DATA-DRIVEN MARKET ANALYSIS USING ASPECT-BASED SENTIMENT ANALYSIS

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Abstract: The increasing availability of user-generated content on digital platforms has transformed the way businesses conduct market analysis and evaluate customer preferences. Traditional market analysis methods, including demographic analysis, market segmentation, target market identification, competitor evaluation, and assessment of market needs, continue to play a critical role in business planning and strategic decision-making. However, these conventional approaches often rely on structured data, surveys, and publicly available reports that may not fully capture customers' real-time opinions and experiences. In this context, Aspect-Based Sentiment Analysis (ABSA) has emerged as a powerful artificial intelligence technique capable of extracting detailed customer insights from online reviews, social media discussions, forums, and other textual sources.

This study investigates the advantages of integrating ABSA into the early stages of business development, particularly during the market analysis phase. Unlike general sentiment analysis, which classifies an overall opinion as positive, negative, or neutral, ABSA identifies sentiments associated with specific aspects or attributes of products and services. This enables businesses to obtain fine-grained insights regarding customer satisfaction, preferences, complaints, and expectations. The research examines how ABSA can complement traditional market analysis components by improving the identification of market opportunities, customer needs, competitor strengths and weaknesses, and product improvement possibilities.

By analysing customer-generated data, businesses can gain a deeper understanding of consumer behaviour patterns and market trends that are often inaccessible through traditional analytical tools.

The findings indicate that the most significant contribution of ABSA is observed in competitor analysis and competitive intelligence. Through the analysis of customer opinions related to competing products and services, new businesses can identify the strengths, weaknesses, opportunities, and limitations of existing market offerings. Furthermore, ABSA enables organizations to detect recurring issues, preferred product features, pricing concerns, and customer expectations directly from consumer feedback. Since companies do not always disclose complete strategic or operational information in public reports, customer opinions available online represent an alternative and valuable source of market intelligence.

The study concludes that integrating ABSA into market analysis can support more informed strategic decisions, reduce uncertainty during market entry, lower the risk of business failure, and enhance innovation in product and service development. Consequently, ABSA represents a valuable complementary tool for modern market research, enabling organizations to better understand customer perspectives and improve their competitive positioning in increasingly dynamic and data-driven markets.

Keywords: Aspect-based sentiment analysis, Market analysis, Competitor analysis

1. INTRODUCTION

Market analysis is an important constituent in the first stages of establishing new businesses. The success of a new service or a product is greatly affected by market dynamics, competition and understanding of the needs of customers. Traditional mechanisms of market analysis depend on targeting and segmentation, demographics, as well as different analytical tools which identify target markets and competition (Kotler & Keller, 2016). In spite of that, these methods do not always understand the growing preferences and sentiments of customers.

In this setting, aspect-based sentiment analysis (ABSA) provides complementary techniques which support the traditional market analysis methods, such as detailed insights into customers' choices and analyses regarding particular aspects of products and services. This paper intends to determine the advantages of assembling ABSA into market analysis, focusing on competition analysis.

In our case- study we have analyzed the strengths and weaknesses of a direct competitor for a new restaurant in North Macedonia. We have created a corpus of online customer reviews that were given over a period of one year. We have implemented a semi-supervised learning approach for conducting the tasks of ABSA, and we have managed to extract the aspects for which the reviewers have been commenting and their corresponding sentiments. The high accuracy of the results that we have achieved, assures the new business that considering those findings can be a strong basis for building good business strategies.

The first step of traditional market analysis is the identification of different criteria such as age, gender, behavior and income, which helps businesses adapt their offerings to their target (McDonald & Dunbar, 2013). Even though these criteria are a convenient start, they often miss the distinction to fully understand the preferences of customers. Same target groups belonging to the same demographic segment can have extremely different preferences about a specific service or a product based on their personal experiences.

In order to comprehend market needs, businesses must analyze customers' preferences and their demands. This is usually done through the identification of focus groups, surveys and observational studies. Even though these approaches provide beneficial insights, they often apprehend only surface-level data. ABSA addresses this cut by obtaining sentiments that express features or aspects of products or services, which enables businesses to better understand the needs of customers and their underlying reasons.

Another point of market analysis is competition analysis, which includes identifying competitors, analyzing their market strategies, and their strengths and weaknesses. Traditional competitors' analysis usually is based on already existing market research and reports, which are not always complete and up to date (Barney & Hesterly, 2015). For example, a business might identify advertising as a weakness; however, customers might think that their approach is actually appropriate. The advantages that come with using ABSA enable companies to easily identify customer sentiments of their competitors, which leads to a more precise assessment of their position in the market.

Every business strategy and market position is also affected by the regulatory frameworks and market entry barriers (Hayes, 2024). Traditional market analysis often fails to take into consideration the crucial importance of customer perceptions, which vary across different regions and demographics. That is why businesses need to apply new methods and use the power of the voice of the customers, which nowadays is spreading more and more in the online world.

Effective competitor analysis helps businesses surpass their competitors and gain loyal customers. To perform this task, sentiment analysis may be used to evaluate interest in specific products or services, uncover market conditions, and study competitors (Taherdoost & Madanchian, 2023). Sentiment analysis at its first stage focused on determining the overall sentiment of documents (Pang, Lee, & Vaithyanathan, 2002; Turney, 2002; Pang & Lee, 2008). However, by succeeding the granularity work in deeper levels of documents and sentences respectively, the need for more detailed analysis has arisen.

Aspect-Based Sentiment Analysis (ABSA) refers to systems that rely on machine learning techniques to determine the opinions or sentiments expressed on different features or aspects of the products or services under evaluation (e.g., food or service for a restaurant). An ABSA model should categorize the reviews or opinions according to the proper aspect, depending on the domain, and to classify the sentiments into their three possible polarities. The used techniques for the whole process are: lexicon-based, feature-based and machine learning approaches, which may be supervised, semi-supervised and unsupervised methods, and as of lately, deep learning approach. A summarized description of all techniques applied to sentiment analysis is done by Rana and Cheah (2016). Recent studies have emphasized the increasing significance of ABSA in extracting fine-grained customer opinions and enhancing business intelligence systems. In particular, ABSA enables organizations to identify specific aspects of products and services that influence customer satisfaction and decision-making processes (D'Aniello et al., 2022). Moreover, recent systematic literature reviews have highlighted the rapid advancement of ABSA methodologies, with a growing focus on deep learning approaches for aspect extraction and sentiment classification tasks (Hua et al., 2024; Kumar et al., 2023).

Regarding the tasks of aspect-based sentiment analysis, different research works contain between two to four subtasks. Hamdan et al. (2014) propose the steps: aspect term extraction, aspect term polarity detection, category detection and category polarity detection. On the other hand, Pavlopoulos (2014) recommended to cover the whole task through three steps: The extraction of aspects and its terms for each one, the aggregation of the terms, and at last the prediction of the sentiment polarity for the defined aspect terms. Later, in 2015, Singh and Ullah performed the same process through two aggregated steps: aspect term detection and sentiment polarity detection. Except for the category detection and its polarity, all the other tasks cover the same functionalities, even though they are organized differently (decomposed or aggregated steps). In our work we have conducted the tasks into two main phases: aspect term extraction and sentiment polarity classification.

2. MATERIALS AND METHODS

To find the strengths and weaknesses of the competitors' products by using ABSA, in our case we have used a semi-supervised machine learning technique which is based on Non-Negative Matrix Factorization topic modeling technique in combination with word2Vec model and Maximum Entropy classifier. The only supervision that is done in this application is the input of seed words for both aspect terms and sentiments and a list of stop-words (words that need to be excluded, because they don't hold any sentiment polarity).

In our case-study we have analyzed the reviews of a local restaurant in North Macedonia, which is the direct competitor of a new restaurant. The collected data are taken from Google reviews and Facebook. The created corpus contained more than 2000 customers' comments. However, after the data cleansing in the preprocessing phase, the number of reviews was reduced to 1200. In this phase first, we eliminated the empty comments and then we did unigram tokenization, normalization and noise removal.
In the process of aspect-term extraction, the extracted aspect-terms were categorized into three different aspect-topics: food, service and ambiance. After that, in the second phase, we automatically found the sentiment polarities of each aspect-term and we classified them as positive and negative sentiments. Since the number of neutral sentiments was very low, we didn't take into consideration that polarity.

3. RESULTS

As is stated in the methodology, the whole process of ABSA is conducted in two main phases: Aspect terms extraction and sentiment polarity extraction. First, from the built dataset, we extracted the aspects in an unsupervised manner and grouped them in three different aspect-topics. By applying NMF algorithm, after 50 iterations we extracted 350 aspect-terms, which were categorized into the topics of food, service and ambiance. Some of the extracted terms are as follows:

- food: beef, lamb, steak, chicken, pizza, sauce, peppers, cream, etc.
- service: staff, waiter, cook, chef, service, professionals, etc.
- ambiance: concept, décor, interior, nature, lighting, environment, calmness, etc.

After that, for each aspect-term the related sentiments were extracted. The positive sentiments are noted with 1, while the negative ones are with -1. In order to detect and extract the sentiments we have provided to the system a list of seed words for each aspect-topic. As it can be seen in the table below we have given seed words for both positive and negative polarities.

Table 1: Seed words for sentiment polarities

Aspect- topic	Polarity	Seeds
Ambiance	**Positive**	beautiful, elegant, cozy, modern, good, great
	Negative	narrow, dark, expensive, noisy, bad
Food	**Positive**	ripe, smoked, soft, tasty, juicy
	Negative	dry, uncooked, old, tasteless, burnt, lively, stale
Service	**Positive**	attentive, efficient, fast, polite, smiling
	Negative	inattentive, rude, slow, delayed, irritable

Source: Based on Axhiu (2026).

On Table 2, we have presented a small sample of the output of the system, which includes the reviews, the classification of the aspect-terms in three different categories and the annotated sentiment polarity for each aspect. As it can be noted there are some reviews that contain opinions/sentiments on more than one aspect-terms and for each of them they can hold different sentiment polarities. Here, one more time it is shown the advantage and the granularity of ABSA compared to general or overall sentiment analysis systems.
The dataset that we have worked on, resulted to have 915 positive and 230 negative sentiments.

Table 2: Sample of the output after ABSA

	Aspect-term classification			**Sentiment polarity**		
Reviews	**Ambiance**	**Food**	**Service**	**Ambiance**	**Food**	**Service**
Pepper with a cream- that is a must, but not every restaurant can do.	0	1	0	0	1	0
the lamb and the peppers are winners!	0	1	0	0	1	0
a beautifully designed dreamy traditional restaurant that gets scenery at night.	1	0	0	1	0	0
a little crowded but they move that line really fast!	0	0	1	0	0	1
a little overpriced but worth it once you take a bite.	0	1	0	0	1	0
a restaurant that doesn't try to do anything except serve great food with great service in a pleasant atmosphere.	1	1	1	1	1	1
a weakness is the chicken in the salads.	0	1	0	0	-1	0
all in all the food was good - a little on the expensive side, but fresh.	0	1	0	0	1	-1
all in all, I would return - as it was a beautiful restaurant - but I hope the staff pays more attention to the little details in the future.	1	0	1	1	0	-1

Source: Authors' own analysis using aspect-based sentiment analysis

For measuring the accuracy of sentiment polarity classification, we have used the performance metrics of Precision, Recall and F1 score. Below is the table with the results for both polarities. The accuracy score of negative polarity resulted to be lower, compared to the positive polarity and that is due to the language structure in the presence of negations. However, we consider that these accuracies of the system are strongly acceptable and relatively high for weakly supervised systems.

Table 3: Accuracy of sentiment polarity classification

Performance metrics	**Results**
Precision (positive polarity)	0.82
Recall (positive polarity)	0.85
F1 score (positive polarity)	0.83
Precision (negative polarity)	0.80
Recall (negative polarity)	0.76
F1 score (negative polarity)	0.78

Source: Generated by the authors based on sentiment classification results.

4. DISCUSSIONS

Considering the outcomes of ABSA, it resulted that 80% of the customer reviews were positive and 20% negative. This gives us a sign that the direct competitor of the new business is very strong and they should take into account all the findings for their business strategies. Some of the most important findings are as follows:

- The positive reviews were mostly about the food quality and ambiance.
- The negative reviews were addressed to the food price and waiting time during the peak hours.
- The top three favorite foods were mentioned to be: beef steak, lamb chops and peppers with cream.

- Regarding the ambiance, the customers have highlighted the location, the wide area of the outdoor part of the restaurant and the calmness of the atmosphere which was affected by nature.

Considering all these insights, we think that the new restaurant now has strong basis for taking adequate strategic decisions. The above-mentioned findings can contribute to the process of creating the menu, creating service rules and developing marketing campaigns.

Taking into account the first conclusions about the food quality and price, the new restaurant should think about the size of the portions and bring some new tastes. Regarding the price, with the aim of attracting dissatisfied customers, the restaurant can launch some promotional campaigns that will highlight its value, namely, it can offer high-quality food at reasonable prices. Regarding the waiting time during peak hours, the restaurant should focus on employing highly experienced staff who will provide efficient service without reducing quality.

One of the common advantages and strong points for both restaurants is the. The fact that people liked the calmness of the competitor, the new restaurant should also keep in mind that it should preserve the calmness and atmosphere that the suburbs provide. This should also be considered during the design of the interior, lighting, etc.

5. CONCLUSIONS

Taking into consideration the above findings and the detailed information, which is obtained by using ABSA, we can recognize several advantages of ABSA versus traditional methods of market analysis. Initially, through analyzing customer sentiments about the existing products in the restaurant, we have been able to discover market needs, such as the ambiance affected by nature.

Secondly, we have been able to examine the sentiments about products served by competitors, thus we have been able to identify that customers were not happy to experience the waiting time during peak hours, as well as slightly higher prices of their products. In this context, through the usage of ABSA, businesses can have a clearer opinion about the competitive advantages and disadvantages, which gives them the opportunity to refine better business strategies.

While customers were dissatisfied about the food price on one side, they were also really positive about the food quality, which gives businesses a hint that their target customers prefer more reasonable prices without losing the quality they get.

The proposed methodology, which is almost unsupervised and depends only on small lists of seed words, is flexible and adaptable for application in different domains and languages. Through this method, there is no need for building lexicons or for supervising and training the machine.

REFERENCES

Axhiu, M. (2026). Aspect-based sentiment analysis of Albanian texts - Scientific monograph. MIL MAG.

Barney, J. B., & Hesterly, W. S. (2015). Strategic management and competitive advantage: Concepts and cases. Pearson.

D'Aniello, G., Gaeta, M., & La Rocca, I. (2022). KnowMIS-ABSA: An overview and a reference model for applications of sentiment analysis and aspect-based sentiment analysis. Artificial Intelligence Review, 55, 5543–5574. https://doi.org/10.1007/s10462-021-10134-9

Hamdan, H., Bellot, P., & Bechet, F. (2014). Supervised Methods for Aspect-Based Sentiment Analysis. In 8th International Workshop on Semantic Evaluation (SemEval 2014) (pp. 596-600). Dublin, Ireland.

Hayes, A. (2024). Barriers to entry: Understanding what limits competition. Investopedia. https://www.investopedia.com/terms/b/barrierstoentry.asp

Hua, Y. C., Denny, P., Wicker, J., & Taskova, K. (2024). A systematic review of aspect-based sentiment analysis: Domains, methods, and trends. Artificial Intelligence Review, 57, 296. https://doi.org/10.1007/s10462-024-10906-z

Kotler, P., & Keller, K. L. (2016). Marketing management. Pearson.

Kumar, A., Sharma, K., & Dubey, A. K. (2023). Aspect based sentiment analysis using deep learning approaches: A survey. Computer Science Review, 49, 100576. https://doi.org/10.1016/j.cosrev.2023.100576

Malhotra, N. K. (2010). Marketing research: An applied orientation. Pearson.

McDonald, M., & Dunbar, I. (2013). Market segmentation: How to do it, how to profit from it. John Wiley & Sons.

Pavlopoulos, I. (2014). Aspect Based Sentiment Analysis. PhD Thesis, Athens University of Economics and Business

Pang, B. & Lee, L. (2008). Opinion mining and sentiment analysis. Foundations and Trends in Information Retrieval, 2(1-2):1–135.

Pang, B., Lee, L., & Vaithyanathan, S. (2002). Thumbs up? Sentiment classification using machine learning techniques. In Proceedings of EMNLP, pp. 79–86.

Rana, T.A., and Cheah, Y.N. (2016). Aspect extraction in sentiment analysis: Comparative analysis and survey. Artif. Intell. Rev., vol. 46, no. 4, pp. 459-483, Dec. 2016.

Singh, A., and Ullah, E. (2015). Aspect based Sentiment Analysis. Retrieved from http://home.iitk.ac.in/~enayat/files/report_aip.pdf

Taherdoost, H., & Madanchian, M. (2023). Artificial Intelligence and sentiment analysis: A review in Competitive Research. Computers, 12(2), 37. doi:10.3390/computers12020037

Turney, P. D. (2002). Thumbs up or thumbs down?: semantic orientation applied to unsupervised classification of reviews. In Proceedings of ACL, pp. 417–424.