pearson's correlation coefficients

Factors	Coefficient of correlation
TECH_CAP	.262
SIZE	.017
IT_INF	.256
MAG_SUP	.184
RCS_AVB	.282
SKILL	**.523****

SCBLTY	**.607****
COMP	**.486****
SEC_PRV	.103
COST	.347
COMPTY	.112
POL_REG	**.407***

As shown in appendix F, the Pearson's r for the correlation between each factor and BDA adoption was positive. This means that as one variable increases in value, the second variable also increases in value. Similarly, as one variable decreases in value, the second variable also decreases in value. The values of r were rather average; it also means that this relationship is not strong, at least not with all the factors. The strongest correlation is with the scalability, which refers to the ability to maintain its functionality and performance in the event of amount volume of data (0.607).

In order to better analyze these factors and show the ones that most influence the adoption of the BDA, a multiple regression analysis was performed. The following table presents the results.

Table 4: multiple regression analysis

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	-2,078	,568		-3,659	,002
SIZE	-,033	,124	-,060	-,267	,793
TECH_CAP	,458	,156	,565	2,933	,009
MAG_SUP	-,046	,101	-,096	-,454	,655
RCS_AVB	,629	,124	,923	5,088	,000
SKILL	,457	,141	1,040	3,243	,005
SEC_PRV	,270	,094	,609	-2,884	,010

IT_INF	-,199	,118	-,444	-1,680	,111
COMP	,212	,122	,401	1,739	,100
SCBLTY	-,123	,079	-,284	-1,560	,137
COST	,405	,132	-834	-3,069	,007
COMPTY	-,063	,066	-,159	-,950	,356
POL_REG	,117	,111	,187	1,051	,308
R^2 = .735 R^2 aj =.547 R = .857 df = 12 , 17 Sig = 0.005 F = 9.620					

Based on the results of the regression analysis, only five of the twelve factors proposed in this study have a positive and significant correlation with the adoption of the BDA. These are: Overall **costs** of tools that facilitate the use of BDA, **resources availability** that allow companies to provide the necessary tools, the **technological capacity** (software ... existing), the considerations vis-à-vis the data **security** and of course the **skills** of their human resources (the availability of experts in the field).

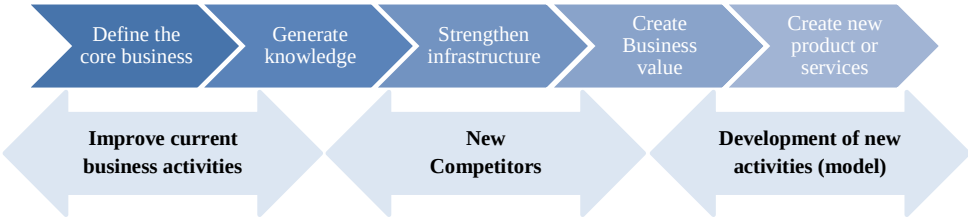
That leads us to accept the hypotheses: H1, H4, H5, H7 and H9 ($p < 0.05$), relative to these five factors, and to refuse the other hypotheses: H2, H3, H6, H8, H10, H11 and H12. This means that these factors are not considered by the surveyed companies as factors encouraging them to adopt analytics and embrace the opportunities of big data universe.

Conclusion

BDA refers to tools and methods that aim to turn massive amounts of data into strategic information. The challenge lies in the ability to cross the maximum of data from internal and external sources, in order to extract the best elements for decision-making process. Data processing requires an investment in computer architectures to store, manage, analyze and visualize a huge amount of data. This specific technology is a way to enrich the analysis and show the strength of the today's available data.

For a Algerian company to seize the opportunities of data analysis it must recover a business model appropriate to its data. There are five ways (see Figure 5), according to our point of view, that allow the company to use the data in a cost effective and efficient way; they form a range of activities that transform and value the data.

Figure 5. Data use in five steps



Each step will generate additional revenue. However, some are more transformative than others; in another words, they are more likely to reshape the business. Data analysis crosses a company's value chain, from strategy to operationalization. And that's where the definition of the data to monetize, the way or the operating model really comes into play. Then take all this into a more operational view to cover the entire value chain. If companies want to gain in value or generate earnings, they must have a good strategy, a relevant business model and then turn that into the right activities to profit from it.

But, it is clear that the value that a company can generate as well as the different opportunities based on the power of analytics in an increasingly changing world. Big data analysis has the potential to cover a number of specific strategies to help increase the value of the business. It offers

realistic and pragmatic solutions to organizations to meet the challenges of this dynamic environment.

It is necessary to have the right analytics method to be able to better analyze the structured and unstructured data. But it also involves investing in human skills that allow for more precise analysis of these quantities and the development of relevant algorithms and models. The intelligent exploitation of big data requires filtering, analysis and processing to create value in order to integrate and share knowledge.

The empirical study carried out shows that the adoption of the BDA by the Algerian companies is influenced by several factors: the existence of a structure in terms of software, cloud, ICT ... to ensure the good management and secure exploitation of the data, the availability of the workforce capable of managing data volumes (analysts, data scientists, ...) and generating analysis models to better map business strategies and support the decision-making process; good financial health that can provide the advanced tools in this area, and the cost of the latter which can encourage companies to involve and practice, under better conditions, these techniques of big data analytics.

This study appears that the BD concept is still in its infancy stage in the Algerian businesses as most managers were likely to view it as mere implementation of IT to better manage and exploit their data. Possibly, inadequate investment in ICT, coupled with little understanding of the BDA benefits, insufficient business database, and poor IT skills, could have been behind this delay in Algeria. However, more government policies and support may be required to provide an enabling environment for development e-commerce.

Although the research rests upon an empirical investigation, the study should in no way be seen as to offer conclusive findings, as it focuses on a subject to constant changes due to technological advances, databases size and changing consumer behaviors. It is hereby recommended that for Algerian companies to embrace analytics techniques for their business operations, technological infrastructures should be put in place by the government.

Thus, BDA appears to be a fruitful area of research far into the future. This study has identified several potentially interesting questions for further research that would enrich our understanding of BDA adoption and help to improve its practice in Algerian business context.

Regarding big data value and analytics power, studies reflect that these techniques will be a competitive necessity, so Algerian enterprises need to start to adapt to the trends in order to survive in the dynamic and digitalized markets. Having undertaken this colossal task it is important that more empirical studies are undertaken about internal culture and ICT investment settings to further understand more reasons for which businesses adopt (or not) big data analytics and how to do it.

Bibliography

1. Ackoff, R.L. (1989). From data to wisdom, Journal of Applied Systems Analysis, 15, 3-9

2. Boyd, D., & Crawford, K. (2012). Critical Questions for Big Data. *Information, Communication & Society*, 15(5), 662–679.

3. Bughin, J., Livingston, J., Marwaha, S. (2011). Seizing the potential of 'big data', McKinsey Quarterly, n° 4.

4. Chen, H., Chiang, R.H. and Storey, V.C., (2012). Business

intelligence and analytics: From big data to big impact. *MIS quarterly*, 36(4).

5. Cukier, K., and Mayer-Schonberger, V. (2013a). *Big Data: A Revolution That Will Transform How We Live, Work and Think*, Boston, Ma: Houghton Mifflin Harcourt.

6. Cukier, K., and Mayer-Schoenberger, V. (2013b). The Rise of Big Data, *Foreign Affairs* 92(3), May/June, 28-40.

7. Davenport, T.H., Harris, J.G. (2007). *Computing analytics: the new science of winning*. Boston, MA: Harvard Business School Review Press.

8. Delen, D., and Demirkan, H. (2013). Data, information and analytics as services. *Decision Support Systems*, 55(1), 359-363.

9. Luccehetti, R. & Sterlaccini, A. (2004). The Adoption of ICT among SMEs: Evidence from an Itallian Survey. *Small Business Economics*, 23(2), 15 –168.

10. Matambalya, F., & Wolf , S. (2001). The Role of ICT for the Performance of SMEs in East Africa: Empirical Evidence from Kenya and Tanzania. *ZEF – Discussion Papers on Development Policy* No. 42, Center for Development Research, Bonn.

11. McConville, A. (2008). Impact of ICT on SMEs in the South East. Prepared for *South East of England Development Agency* (SEEDA) Birmingham UK.

12. Mithas, S., Lee, M. R., Earley, S., & Murugesan, S. (2013). Leveraging big data and business analytics. *IT Professional*, 15(6), 18–20.

13. Ngai, E. W. T., Xiu, L., & Chau, D. C. K. (2009). Application of data mining techniques in customer relationship

management: A literature review and classification. *Expert Systems with Applications*, 36(2), 2592–2602.

14. Satell, G. (2014). *Five things managers should know about the big data economy*. Forbes

15. Schniederjans, M.J., Schniederjans, D.G., and Starkey, C.M. (2014). *Business Analytics Principles, Concepts, and Applications: What, Why, and How*, New Jersey, Pearson Inc.

16. Sedkaoui, S. (2018a). *Data analytics and big data*, London: ISTE.

17. Sedkaoui, S. (2018b). How data analytics is changing entrepreneurial opportunities?, *International Journal of Innovation Science*, 10 (2), 274-294,

18. Sedkaoui, S. (2017). The Internet, Data Analytics and Big Data. Chapter 8. In *Internet Economics: Models, Mechanisms and Management* (pp. 144-166). Gottinger, H.W: eBook Bentham Science Publishers, Sharjah, UAE.

19. Sedkaoui, S., and Monino, J.L. (2016). *Big data, Open Data and Data Development*, New York: ISTE-Wiley.

20. Shiels, H., McIvor, R., & O'Reilly, D. (2003). Understanding the Implications of ICT Adoption: Insights from SMEs. Journal of Logistics Information Management, 16(5), 312 –326.

21. Stubbs, E. (2011). *The Value of Business Analytics*. John Wiley & Sons, Hoboken, NJ.

22. Viaene, S. (2013). Data scientists aren't domain experts. *IT Professional*, 15(6), 12–17

Appendix

Factors' abbreviation and Cronbach alpha

Factor	Abbreviation	Cronbach Alpha
Firm size	SIZE	.800
ICT Infrastructure	IT_INF	.812
Support management	MAG_SUP	.806
Resources availability	RCS_AVB	.795
Skills for BDA	SKILL	.792
Scalability	SCBLTY	.796
Technological capacity	TECH_CAP	.798
Complexity	COMP	.800
Security	SEC_PRV	.795
Cost	COST	.802
Competitive pressure	COMPTY	.806
Government Policy and Regulation	POL_REG	.809