

Data Analytics and Customer Experience in Industry: An Option

¹Michail K. Angelopoulos, ²Christina Kontakou

1Michail K. Angelopoulos, Department of Economics, University of Piraeus, Greece

2Christina Kontakou, Management Organization Unit of Development Programmes, Ministry of Development and Investment Greece

Corresponding Author: Michail K. Angelopoulos

Submitted: 30-03-2021

Revised: 06-04-2021

Accepted: 09-04-2021

ABSTRACT: The Customer Experience is a crucial key aspect for the function of companies. It ensures the trust between the customer and the company itself. Moreover it enables the organisation to improve by analyzing the comments from feedback, in order to comprehend customers and keep them close to the company or attract further by spreading good rumors to the market. However, these technologies are new and they begin integrating now in the functions of organisations. Hence a lot of studies have recently been conducted for proposing methods to improve different aspects of the organisation with the help of big data analytics. There are a lot of factors which should be considered carefully and put into consideration. Due to the complexity of the problem, different fields of science have to be coordinated e.g. social sciences, maths, software, electronics. In this article, it is presented a review from some papers on Big Data analytics, which emphasize on Customer Experience and they describe the methods to extract data from customers and process them efficiently with automated procedures.

KEYWORDS: Artificial Intelligence, Machine Learning, Deep Learning, Customer Experience, Insights, Customer Feedback

I. INTRODUCTION

It is a fact that Artificial Intelligence leaves the field of experimentation and applies in real life with tremendous consequences. The effect is so great that even specialists in White House examine the aspects and its effects in economy and manufacturing industry [11]. The radical change in the industry, caused by AI in parallel with Internet of Things (IoT), big data analytics, cloud and cyber physical systems, is called Industry 4.0 [14]. The field of action is very wide from health care to retail and helps in solving problems which require human intelligence intervention [2]. A survey

showed the importance of tracking the electronic traces of customers (e.g. searching in Internet for internet planning, reservations and bookings services, etc.), in order to maximize benefits for Swedish mountain tourism [5]. Another important example is cases of prevention/preparation of natural disasters. There are centers, which collect real time and archived data (e.g. weather agencies, sensors, satellites, social media feeds, photos, video and mobile phone GPS signals), making more efficient the collaboration between different networks and organizations, and enabling faster decisions, in order to react faster and anticipate the effects (for example a flood) in human and economic loss [23]. Besides the other fields, AI is very useful for optimizing customer experience. AI algorithms have the ability to predict quite accurate customer demands, assist front line service employees and satisfy some basic aspects of customer support

It is obvious, as concern to marketing, AI and machine learning will contribute a lot. This article will investigate mainly the implementation of AI, data analytics in customer experience, introduce the reader to some basic terms of the field and present some methods.

II. THEORETICAL BACKGROUND

i. Big Data Definition

During last years, there was a great favor of implementing more and more big data analytics in industry. Essentially, the term 'big data' is abstract as it was first referred in the mid-1990s and then evolved [6]. The conclusion was the definition of three Vs, which is abbreviation of Volume, Variety and Velocity. Volume indicates the size of data structure. Today the data structures capture even some petabytes of digital storage (1 petabyte =1024 terabytes). Naturally the term of big is relative to the storage capabilities and in the near future something will not be considered big

anymore. Also it depends on the kind of data (video is bigger than text information by definition). Variety indicates the structural heterogeneity in a dataset, because the data come from a large number of sources and majority of them are semi-structured or unstructured [19]. By making progress in data extraction methods (implementation of XML), semi-structured data can be machine readable [6]. Velocity refers to the rate of generation of data and this affects the rate of data analysis. Some studies propose a fourth V, Value which refers to probable economic benefits from a data structure [7], [9]. Additionally, there is a recent suggestion for even a fifth V, Veracity which is used to describe the trustworthiness of data [24]. It is noteworthy to comment that there is also another approach to define big data from the aspects of data sources or else from the storage and analysis requirements [23]. Hence, three main characteristics are identified[23]:

- (1) Data
- (2) Analytics of Data
- (3) Presentation of results of analytics for product creation

ii. Customer experience (CX)

Customer Experience (CX) is defined as customer response to interaction with an organisation, before, during, after purchase or consumption. It has become an essential tool for improving competitive differentiation. Customers have habits or touchpoints, which are used to describe the social, behavioural, cognitive, sensorial reactions to an interaction with a company, resulting in a static Customer experience [12],[10]. The responsible department for this feature, Customer Experience Management utilizes cultural mind-sets, strategic directions, organisational capabilities, in order to deliver value proposition.

III. CUSTOMER EXPERIENCE AND DATA ANALYTICS

In today's fast developing digital economy, Data Analytics have an immense potential to empower CX as they can help organisations to achieve a better and faster understanding of the customer journey and make decisions to improve their performance. There was an interesting case study which emphasized on one type of touchpoint, through organisation-solicited data (e.g. surveys) with text mining [16].

i. Customer Experience data classification

Though interaction between customers and company generates a huge variety of data,

some of them being structured or unstructured. Structured data can easily be replaced by numbers (e.g. GPS coordinates, survey results, etc.), on the other hand unstructured data contain multimedia information (e.g. video, sound, text) and they are not easily classified. This leads to the solicitation of data (attempts to collect feedback from customers who participate into surveys).

On the contrary, unsolicited data is a feedback which begins from personal motivation of a customer (e.g. comments from social media, direct contact to company through e-mail, feedback to employees). It is useful for a company to decide which of these data structured-unstructured, solicited-unsolicited can be captured for their entrepreneur purposes.

ii. Data analytics methods for Customer Experience

Big data analytics targeted to Customer Experience can be categorized into [10]:

- (1) descriptive
- (2) inquisitive
- (3) predictive
- (4) prescriptive

Descriptive category is engineered to investigate the answer to the question "What happened?". In this category statistical charts and graphs are used with appropriate numerical summaries i.e. median, mean, variance etc., cross tabulations, clustering techniques like k-means cluster analysis group Customer Experience data with unlabeled responses in order to relieve the most frequent words from a stack of documents. Inquisitive category will relieve the reasons of things happening. This is useful to understand the effects of different variables and identify their effect on customer experience management. Predictive category will indicate the future trends of a market by implementing forecasting models like regression-based time-series model, auto-regression models etc. This is a powerful tool for describing what will happen with Customer Experience. Prescriptive category is useful to decide the best action, in order to achieve the best outcome. This can help for better determination of the distribution of budgets for Customer Experience, the improvement of performance. This category uses methods like models for optimization, queuing models.

iii. Customer Experience Insights

Customer Experience insights are classified [10]:

- (1) attitudinal or psychographic
- (2) behavioural
- (3) market insights

Attitudinal and behavioural are linked to each individual customer's perception. On the contrary, market insights describe how organisations perform in the field of Customer Experience relative to the marketplace. For the sake of simplicity, attitudinal insights sum up the mood of customers towards the Customer Experience.

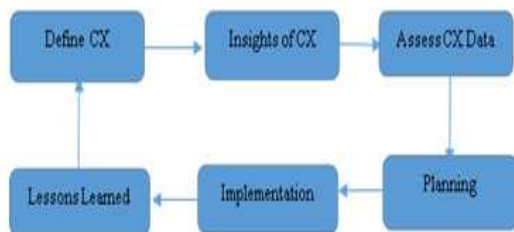


Figure 1. A presentation of steps for customer experience (cx) process

In addition, the customers' desire for pleasure, their sensitivity towards political correctness, peer pressure and convenience are also influences [1].

Psychographic insights describe the feelings of the customers during experiences. This is crucial factor as it refers to the way customers decide for things according to their experiences. Market insights is a powerful tool for measuring performance effectiveness of organisations. As it was said, attitudinal/psychographic indicate satisfaction of a customer. Specialized contact centers, which provide telephone, e-mail, websites services gather an amount of either structured/unstructured data.

For example a powerful tool is the application of predictive analytics, so as to extract the emotion of the customer through voice process algorithms. It is essential to detect the emotion of rage, due to the fact that a furious customer tends to spread his negative feeling at public places and affects bad other customers. Furthermore, either very satisfied or dissatisfied customer tend a lot of times not to communicate directly to the company for expressing their feelings [10]. Another way to use this is to analyse the photos a customer is posting at social media. From this feature the organisation is able to extract someone's personality traits. Inquisitive analytics for exploiting this photo related industry.

Concerning to behavioural insights, Google conducted with descriptive analytics a survey on the preferences of the customers according to the ad-clicks they chose to open [10]. Furthermore by applying predictive analytics it was possible to estimate the value of some keywords in

the near future. Of course the use of previous choices are crucial in order to predict the future choices for the customer and they entail a valuable source of behavioural insights.

A very important source of data in a world that offers huge chances of connectivity everywhere through WLAN technology (airports, shopping malls, train stations etc.) are the geolocation traits, timestamps, type of devices (brand, tablet or smartphone), visits, and reaction of customers to promotional push messages.

iv. Customer experience steps

As show in figure1 the Customer experience is an iterative process. At first, it is important to define the customer experience actions in order to decide which specific touchpoint should be improved. Secondly, there should be defined which customer experience insights should be used and which kind of customer experience analytics should be deployed. Moreover, it is wise to consider what is already offered by the current infrastructure and if it could be used for this project. Thirdly, the company should decide the kind of data which are going to be used (structured-unstructured, solicited- unsolicited). Data will be decided to whom they belong (the company itself or third party partners) and it should be legally decided if it is in accordance to the laws of privacy and ethical prospective for their process by the company or any other kind of organisation. At step 4, the planning should concern if the already extracted data are essential for the project and what will be the cost for buying further equipment (hardware, servers, software). Another decision which has to be made is, if the entire argument will be implemented by the organisation itself or a third party one will take over it. At step 5, the implementation procedure has to be considered like which people will actually make it, how will be the program integrated with other software, what is necessary to be flexible and dynamic for future amendments. Also in this stage, it belongs the design of a test pilot for an initial test and evaluation about its success at a smaller scale before the complete installation in the function of organisation. For this reason, it is important to define the way of its proper monitoring and troubleshooting. The sixth and final stage contains the actions for learning by the outcome. The people in charge will define both positive and negative consequences from using Big Data Analytics in Customer Experience. Bottlenecks of using this technology, will be realised and methods for avoiding them in future will be deployed. The way of communicating inside the organisation for

obtaining Customer Experience insights will be evaluated. Additionally, it will be clear if the organisation measured effectively the benefits from integrating the system.

IV. TEXT MINING

In this part, the method of text mining will be highlighted, a relatively new method, in order to extract structures and hidden meanings within texts. By processing a sum of documents with some criteria called concepts, the results are a textual and non-textual information [17]. Up to now this method has born fruits at the sector of tourism, financial and mining services and it seems promising for further exploration [13], [15]. Text mining presents two approaches [21]:

linguistic techniques take into consideration natural language characteristicse.g. syntax, grammar.

nonlinguistic techniques review the text as a series of characters, words at a higher level as sentences and so on as paragraphs. They emphasize on terms like how frequently appear specific words within texts and define any correlation between some words at corresponding kind of texts [26].

Linguistic techniques use a database of English words for example WordNet, alongside domain-specific resources, such as lexicons and taxonomies. They are used for the classification of the topic of texts. The efficiency of these algorithms is better than human intervention [8].

A text can be [18]:

domain independent, in which, the natural language resources are used with- out the relation to any specific body of knowledge.

domain dependent, in which, the relation to a specific body of knowledge is necessary. This category of text mining is necessary for the Customer Experience service.

On the contrary to the service literature, researchers nowadays focus on the importance of a perspective and frameworks which emphasize holistic approaches for understanding the customer feedback not only from output evaluations but also from co-creation processes from total Customer Experience service. Nowadays, this method proceeds in the field of unstructured data.

4.1. Case study example of text mining

In this section an empirical case study [18] will be presented for better comprehension. A number of medium to large size organisations in UK participated into this experiment. There were 6 companies from energy sector, telecommunications, recycling, health, water, car park services. These companies handed over datasets (mainly unstructured textual data) deriving

of customer feedback. There was an evaluation of these datasets according to each field of a corresponding company about the quality and suitability. The researchers chose the data coming from car park and traffic services of a British airport. The reason of this choice was because these data were better at terms of source, context, and average words per comment.

For this industry the Customer Experience consists of these important stages [18]:

- (i) booking and paying in advance
- (ii) travelling to the airport
- (iii) locating the car park
- (iv) paying if not prebooked
- (v) entering the car park
- (vi) finding a space and parking
- (vii) locating and waiting for a bus transfer
- (viii) transferring to the airport

Due to the high number of steps, it is expected to come out a significant size of feedback context from customers. The company administers a system for conducting surveys by sending a questionnaire to the customers about the quality of service. This procedure is operated by humans. Considering the fact that the responses count approximately 50.000 every year and customer comments 1.000 per week, this creates a great burden for manual process and response (it takes around 2 weeks). Generally, text mining is regarded as workflow process that entails user defined pipelines with the ability to be modified by the user. The text mining for this case was based on the Cross-Industry Standard Process but at domain specific edition [3]. The process is described by these steps:

- (1) Business and data understanding
- (2) Training or model development
- (3) Import the documents of customer feedback
- (4) Testing and model evaluation

Customer feedback documents are subjected to two stages of analysis. The first operates predefined analyzers and dictionaries and the second searches for new patterns and concepts.

Another important tool was IBM Statistical Package for the social sciences Modeler. This one conducts two iterations of text mining model, the first iteration examines the efficiency of a proposed framework and the second iteration indicates probable improvements of the model. At this experiment the first iteration was executed on 100 samples from dataset A (a sum of 1092 customer comments in total). During this procedure a researcher made annotations on samples bearing in mind the value creation. An insight manager from Customer Experience was checking the

validity of the model. The model included linguistic patterns biased by the choices of the researcher (coder) for some specific services for example booking. In addition, it posses the ability to distinguish between positive and negative reviews from comments.

The next phase is to test the acquired model on entire dataset with a goal of making predictions. This was able to classify compliments and complaints and the involved activities. Data capture and accuracy are the metrics for evaluating the predictions, where data captures presents the number of comments, which are connected to patterns, and data accuracy is an indicator for the accuracy of predictions.

Afterwards, the researchers reduced the season bias for analysing the data set. They included new coders for validation of the framework and they worked more in designing strategies for further improvements. Hence, it was conducted a second iteration on a dataset B, which contained 100 customer comments. This moment of time, sentence level analysis was enlisted for the extraction of more insightful information and another kind of manual annotation was followed [20]. The information was divided into phrases and sentences before the annotation. This created custom linguistic patterns for use. Then the researchers finalized, which subcategories will be considered for the experiment, a very crucial aspect for the interpretation of textual data and the utilization of linguistics based text [4]. This approach was more in detail because the researchers examined even the cases of synonyms for the implementation of text mining model. At first iteration, synonyms were only used for correcting the typos of customers in their comments. Feature of Macros is a good tool for simplifying the appearance of literals and word strings [22]. There is a schematic depiction of the procedure at figure 2. As it was written before, customer insight manager of the company was vital for the evaluation of the model results and it is wise to incorporate more in the design process.

V. CONCLUSIONS

In this study presented the Customer Experience process that the accuracy of the models for predictions was 92%. The model was also successful for classifying the complaints of the customers (e.g. complaints for high price of services). An interesting aspect was a case that a person due to the death of a close person had to cancel his flight but the company did not accept it as a reason for refunding the money and this resulted in written complaint [18]. The algorithm

spotted the words "death", "missed flight" and categorized these sentences to a situational context category. This incident shows the complexity of analysing customer feedback. There is also a concern about the privacy of data and some new methods highlight this aspect. In order to remain anonymous the relation with each customer it should be inserted a randomness in the analysis of acquired data. This inserts a factor of uncertainty that may affect the results of the models. A method called traditional collaborative filtering recommendation algorithm [25] is useful to compromise both desired accuracy and privacy of data. The benefit of losing a big workforce from this field and exploiting in other more creative aspects leaves promises for the industry.

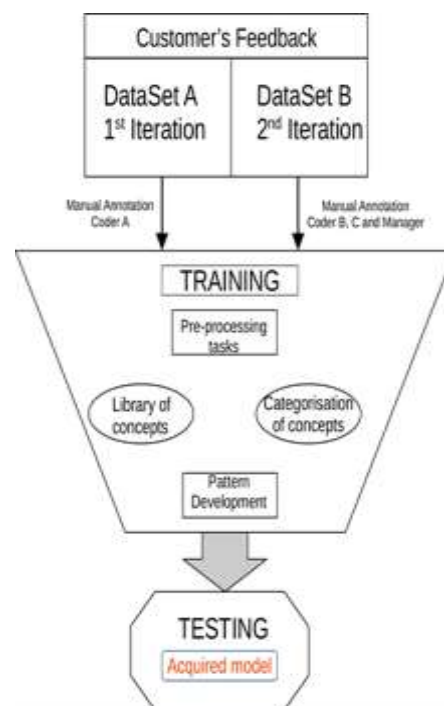


FIGURE 2. SCHEMATIC DEPICTION OF THE PROCEDURE [10]

Even reports from national organisations of leading countries emerge the necessity to educate people and especially younger generation in the field of Artificial Intelligence with methods of data analytics [11]. The future seems promising, and studies enlighten us that big data analytics should be integrated by companies and not just in the field of Customer Experience. Otherwise they will be left behind in the competition of entrepreneurship [23] and their future will be in jeopardy.

REFERENCES

- [1]. Paul A Bottomley and John R Doyle. "The formation of attitudes towards brand extensions: Testing and generalising Aaker and Keller's model". In: International Journal of Research in Marketing 13.4 (1996), pp. 365–377.
- [2]. Colin Campbell et al. "From data to action: How marketers can leverage AI". In: Business Horizons 63.2 (2020), pp. 227–243.
- [3]. Pete Chapman et al. "CRISP-DM 1.0: Step-by-step data mining guide". In: SPSS inc 9 (2000), p. 13.
- [4]. Fernando Fastoso and Jeryl Whitelock. "Regionalization vs. globalization in advertising research: Insights from five decades of academic study". In: Journal of International Management 16.1 (2010), pp. 32–42.
- [5]. Matthias Fuchs, Wolfram Hoopken, and Maria Lexhagen. "Big data analytics for knowledge generation in tourism destinations—A case from Sweden". In: Journal of Destination Marketing & Management 3.4 (2014), pp. 198–209.
- [6]. Amir Gandomi and Murtaza Haider. "Beyond the hype: Big data concepts, methods, and analytics". In: International journal of information management 35.2 (2015), pp. 137–144.
- [7]. John Gantz and David Reinsel. "The digital universe in 2020: Big data, bigger digital shadows, and biggest growth in the far east". In: IDC iView: IDC Analyze the future 2007.2012 (2012), pp. 1–16.
- [8]. Amir Ghazvinian. "Star Quality: Sentiment Categorization of Restaurant Reviews". In: working paper, Stanford University (2011).
- [9]. S Gogia et al. "The Big Deal About Big Data For Customer Engagement: Business Leaders Must Lead Big Data Initiatives To Derive Value [verkkodokumentti]. [Viitattu 14.10. 2016] Saatavilla <https://www.forrester.com/report/The+Big+Deal+About+Big+Data+For+Customer+Engagement/>". In: E-RES72241 (2012).
- [10]. Maria Holmlund et al. "Customer experience management in the age of big data analytics: A strategic framework". In: Journal of Business Research (2020).
- [11]. White House. Artificial intelligence, automation, and the economy. Executive office of the President. 2016.
- [12]. Anne-Madeleine Kranzbu"bler et al. "The multilevel nature of customer experience research: an integrative review and research agenda". In: International Journal of Management Reviews 20.2 (2018), pp. 433–456.
- [13]. Kin-Nam Lau, Kam-Hon Lee, and Ying Ho. "Text Mining for the Hotel Industry, Cornell Hotel and Restaurant Administration Quarterly". In: (2005).
- [14]. Jay Lee et al. "Industrial Artificial Intelligence for industry 4.0-based manufacturing systems". In: Manufacturing letters 18 (2018), pp. 20–23.
- [15]. Stephan Ludwig et al. "More than words: The influence of affective content and linguistic style matches in online reviews on conversion rates". In: Journal of Marketing 77.1 (2013), pp. 87–103.
- [16]. Janet R McColl-Kennedy et al. "Gaining customer experience insights that matter". In: Journal of Service Research 22.1 (2019), pp. 8–26.
- [17]. Alexander Mikroyannidis and Babis Theodoulidis. "Heraclitus II: A framework for ontology management and evolution". In: 2006 IEEE/WIC/ACM International Conference on Web Intelligence (WI 2006 Main Conference Proceedings)(WI'06). IEEE. 2006, pp. 514–521.
- [18]. Francisco Villarroel Ordenes et al. "Analyzing customer experience feedback using text mining: A linguistics-based approach". In: Journal of Service Research 17.3 (2014), pp. 278–295.
- [19]. Philip Russom et al. "Big data analytics". In: TDWI best practices report, fourth quarter 19.4 (2011), pp. 1–34.
- [20]. Surendra N Singh, Steve Hillmer, and Ze Wang. "Efficient methods for sampling responses from large-scale qualitative data". In: Marketing Science 30.3 (2011), pp. 532–549.
- [21]. Maite Taboada et al. "Lexicon-based methods for sentiment analysis". In: Computational linguistics 37.2 (2011), pp. 267–307.
- [22]. Mikalai Tsytarau and Themis Palpanas. "Survey on mining subjective data on the web". In: Data Mining and Knowledge Discovery 24.3 (2012), pp. 478–514.
- [23]. Samuel Fosso Wamba et al. "How 'big data' can make big impact: Findings from a systematic review and a longitudinal case study". In: International Journal of Production Economics 165 (2015), pp. 234–246.

- [24]. Martin White. “Digital workplaces: Vision and reality”. In: Business information review 29.4 (2012), pp. 205–214.
- [25]. Yuwei Yan et al. “Data mining of customer choice behavior in internet of things within relationship network”. In: International Journal of Information Management 50 (2020), pp. 566–574.
- [26]. Ning Zhong, Yuefeng Li, and Sheng-Tang Wu. “Effective pattern discovery for text mining”. In: IEEE transactions on knowledge and data engineering 24.1 (2010), pp. 30–44.



**International Journal of Advances in
Engineering and Management**
ISSN: 2395-5252



IJAEM

Volume: 03

Issue: 03

DOI: 10.35629/5252

www.ijaem.net

Email id: ijaem.paper@gmail.com