LITERATURE REVIEW

The Necessity, Skills and Tasks of the Chief Analytics Officer

Seminar paper

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Abstract

In the era of big data, an increasing amount of companies try to establish the new role of an executive chief analytics officer (CAO). The CAO plays a crucial role in the transformation process from traditional businesses into a data-driven organisation. It is important to adapt to today's development and focus on the strategic advantages when implementing data analytics throughout the whole organization. That is why a c-level position needs to be created while his primary job is to focus on the meaningful use of data within the organisation. The purpose of this systematic review is to identify the state of the art of literature about the CAO's role as well as the necessity and added value of the chief.

Keywords: chief data officer, Big Data, analytics, data driven

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1   Introduction

There has been a large shift of focus from technology to data in the last decades. In IT, the driver has been the technology. The job of the chief information officer (CIO) was to manage servers, storage and networks. Information technology was mainly about the hardware, software and the right investments in technology. Data was only a small component of the IT-strategy and was even forgotten in many cases which are to be looked at separately. Times have changed and information enlarged. The ability to store, analyse and predict based on data turned to a big strategic competitive advantage. Customers have shared more and more information of themselves in the last decades which can be used by companies to create enhanced products customized to the needs of their clients. Data is an asset which is necessary to be built and managed on its own (Feinleib, 2014).

Big Data is the new buzz word of the last decade. It is a powerful strategic resource for uncovering unforeseen patterns and developing sharper insights about customers and markets (Lee, 2014). The principle of Big Data focuses on the so-called V's: volume, velocity, variety, veracity and value. Volume, because there is a huge amount of data from various sources which can be processed. Variety and velocity due to its different forms (structured, unstructured and semi-structured) and its dynamics (Gronwald, 2015). Big Data can be used to develop new products, reduce costs and improve decision-making processes. The primary value of Big Data is not just in its raw data but in its processing, analysis and gained knowledge that can be derived from it.
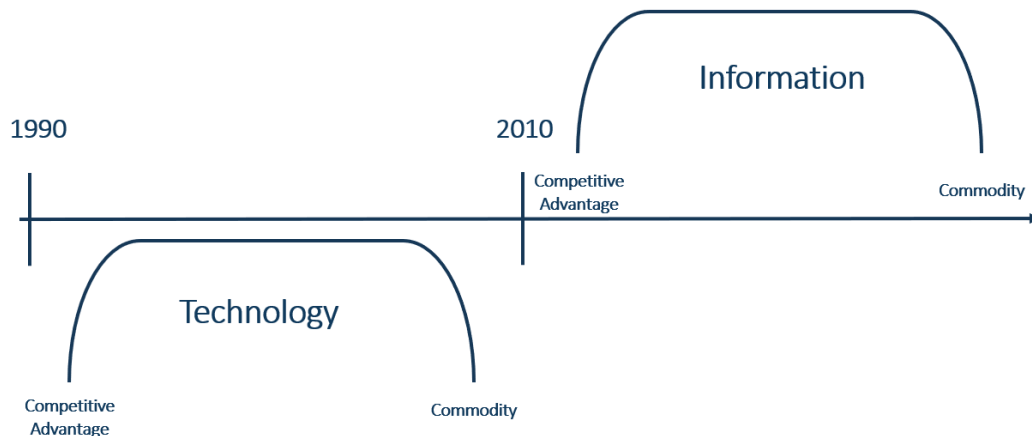

Figure 1: Timeline - shift of focus (leaned on Feinleib, 2014)

The company should prepare itself for fundamental changes in the attitudes and activities in the organisation. The organization needs to integrate adapted skills, new leadership roles, changed organisational structures and technologies. It should be the aim to create a data-driven culture in which intuition is replaced by decision-making based on data and facts (Davenport, 2014).

There is also a demand for access to data, the right tools for analysing, visualizing and sharing it. Actionable insights based on data are now in high demand by all members of the organization.

But most of the companies are not prepared for the static data volume growth. They are still on a learning curve towards managing big data at enterprise level. Questions like "Who is the owner of the data?" and "Who is managing and analysing the data?" are being asked. That is one reason why many businesses are not using data at all instead of seizing the opportunity (von Boeselager, 2018).

Businesses need a responsible person who can pull all the data, provide necessary tools, training and access to data. Since the importance of data to the executive level rises, the need for this role is increasing (Feinleib, 2014).

That is why the position of a chief analytics officer has recently become very important. Companies have started to employ people who supervise the process of data management and analytics. Even though businesses have already identified the need of a new executive level dedicated to data analytics, there has been very limited scientific research conducted so far.

Observing a relevance in both theory and practice led to the following research question: "What is the state of the art of literature of the position of a chief analytics officer?". The paper aims to present an overview of the skills and tasks of a chief analytics officer, also in comparison with the chief data officer. It will summarize available findings of the CAO for managers and employees in companies who detected the need for employing analytics experts in c-level positions.

The structure of the paper is the following: Firstly, an introduction concerning the actual status of big data and the connected need to employ a chief of analytics. Secondly, the procedure of the literature approach including keyword research, choice of databases, as well as the identified literature together with the concept matrix. The collected findings of the literature review will be presented in chapter three. In chapter four, these findings are going to be discussed and limitations are going to be reflected. Lastly, a conclusion summarises this paper.

2 Literature Review

This paper deals with a literature review on the tasks of the new c-level positions "chief analytics officer". In this chapter, I am going to describe the process of identifying and analysing the relevant literature for this paper. Firstly, I will present the used databases, searched terms and the results of the search by displaying them in a table.

2.1   Research process

The research process started with searching the term "chief analytics officer" (CAO) in databases like EBSCOhost (Business Source Complete) and EconBiz (a service of the ZBW- Leibniz Information Centre for Economics).

Six out of 97 matches of this keyword in EBSCOhost were usable. Most of the literature that was found had citations or comments from employees in the position of a chief analytics officer which is why they were shown in the searchlist. EconBiz showed six matches with only one that was relevant.

I expanded my search and used the key words "chief information officer" and "chief digital officer". This resulted in too many matches with no connection to the tasks of a chief analytics officer.

I continued experimenting by replacing the search term with "chief data officer" (CDO) or single words like "chief" and "data" or "Big Data", because both jobs, the CAO and the CDO, deal particularly with the common topic "data analytics". That is why the CDO will also be discussed in the following chapters.

Sources and Online libraries like the "Staats- und Universitätsbibliothek Hamburg Carl von Ossietzky" (Stabi) and the library of the "Leuphana University Lüneburg" also helped me to get free access to documents uploaded to SpringerLink. Additionally, the registration to Researchgate was of great help to access reports from authors that are not so well-known.

According to the VHB JOURQUAL list and the quality of identified journals, I did not have the problem of finding too much relevant journals. I rather had difficulties finding appropriate journals. That is why I used magazines ranked in B or C (according to VHB-JOURQUAL3) to have literature to review. In Addition to journals, I used books about Big Data and the chief data officer and practical reports from consultancies.

2.2   Identified literature

I read available abstracts to identify relevant papers, analyzed the literature and used the references to find additional sources. Important articles and books where filled in the concept matrix based on Webster and Watson (2002).

By reading the "identified as important" chapters, I took notes on the most relevant statements and information. Papers with a strong relation to the topic were fully read and others only skimmed. I classified the papers into different topics like necessity and job profiles of the investigated chief positions.

Literature	Author	Year	Importance of Big Data & its evolution	**Necessity**: Change to Data-Driven Businesses / Added value for the business	**Job Profile** CAO (skills & tasks)	**Job Profile** CDataO
Does the World Need Another Chief?	Davenport, Thomas H.	2007		x	x	
Big Data Bootcamp	Feinleib, David	2014	x			x
A Cubic Framework for the Chief Data Officer: Succeeding in a World of Big Data	Lee, Yang et al.	2014		x		x
BigData@Work	Davenport, Thomas H.	2014	x		x	
Creating a data-driven Organization	Anderson, Carl	2015		x	x	x
IT-Management im Zeitalter der Digitalisierung	Urbach, Nils et al.	2016	x			
The evolving role of the chief data officer in financial services	Deloitte	2016	x			x
Let's stop trying to be "sexy" – preparing managers for the (big) data-driven business era	Carillo, Kevin Daniel	2016	x	x		
What's the difference between a chief data officer, chief digital officer, and chief analytics officer?	Zetlin, Minda	2017			x	
What is a chief analytics officer? The exec who turns data into decisions.	Zetlin, Minda	2017			x	
The influence of chief data officer presence on firm performance: does firm size matter?	Nie, Yu et al.	2018		x		x
Chief Analytics Officer Vs Chief Data Officer: What's The Difference?	Chawla, Vishal	2020			x	x

Table 1: Concept matrix based on Webster and Watson

As shown in Table 1, the literature is listed with the older written books at the beginning and the newest from 2020 at the end. Due to the relatively new topic, there is no source older than 2013. Additionally, it can be detected that studies about the CAO are scarce. There are only two to three texts on the Job Profile of the CAO.

3   Results

In this chapter, the findings are going to be presented. Based on the selected literature, an analysis is conducted. It starts with a quantitative analysis which observes the publications about this topic that were found. Subsequently, a qualitative analysis of each category mentioned in the concept matrix is going to follow.

3.1   Quantitative Analysis

The first publications about the role of the chief analytics officer are dated in the year of 2014. That is why one can say that the topic is still new throughout the business environment and tasks are defined variably. The topic gained relevance during recent years. The topic was frequently published between 2016 and 2018 and did not appear at all in 2019.
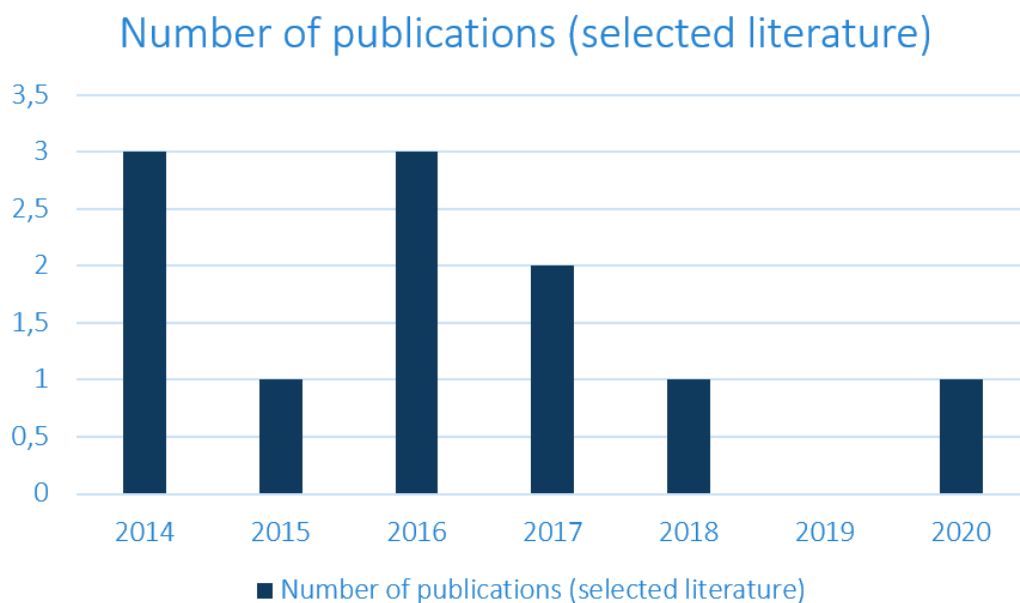

Figure 2: Number of publications of selected literature

The Figure 1 shows that the selected literature of the publications focuses on newer publication due to non-existent existing literature before 2014. There is also a trend towards more literature on the topic

which could be recognized during the searching process. However, some journals were either not of high quality (scientifically) or journals might still be in the research process and are therefore not published yet.

3.2 Qualitative Analysis

In comparison to the descriptive analysis, the qualitative analysis focuses on the content of the categories from the concept matrix.

3.2.1 Necessity and added value of the chief position

Big data and data analytics play an increasingly important role in today's digitalized world. Data has changed in its complexity, volume and strategic importance. It is rapidly growing and harder to manage than 20 years ago. New opportunities like advanced analytics, blockchain, robotics and big data in general have been developed to improve the business performance (Deloitte, 2016). Companies realized that they need to change the entire organization to adopt to the current situation.

Data becomes a strategic resource and asset with high value for the company. It will deeply impact industries, institutions and jobs in the future and already does nowadays. Managers who understand the evolving data process and jump on the train on time have the chance to be market drivers due to an improved decision-making process. Unfortunately, there is a lack of managers with analytical talent and understanding. The organization must be transformed into more scientific and analytical processes in its nature and its work (Carillo, 2016; Lee, 2014).

A few companies are already in the learning process on how to manage big data at enterprise level and turn the organization from a traditional business to a data-driven organization. A data-driven organization should be information-centric, analytics-driven and open-minded to leverage all available information and make better business decisions. It needs to proactively grasp the opportunities which are enabled by data analytics (Deloitte, 2016; Yang, 2014).

Businesses must breed new executives to create a data-driven culture. Active top-down data leadership needs to be used to address the new challenges and opportunities of big data. Data scientists should not only be placed in operational business units without leadership. With new positions like the CAO, enterprises can reach the full potential by integrating and using data and analytics. Analytical opportunities of big data can be capitalized, and new strategies developed (Anderson, 2015; Carillo, 2016; Lee, 2014). As a chief on the executive level, CAOs are able to focus on data and analytics strategies, define top-level metrics, restructure the enterprise by aiming attraction at the bigger picture, namely on what is needed and should be achieved with data and analytics in the organization. In this case, data and analytics can become an integrated part of the business (Anderson, 2015).

When we look in sectors like health care and financial industries, processing data is already part of the daily business. The health care sector currently provides much larger amounts of structured data from numerous electronic patient record systems than in the past. Banks profit from data on their client's transactions and financial activities. They create marketing offers which are individually tailored to the customer (Davenport, 2014). Because they realized that data is the main key to success, the role of a CAO is already implemented in these sectors: 40% of the CAO's work in banking and financial services, most of the other CAOs work in government (local, state or federal) and healthcare. The common topic is the regulation in these three branches. All data-centric activities are complex, closely monitored and come with penalties. Hence, it is a major risk for these organizations which is why they need someone to monitor it. They realized that data can be leveraged in new ways and data must be viewed as an asset instead of a cost factor (Anderson, 2015).

In contrast to positions like chief information officer, chief technology officer or chief digital officer, the chief analytics officer's main work is monitoring data and analytics in the company without partly focusing on the information systems or infrastructure. Data has become a key factor for the company's success which is why it is necessary to create a new executive role which focuses on the data of the businesses only. The barriers to implement innovative ideas and offers can be removed when placing people who focus on these topics in the executive levels. With targeting and improving the analytics skills, costs can be saved, and decisions, products and services can be improved (Davenport, 2014).

There is and there will be a strong paradigm shift from traditional business to a data-driven organization. The business model, strategies and processes will be reflected, and new ways of working can be created. Analytics competencies should not only be a skill of a data scientist. It can be a cultural component which is shared among the organization and especially among the managers who make the decisions. A CAO can provide the needed long-term strategic guidance, the executive support and the mindset for a transformational path (Carillo, 2016; Deloitte, 2016).

3.2.2 Skills and tasks of the chief position

The role of the chief analytics officers, which has evolved over the last decades, needs to possess different skills to succeed in an organization. It demands a mix of hard and soft skills. He[1] must have the knowledge about data, technology, statistics expertise and analytics. Besides the expertise, communication, leadership and the willingness to change the status quo needs to be part of his portfolio (Anderson, 2015).

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[1] Whenever a gender-specific term is used, it should be understood as referring to both genders, unless explicitly stated. This is done solely for the purpose of making the text easier to read, and no offense or sexism is intended.

The essence lies in the combination of tech skills, business knowledge and people's skills to be successful in a company. The CAO serves as an "evangelist" who is willing to convince the employees of the importance of data analytics for the enterprise. The colleagues need to understand the power of broad and high-quality contextualized data. He must invest time, effort and money to persuade the managers and business users to see the value in the strategies, analytical tools and models he developed (Anderson, 2015).

Nowadays, there is a big lack of managers with analytical skills and understanding. Data scientists cannot transform the business alone. The CAO tries to transform or even implement data analytics methods in the whole organization transforming data into business value. He focuses on turning a traditional business into a data analytics-driven organization. He is responsible for the integration of data into the business-oriented decision-making process to create a higher value (Carillo, 2016; Chawla, 2020; Zetlin, 2017).

The CAO should constantly be in touch with the analysts, data scientists and other data-related roles to implement the strategy and the tools standardized in the company. Data only helps the company's strategy when it is analyzed and understood. The executive level position is needed to track the performance and use of analytics across the organization and to bring data together. He needs to have a vision to see the potential of the existing data and understand how it relates. In this position, analytical activities can be centralized under the umbrella of a single strategic leader who trains and mentors the analyst teams for a more standardized analytical movement. The more analytics is used and present in the business, the more essential is a chief position to convey the strategic plan (Anderson, 2015).

It is also important to mention that the CAO will not replace any of the analysts. He is the one who gives accountability and the organizational capability and leadership to energize the topic in the whole organization. He has the power to establish the created ideas, policies and strategies. Moreover, the chief analytics officer can bring the analysts from different teams and business units together. He is the one who provides trainings and mentoring in the organization to convert it into a data-driven company (Lee, 2014).

The CAO's target should be to develop a data warehouse as storage for all the incoming information. He collects the data, understands it and analyses it to create business intelligence tools for the data-driven decision-making process. He could be owner of the data governance or the data focused management frameworks. To implement, establish or improve a reporting and visualisation tool could also be part of his job. But one of the most important tasks is to report to the managers.

The reporting process differs in every company. Some CAOs report to the chief information officer regarding the infrastructure needed for the analytics operations or the chief technology officer, others directly report to the chief executive officer. It can also happen that the chief working with data is placed

under the chief financial officer or chief marketing officer because data is understood to be "owned" by business and not by the IT. The main key is that he needs to report to someone who also supports change and shifting culture in the organization (Carillo, 2016; Chawla, 2020).

In summary, the CAO's role depends on the company and the individual needs. He can have different task, some exploit data for business concepts, others focus on data preparation for external reports or establish data governance and analytics strategies (Lee, 2014).

3.2.3   CAO vs. other chief positions (chief data officer)

The position of a chief data officers already existed many years before the role of the chief analytics officer was created. Even though many companies try to merge the two different positions into a single senior-level position, the two obviously differ from each other (Carillo, 2016; Deloitte, 2016).

When comparing the emergence of the positions, the CAO role has not been completely understood and explored in the last years. In contrast, the CDO position is already placed in thousands of companies worldwide. The necessity of the CDO was primarily addressed in sectors like banking and financial services, government and healthcare. The most common topic in these branches is the regulation. In healthcare, for example, the data-centric activities are complex and need to be monitored. The areas realized a long time ago that data is an important asset. It can be leveraged and does not only create liability and costs. Sectors like banking already collected and protected the data much earlier than other sectors (Anderson, 2015).

Before the turn of the century, only six CDOs existed in the world. From 2001 to 2010, already 35 positions were placed and from then on, the number of CDOs increased enormously. Over 1000 CDOs and CAOs existed in 2015. The Gartner Report from 2016 and 2019 reviewed those numbers and did not make a difference between CAO and CDO. Gartner also estimated that 90 percent of the corporate strategies by 2022 will identify information as an important enterprise asset and analytics as an essential competency (Gartner Report, 2016 and 2019).

The high-quality report which did not see the necessity to differentiate between the CAO and CDO makes clear that the two roles have many skills in common (Nie, 2018).

Every company decides the position name and skills-set of the needed executive data expert on its own. Some companies seek to leverage data science and advanced analytics to generate new insights and combine the two positions because of their overlapping skills-descriptions. Others only want to focus on data management or the analytics part and name the position only data or analytics chief. It is up to every business how to handle the new development of big data (Chawla, 2020).

The few differences between the CAO and CDO will be examined in the following.

The role of the chief data officer can be a broad one with different areas and responsibilities. He creates and executes data strategies to drive business value. The actions of the CDO are very situational always depending on the budget, the staff and person to report to. He defines the processes, methods and strategies by which the company stores and manages its data and quality. He also oversees the data engineering and the data management in general (Lee, 2014).

The CDO educates the organization about data management and gives concrete examples on how data is and could be used for delivering impact. That is why he needs good soft skills to motivate and inspire the colleagues. He identifies and exploits new business opportunities to take the business into new directions. Data must be democratized by integrating data sources, increasing data access and data literacy of the organization (Lee, 2014).

But not only data management should be focused in a data-driven organization. With the CAO as an executive, the goals also drift more to the analytics of the data. The data-driven strategies change more and more to artificial intelligence strategies. It is not only about managing data; it is more about leading data analytics. The CAO tends to be in a spot where some analytics is already around. The role is to broaden, strengthen and evangelize that function (Anderson, 2015; Chawla, 2020).

With the CDO, you may gain a better understanding of business management building a data-driven processes. They are similar to the role of a chief information officer (CIO) or chief digital officer. The CAO, on the other hand, derives insights from data and makes decisions based on the gained information. He implements business intelligences models and data science techniques (Chawla, 2020).

All in all, they do have many common goals in the organization. Both are supposed to put data on the organizations' business agenda. Of all the c-level executives, not many positions are dealing with data. With a top-down data leadership, business strategies are reflected, and data is exploited. Big data is placed on priority and data is not only treated as a by-product of running the business. They both help companies produce better data products, conceive and experiment with new information products to add a new strategic value (Lee, 2014).

4   Discussion

The conducted systematic literature review concluded that there is limited literature on the topic of the chief analytics officer. The identified literature was mostly found in magazines like CIO or other high qualitative magazine programs. Thus, this paper is more of a review on experiences and opinions of journalists, managers and experts, rather than a conducted research. The papers of consulting agencies may present useful information but must be cited carefully due to restricted neutrality. One of the articles with the highest (scientific) quality is the paper of Yang Lee in 2014 which has been cited many times by other authors. Because of limited research in this field, authors build on each other's opinions to build up their background which resulted in homogenous understanding of the necessity of the position, for example.

The reviewed literature also contained different opinions on the importance and necessity of the chief analytics officer position. Although the positive views are in the majority, some journalists or authors questioned whether this position, compared to the other c-level positions, need to be newly created. They claim that the chief data officer and the chief analytics officer can be represented in one position. Other authors also mentioned that the CAO will have a difficult time establishing his position in the company and will not last for a long time.

Another difficulty was to find a common definition of the job profile and skills of a CAO. The journalists and authors had different views on the tasks. That is why I tried to find the mean value from all the opinions.

Due to the limited possibility to get access to databases, only a selection of databases was chosen. The position has been created and developed in the last century, that is the reason why there is no literature older than 2014, except one (table 1).

Additionally, there has been much more literature focusing on the CIO, CTO and even the chief data officer whose tasks are very close to the tasks of a CAO but due to the main emphasis on the CAO, the literature was unfortunately not relevant and useful. The challenge was to not mix up the two different c-level positions CAO and CDO and keep the focus on the CAO.

An additional limitation was the concentration on specific aspects concerning the CAO. It was about reviewing information about the CAO's job profile and not the emergence or the disadvantages of this position. These influences reduced the amount of possible relevant sources.

As already mentioned and identified, there has been limited research concerning the topic of CAO which is why the following steps are recommended. For further research, it is reasonable to integrate more used cases of CAOs already working in companies and identifying the gained added value. It is difficult to detect the increasing enterprise value through the CAO, because still not many CAO's are placed in

companies nowadays. There has not been any paper focusing on an empirical scientific research concerning the added value and change in the company through the new position. In order to increase the reliability and validity, future research should conduct quantitative studies to complement these qualitative studies.

From a practice perspective it would be helpful to see future studies focusing on the mentioned added value. A great need is detected in focusing on this newly emerging position and aim to find the relationship between the CAO's presence and the firm performance.

This paper can be used in the beginning of the process of identifying the need of a CAO. The managers will have a first impressions of the tasks and skills of a CAO as well as the necessity of this position.

5 Conclusion

All in all, the literature review shows the increasing importance of the CAO in companies. The most relevant literature for this paper was written between 2016 and 2020. That is the reason why this field of literature review is still in its developmental phase in which new articles and research will be published throughout the next years.

Companies turn from a traditional perspective on business more and more to a data-driven organization where decisions are not based on intuition but rather on analytical processes with business intelligence tools and the adequate use of data. That is why the relevance of the CAO in companies has been detected lately and is constantly gaining importance. He will be the one monitoring the implementation of analytics and will change the mindset of the employees. He can be an effective transitional role for an organization wanting to improve its analytical capabilities. Such a position could mobilize the needed data, people and systems. Executives can gain more knowledge of analytics and integrate it into their daily activities.

With no new development and the data-focus, companies will lose pace with other competitors. This is the reason why there is more high qualitative literature needed to get the businesses back on track and make them realize how important the new c-level position can be.

References

Anderson, C. (2015). *Creating a Data-Driven Organization: Practical Advice from the Trenches.* O'Reilly Media.

Carillo, K. D. A. (2017). *Let's stop trying to be "sexy": preparing managers for the (big) data-driven* business era. Business process management journal. Bingley: Emerald Group Publishing Limited, Vol. 23.2017, 3, p. 598-622.

Chawla, V. (2020). *Chief Analytics Officer Vs Chief Data Officer: What's The Difference?*

URL:https://analyticsindiamag.com/chief-analytics-officer-vs-chief-data-officer-whats-the-difference/ (visited on 31/10/2020).

Davenport, T. H. (2014). *big data @ work: Chancen erkennen, Risiken verstehen.* Ingram Publisher Services, Perseus Distribution.

Davenport, T. H. (2007). *Does the World Need Another Chief?.* Harvard Business Review URL: https://hbr.org/2007/09/does-the-world-need-another-ch (visited on 31/10/2020).

Deloitte (2016). *The evolving role of the chief data officer in financial services.* URL: https://www2.deloitte.com/tr/en/pages/financial-services/articles/the-evolving-role-chief-data-of-ficer-financial-services-turkey.html (visited on 21/09/2020).

Feinleib, David (2014). *Big Data Bootcamp: What Managers Need to Know to Profit from the Big Data Revolution.* Apress.

Gartner Report (2019). 10 Ways CDOs Can Succeed in Forging a Data-Driven Organization. URL: https://www.gartner.com/doc/reprints?id=1-1ZM4VXMV&ct=200804&st=sb (visited on 18/11/2020).

Lee, Y. and Madnick, S. E. and Wang, R. Y., Wang, F., Zhang, H. (2014). *A Cubic Framework for the Chief Data Officer (CDO): Succeeding in a World of Big Data.* Management Information Systems Research Center, Carlson School of Management, University of Minnesota. MIS Quarterly Executive 13(1) p. 1-14.

Nie, Y., Talburt, J., Feng, T. (2018). *The influence of chief data officer presence on firm performance: does firm size matter?* Industrial Management & Data Systems 119(1).

Zetlin, M. (2017). *What's the difference between a chief data officer, chief digital officer, and chief analytics officer?* Computerworld Philippines - Online Edition. 11/14/2017, p1-1.

Zetlin, M. (2017). *What is a chief analytics officer? The exec who turns data into decisions.* CIO (13284045). 11/1/2017, p6-6.