

Research

A new perspective on social sustainability: examining Amazon workers' working conditions and protests applying computational methods in social sciences

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Abstract

The regulation of workers' working conditions is a crucial issue for achieving social sustainability. This research aims to investigate the reactions to the workers' protests at Amazon, one of the world's largest companies, in the context of the gig economy. The originality of the study lies in the analysis of 5500 comments from the YouTube channel on the subject in terms of social sustainability applying the computational methods in social sciences (CMSS). The analysis revealed some remarkable findings. For example, it was found that the working conditions of Amazon workers contravene the International Labour Organization (ILO) and the United Nations (UN) definition of decent work. It also found that the zero-hours contract, which is characteristic of the gig economy, and the negative externalities it creates, as well as extremely low wages, were among the most significant objections. These findings are crucial for governments, international institutions and policymakers who are committed to social sustainability. It should be noted that it will be impossible to achieve social sustainability without raising labour standards. In particular, governments and institutions need to develop policies that are in favour of workers.

Keywords Gig economy · Decent work · Amazon workers · Computational methods in social sciences

1 Introduction

Sustainability is one of the most frequently used concepts that have been on the tongues for the last quarter century. For sure, there are some historical and social reasons for its popularity. Conceptually, sustainability can be defined as the process of re-stabilizing or restoring an activity whose continuity is endangered. The United Nations (UN) World Commission on Environment and Development described sustainability as "to meet today's needs without denying the needs of future generations" [1]. In this respect, the Sustainability approach is evaluated together with environment, social and governance (ESG) and corporate social responsibility (CSR) [2]. However, the overwhelming majority of studies on sustainability are related to environmental sustainability compared to social sustainability. It should be noted that the social sustainability and working condition nexus occupies a minor place in sustainability studies. However, it should be underlined that each of the seventeen sustainability goals of the United Nations is of equal importance and integrated with each other.

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Therefore, our study focused on the relationship between social sustainability and working conditions, particularly in relation to the gig economy. The COVID-19 pandemic has profoundly affected every aspect of life, including the gig economy. [3] concluded that COVID-19 positively impacted the gig economy and created new jobs through this economy. The study by [4] showed that 3.1 million people joined the gig economy in 2021 who had never been in it in 2020. But the same study also found that 1.2 million people left the gig economy between 2020 and 2021. Therefore, it can be said that the labour turnover among gig workers is huge. Not surprisingly, the reach of the gig economy has increased as a result of the pandemic. However, the workload of gig workers has also increased in parallel. [5], who studied the earnings and work hours of employees performing microtask jobs on Amazon's Mechanical Turk platform in the first months after COVID-19, found that employees' working hours increased after COVID-19, while earnings did not change notably. [6] also examined the impact of COVID-19 on working conditions in the Indonesian gig economy using a combination of interviews, surveys, and focus group discussions. This research found that during the pandemic, gig workers' incomes decreased significantly, and they had to work longer hours. [7] also asserted that gig employees and other workers with zero-hours contracts did not enjoy enough access to the social measures implemented in the aftermath of the COVID-19 pandemic in the UK and that these workers were abandoned to their destiny by the government.

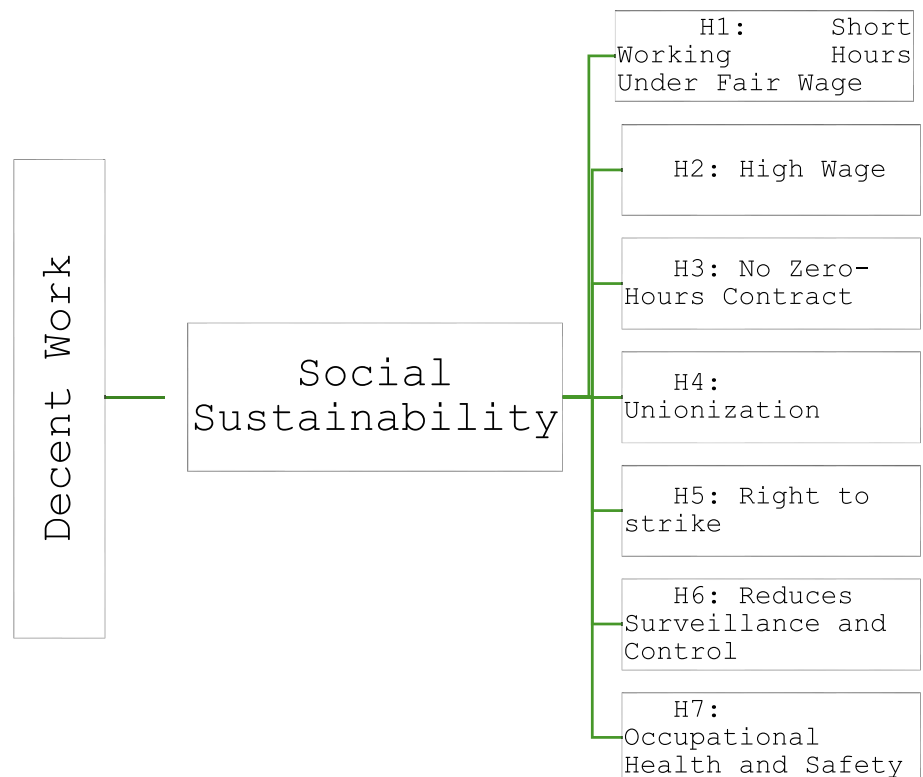
In this context, it is determined that some studies with different content have been carried out. For instance, considerable research has been conducted between labor law and social sustainability [8, 9]. On the other hand, in particular, in the context of declining collective bargaining [10], addresses the potential of socially sustainable sourcing as a form of labour regulation. While [11] sheds light on more broadly at sustainability issues, including green jobs and trade, there is no direct discussion of the link between social sustainability and industrial relations. [12] also examines working conditions in various farming systems, and found these to be subject to various factors, including social, economic and political conditions. [13] enlarges this discussion to incorporate the organizational dimension and proposes a transformation process to ensure social sustainability in work systems.

Subsequently, this study explores the working conditions at Amazon, one of the world's largest companies, in terms of social sustainability by applying CMSS to 5150 comments from 7 YouTube channels. Surveys, interviews, econometric and statistical analysis are commonly utilized to investigate the working conditions of employees [14–16]. Measuring and testing workers' reactions to working conditions through sentiment analysis using the CMSS method brings a new perspective and originality to the field of study. Our assertion is that it will not be possible to ensure the conditions for social sustainability without taking structural steps to enhance working conditions. Therefore, enabling conditions for decent work will contribute to social sustainability. Our research hypotheses based on decent work presented in Fig. 1 are follows as.

- H₁ Short working hours with fair wages create the conditions for social sustainability.
- H₂ Increasing wages provides the basis for the creation of conditions for social sustainability.
- H₃ The elimination of zero-time work encourages social sustainability.
- H₄ An increase in the unionization rate leads to social sustainability.
- H₅ Having the right to strike encourages social sustainability.
- H₆ Reducing surveillance and control promotes the achievement of social sustainability.
- H₇ Increasing occupational health and safety furthers the provision of social sustainability.

Following that, the subheading of the introduction section addresses "Research gaps". Section 2 provides "Theoretical-empirical framework regarding decent work in terms of social sustainability, and decent work in the Gig economy. "The methodology and data" are given in Sect. 3, while "The empirical analysis and results" are presented in Sect. 4. The discussion of the results is given in the Sect. 5, while "Conclusion", "Policy recommendations" and "Future studies" are given in Sect. 6.

Fig. 1 Hypotheses of the research (designed by authors)



1.1 Research gaps

The gap that this study fills in the literature can be summarised as follows. The number of academic studies on social sustainability and the gig economy (see Fig. 2 for gig work characteristics compared to other work types), which has grown and spread non-standard work especially in recent years, is insufficient in the literature. Additionally, according to World Bank data for 2023, ~ 12% of the global labor market is employed on online gig platforms, and gig platforms

Type of work / Characteristics of work	Informal work (e.g., casual or freelance workers)	Platform-enabled gig work (e.g., Grab driver- and delivery-partners)	Formal work (e.g., full-time employees)
Flexibility	High	High	Low or None
Financial security (earnings certainty, level of savings, insurance protection)	Low or None	Some	High
Fair work conditions (safety, inclusion, transparency, representation)	Low or None	Some	High
Professional and career development	Low or None	Some	High

Fig. 2 Characteristics of work type (Source: <https://www.grab.com/sg/blog/public-policy/grab-supports-building-a-sustainable-gig-economy-in-southeast-asia/>)

are growing just as fast in developing countries as in developed countries.¹ Moreover, Approximately 36% of the U.S. labor market is employed on gig platforms, according to McKinsey's American Opportunity 2022 survey.² The reason we chose the Amazon worker protests in the US for our analysis is that the number of workers working on gig platforms is increasing as a proportion of total employment. Thus, in this study, we have taken a close look at the working conditions at Amazon, which operates internationally, from a number of different perspectives. The fact that working conditions at Amazon have been in the news around the world, with protests in many countries and unionisation efforts at Amazon, particularly in the US, highlights the importance of this issue.

In particular, this study fills an important gap in the literature by considering the gig economy and competitive work together and revealing their functions in ensuring social sustainability within the framework of sentiment analysis. In comparison to previous studies, Because, when compared to previous studies, the use of CMSS, one of the most up-to-date sentiment analysis methods that allows people to measure direct reactions to YouTube comments without censorship, fills another important gap in the literature. The BERT model on which CMSS is based, which is widely used in sentiment analysis and classification, was preferred and as a result of the comparison of BERT models, the "cardiffnlp/twitter-roberta-base-sentiment-latest" model was preferred. This model was chosen because it was trained on texts containing short and daily conversations. When we consider Youtube data, it contains daily and short conversations. The model provided its realism with a score of 0.75. All in all, the current analysis technique applied in our analysis process is another important contribution to the literature. We processed 5150 data using CMSS, which is a new machine learning technique.

2 Theoretical-empirical framework

2.1 Decent work: the critical component of social sustainability

One of the United Nations' Sustainable Development Goals is to ensure decent work and economic growth. The term 'decent work' was first introduced at the 89th International Labour Conference in 1999. The International Labour Organization (ILO) aims to achieve this objective by increasing employment opportunities, expanding social protection, upholding workers' rights, and strengthening social dialogue [17]. Fair working conditions is one of the three main themes of the European Pillar of Social Rights (EPSR), a set of 20 principles adopted by the European Union in 2017. [18] outlined in the action plan of the Pillar that the European Union, in collaboration with the ILO and other partners, will continue to promote decent work worldwide.

Decent work is an integral part of social sustainability, given the strong link between individual job satisfaction and social well-being [19]. Published studies have also looked at working conditions across various sectors to further survey the link. For instance, [20] and [21] conducted research in the agricultural sector to that end. Medland examined the relationship between labour standards and social sustainability through the case of an organic production enclave in the El Ejido region, which is part of the global food system. [21] also focused on the nexus between digital agriculture and labour in Germany. Additionally, [22] explored the connection between decent work and social sustainability using the Portuguese tourism industry, which is characterized by informal, labour-intensive work. Moreover, [23] investigated the impact of the race to the bottom on social sustainability in Cambodia's garment industry. [24] conducted a similar study on the same issue in Bangladesh.

Furthermore, several studies have examined the link between working conditions and sustainability in the gig economy. For example, [25] conducted an assessment of the sustainability of food delivery practices in the UK gig economy from an economic, social, and environmental perspective. The authors found that digital platforms are unsustainable in all three aspects due to their intense daily profit ambitions. They suggested that the sustainability mentality in transport and logistics systems should be broadened to encompass the rights of gig economy workers. [26] considered social sustainability in the gig economy with reference to the on-demand delivery sector. On the basis of documentary research, they proposed that gig workers are concerned about working conditions and health and safety issues and that the

¹ See for detailed information <https://www.worldbank.org/en/topic/jobsanddevelopment/publication/online-gig-work-enabled-by-digital-platforms>.

² See for detailed information <https://www.mckinsey.com/featured-insights/sustainable-inclusive-growth/future-of-america/freelance-side-hustles-and-gigs-many-more-americans-have-become-independent-workers>.

management of employees' social issues is important for supply chain sustainability in the platform economy. [27] also highlighted the inadequate measurements that make it difficult to analyze the relationship with non-standard work, including gig work through ICT platforms in India, and social sustainability. In another study, [28] evaluated Amazon's corporate social sustainability performance during the COVID-19 period using information from Amazon's official website and reports obtained from BBC News. The authors suggested that Amazon has been successful in contributing to sustainability through its environmental responsibility efforts. However, the study also identified areas where Amazon could improve, particularly in terms of employee rights.

2.2 Work in the gig economy: is decent work possible?

While non-standard work has always existed in working life, it has recently become the dominant fact of labour markets [29]. International Labour Organization [30] grouped non-standard forms of work under four headings. These are: temporary employment, part-time and on-call work, multi-party employment relationship, disguised employment/dependent self-employment. [31] preferred the concept of precarious employment to the notion of non-standard work, as it details with nuances the distinction between standard and non-standard work. Low pay, flexibility, job insecurity, more health risks, and restricted social rights are some components of the precarious work concept [32].

The gig-platform economy, which further deepens precarious work, has grown rapidly owing to technological advances, the increasing impact of digitalization on economic processes, and the growing share of e-commerce platforms in the exchange of goods and services [33]. [34] has evaluated the expansion of non-standard forms of work, including the gig and platform economies, in two ways. One is that these forms of work offer a range of opportunities, such as flexible working arrangements. The other is that these forms of work are characterized by problems like irregular and poor salaries and a lack of job security. [35] argued that the gig economy, which he examines through the lens of Uber, deepens the subcontracting and precarization that are prominent features of neoliberal labour relations.

In the gig economy, workers are mostly independent contractors, not employees of the firms that pay their fees [35]. Independent contractors couldn't benefit from the many protections that labour law guarantees to employees [36]. Hence, the number of lawsuits regarding the legal status of platform workers has increased in many countries [37]. [38] examined court cases in different countries through the example of Uber. In the United States, Australia, and Belgium, there are court decisions recognizing Uber drivers as "independent contractors" rather than "employees." On the other hand, in the United Kingdom and France, the judiciary classified Uber drivers as workers and decided to grant them their rights under labour and social security law. Court rulings in several countries and questions about the legal status of gig workers have been the subject of debate among authors. For instance, [39] discussed solutions that policy-makers could find to improve the legal security of gig workers in Australia. [40] also criticized the practice of self-employed courier in Turkey. He stated that this practice has been carried out by employers who cheat the law in order to avoid their responsibilities. Furthermore, the author mentioned that these employees should have the status of worker. Zero-hours contracts, which have become prevalent with the development of the gig economy, mean that the employee is not guaranteed any working time and is paid according to the work done [41]. Unpredictable working hours and incomes have increased uncertainty in the daily lives of employees with zero-hours contracts, with devastating consequences for these workers [42]. [43] indicated that zero-hours contracts contribute to job insecurity and should be banned, adding that the Spanish legal system regulates the minimum and maximum working hours of platform employees in her study. Digitalization has made surveillance and control easier. That's why the gig economy and the phenomenon of surveillance are closely related. [44] even used the gig economy and surveillance in the same concept as "a gig surveillance economy". [45] conducted a search for platform workers' posts in gig forums³ on the Reddit network. They looked at digital platforms such as Amazon, Uber, Lyft, Shipt, and Upwork and analyzed a total of 2689 posts in 12 subreddits on Reddit. The comments revealed that gig workers see both platform companies and customers as surveillance agents, unnecessarily collecting data that can threaten their privacy and safety. As a specific example, Amazon was fined 32 million euros by the CNIL due to "excessive surveillance" of warehouse workers in France [46].

A crucial pillar of working conditions is the health and safety of workers. [47] examined the gig economy's working conditions in six European countries using survey and interview data. The study, which examines labour relations in the European gig economy from various angles, found that there are eye and back health problems among remote workers

³ Gig employees use the forums to spread information about workers' rights, provide guidance on issues such as health insurance, and share experiences about customers and platforms. Therefore, these forums are a kind of solidarity ground for workers [6].

and common physical and psychological illnesses among delivery workers. The study also revealed that the risk of occupational accidents is quite high for delivery workers. [48] also studied injury rates in Amazon warehouses in 2020. According to the organization's research, the injury rate per 100 Amazon warehouse workers was 6.5. That rate was 4.0 for workers at other warehouses. Serious injury rates were 50% higher in Amazon warehouses than in all non-Amazon warehouses. The injury rate in Amazon warehouses was more than double the injury rate for all US workers.

Precarious work and deunionization go hand in hand, and gig workers in particular face legal difficulties in accessing union and collective bargaining rights due to their independent contractor status [49]. [50] examined the unionization situation in the US in 2023. The rate of unionized workers was quite low, at 11.2 percent. However, the desire of workers to be unionized was the opposite. Nationally, 59% of workers in all sectors wanted a union at their workplace. The authors cited unionization efforts in high-profile campaigns such as Amazon and Starbucks as part of workers' desire. In [50]'s study, despite the high level of worker desire for unionization, the low rate of unionization was caused by the undermining of organizing efforts by the broken system and weaknesses in US labour law.

3 Methodology and data

3.1 Method

The growing significance of digitalization in social life has led to the emergence of new research methods for accessing, collecting, and analyzing data [51]. As noted by [52], the internet offers data collection tools for traditional social science methods. However, CMSS science methodology has enabled researchers to obtain large amounts of data in addition to these data collection tools. This has made it possible to describe and understand the movements and events occurring in the social world in more depth.

Personal computers have become increasingly powerful over time. Additionally, developments in open-source software for research computing, particularly R and Python, have simplified the process of performing computationally intensive analyses [13]. Therefore, the data analysis was conducted using Python software. The current CMSS can be categorized into five areas: automatic information extraction, social network analysis, geospatial analysis, complexity modeling, and social simulation models [53]. Sentiment analysis is a systematic approach to detecting, extracting, analyzing, and examining emotional states and subjective data using computational methods [54].

There are many models for sentiment analysis and text classification such as LSTM, GPT and BERT. The success rate of each model is different from each other. For this reason, it is very important to choose the appropriate model for the study.

When we look at the LSTM model, also known as Long Short-Term Memory, Long Short-Term Memory in the literature, it is an RNN model that was introduced to solve the problem of memory insufficiency in RNNs. While in RNNs, information before a unit is remembered, in LSTMs, information from longer periods is remembered and therefore LSTMs are more successful. An LSTM model basically consists of an input gate, an output gate, a forgetting gate and a memory (recall) gate [55]. Long short-term memory (LSTM) is a synthetic recurrent neural network (RNN) architecture used in deep learning. Unlike standard feed-forward neural networks, LSTM has feedback connections [56]. Recently used for various natural language processing (NLP) tasks, LSTM's powerful ability to extract advanced text information plays an important role in text classification [57]. Another model is the GPT model. The GPT model can be pre-trained and tuned for other tasks. The scale-up GPT model has produced the GPT-2 and GPT-3 architectures [58]. In this model, it appears as a model that has started to be used frequently. When we look at another model, BERT stands out with its speed and pre-trained structure.

BERT is a conceptually simple, empirically powerful model. New results with the latest technology in natural language processing task are also obtained [59]. The BERT algorithm uses 'Two-Way Language Processing' instead of traditional left-to-right and right-to-left language processing models. Unlike the superficial bidirectional language processing that goes from left to right and right to left, the BERT model uses a more complex 'Masked Language Model' and 'Next Sentence Prediction' learning strategies that try to understand the relationship of each word with the other [60]. In a research, a sentiment analysis was performed on two datasets using the BERT model. Afterwards, the researchers verified the accuracy of the sentiment classification from the GitHub repository, and the experimental results show that the validation accuracy is $\approx 94\%$ [61]. In a study comparing the BERT model with classical natural language processing methods, the superiority of the BERT model is demonstrated. They presented empirical evidence to support the use of BERT as the default in natural language processing tasks. The experimental approach presented provides empirical evidence for the superiority of BERT and its use as the default technique in natural language processing problems. The fact that achieving these results with traditional approaches is much more complex than achieving these results with BERT is emphasised

Table 1 Reviewed Youtube videos

News channel	News title	Number of views	Number of comments
Channel 4 News	Ex-Amazon workers talk of 'horrendous' conditions	1.492.069	3836
CNBC	Why So Many Amazon Workers Are Getting Hurt	331.746	710
ABC News	Amazon warehouse workers around the globe set to protest on Black Friday GMA	136.863	338
Sky News	Amazon workers walkout over pay in first UK strike	52.952	119
Eyewitness News ABCN7	Some Amazon workers at Queens warehouse walk off the job	28.633	65
Fox 2 Detroit	Amazon workers strike outside Pontiac fulfillment center	21.047	58
Al Jazeera English	Amazon workers stage walkouts, protests on Black Friday	17.789	24

in the research [62]. “cardiffnlp/twitter-roberta-base-sentiment-latest” was preferred because the BERT model we used is pre-trained and works more effectively than other models we compared. In particular, this article aims to identify an existing problem and reveal the sentiment states rather than comparing sentiment analysis models. This study employed social network analysis. The comments under the YouTube videos were collected using social network analysis. These comments were then analysed for emotion using the BERT model, followed by frequency analysis.

3.2 Sentiment analysis method

The study utilized the Google BERT model, a bidirectional natural language processing model that effectively reveals contextual relationships between sentences and words based on artificial neural networks [63]. Empirical evidence presented in a comparative study suggests that the BERT model should be used as a default technique in NLP problems [62]. A study was conducted to evaluate the success rates of sentiment analysis models. The most successful model was the one prepared with the BERT architecture, which represented the word size with 128 k vectors. It was concluded that much higher scores were obtained with much less parameter training compared to deep learning methods [64].

Various scientific studies use social media tools and sentiment analysis to analyze political, economic, and social phenomena. For instance, [65] analyzed the impact of Nestle's health crisis in India on consumer response. [65] conducted a sentiment analysis on the refugee issue using social media data in Turkish and English. In another study related to the refugee issue, [65] investigated the reflections of the refugee crisis on traditional and social media in Germany, Austria, and Switzerland, as well as public opinion on this issue. In a separate study conducted on the Youtube platform, sentiment analysis was performed on the comments of movies with the BERT model [66]. [59] emphasized that the BERT model is both conceptually simple and empirically powerful.

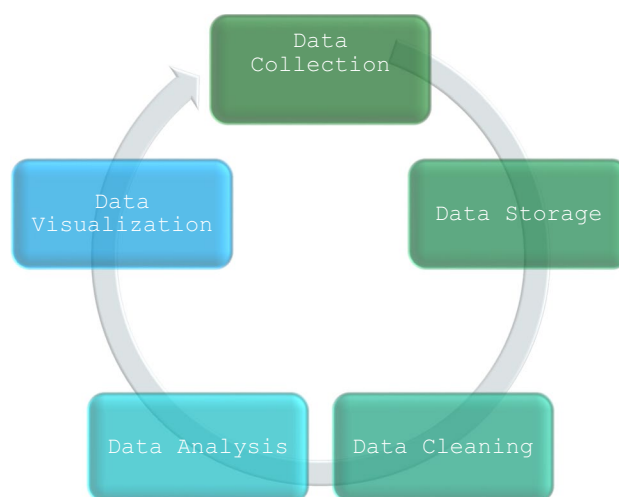
3.3 Data

This study explores working conditions at Amazon, a global company, based on 5150 comments shared on YouTube. In addition, relevant comments were examined by employing CMSS. Table 1 presents information on the video comments used in the research. In addition, Fig. 3 presents steps of the research method.

During the initial stage of the research process, the Python algorithm was utilized for data collection. The video IDs were obtained from the options available through the YouTube Developer API. Subsequently, all comments associated with these IDs were stored in a.csv file. In the data cleaning phase, a simplification process was applied to the YouTube data prior to conducting sentiment analysis. Data cleaning is considered the most critical step in the data mining process [67]. It improves the quality of the data and enables algorithms to progress faster and more accurately [68]. The simplification process aims to provide more effective results in sentiment analysis. In this direction,

- All letters were converted to lower case.
- Punctuation marks were deleted.
- Numbers were deleted.
- Stopwords were deleted.
- Hashtags were deleted.

Fig. 3 Steps of the research method



In another stage of the research, sentiment analysis was conducted using the BERT model. Within the scope of the analysis, three distinct BERT-based models were tested. Of the three models based on the BERT model, the "cardiffnlp/twitter-roberta-base-sentiment-latest" model yielded the most favorable outcomes according to the BERT Score. This model is a RoBERTa-based model trained on approximately 124 million tweets from January 2018 to December 2021 and fine-tuned for sentiment analysis with the TweetEval benchmark [69]. [70] achieved notable results through the development and evaluation of the TRABSA model, a novel hybrid approach combining transformer-based architectures, attention mechanisms, and BiLSTM networks. By leveraging the latest RoBERTa-based transformer model and expanding the datasets, they demonstrated the TRABSA model's exceptional accuracy and relevance. In a separate study, [71] utilized deep learning models, including roBERTa, distilBERT, and XLNet, to examine the opinions expressed on Twitter. Their findings indicated that roBERTa is an exemplary model for sentiment classification. In view of these considerations, the findings of the study are presented through the "cardiffnlp/twitter-roberta-base-sentiment-latest" model. The model was trained on Twitter data and is good at understanding short, casual posts. Since YouTube comments also have short, casual conversations, it worked well with a score of 0.75. Table 2 demonstrates Comparative BERT Scores while Fig. 4 displays Confidence Score.

In this analysis, comments were labeled as negative, neutral, and positive. Following the labeling, data visualizations were made. In the last stage of the research, data visualizations were made in order to present the data obtained in a more understandable way. The data used in data visualization consists of cleaned and sentiment-analyzed data [72].

4 Empirical analysis and results

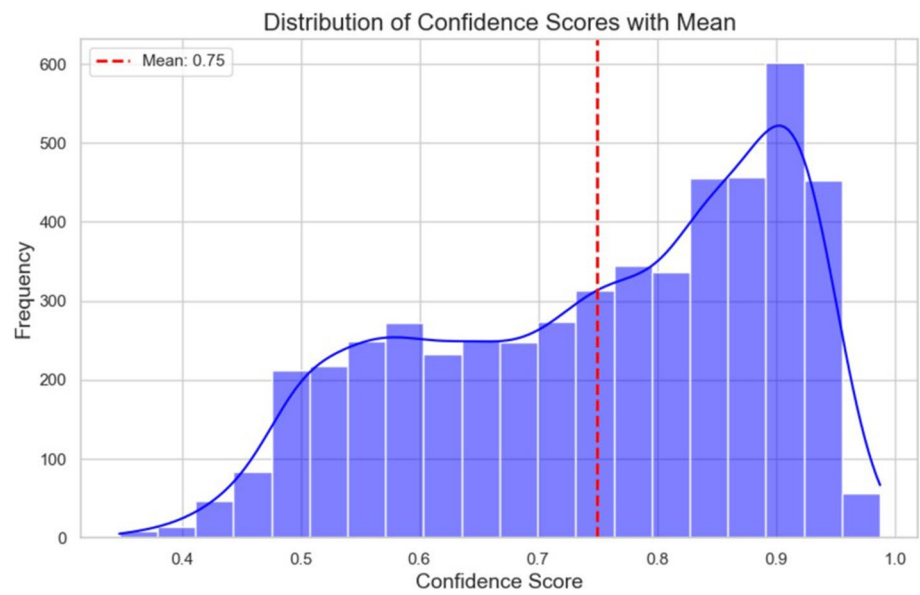
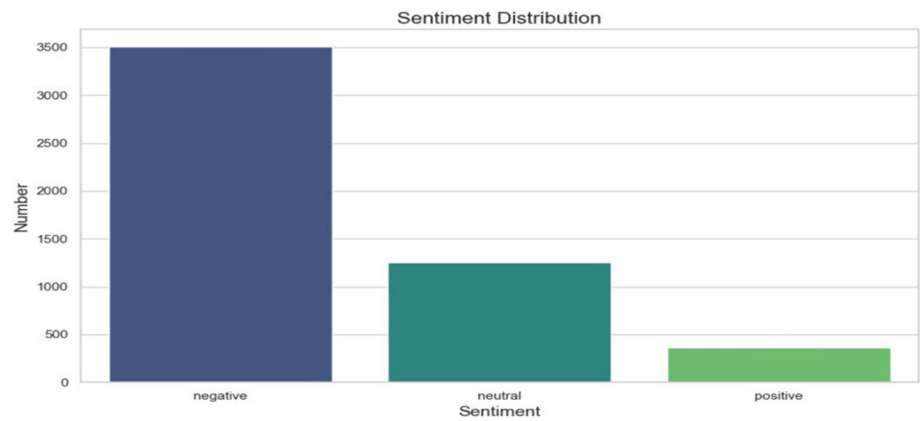
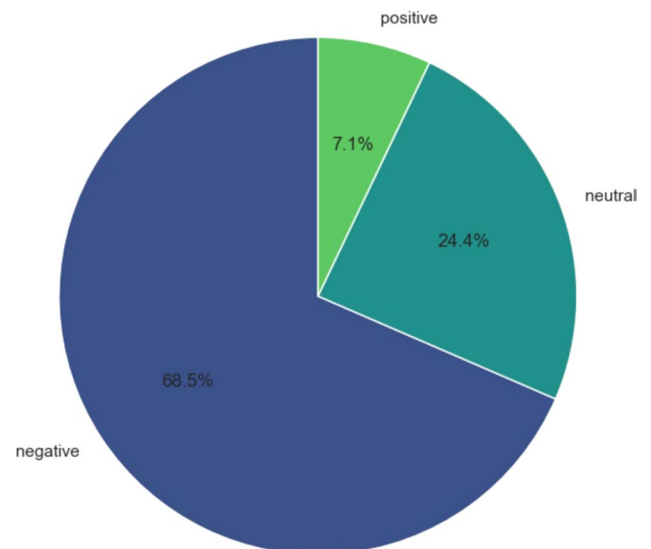
4.1 The distribution of sentiments and satisfaction statuses

Figure 5 shows the numerical distribution of positive, negative, and neutral comments, while Fig. 6 shows the proportional distribution. It is evident from the graphs that negative comments make up two-thirds of all comments, which is more than twice the number of neutral and positive comments. The negative comments mainly criticize the poor working conditions of Amazon workers and support workers' reactions. "Globalism has turned virtually EVERY profession into slave like working conditions around the world.",⁴ "Modern slavery conditions, not different than China or ancient times", "after watching this, I won't buy from amazon again. The CEO is a billionaire, yet can't afford to keep employees happy with decent good pay. More people ought to join in on this, not buying from amazon, and shut down the company.", "Anyone can make record profits if you can get workers to kill themselves for low wages.", "Simple solution. We should ALL stand behind the Amazon workers and simply boycott buying anything through Amazon until they revamp their Worker conditions, pay, breaks, vacation allotments," comments are examples of negative comments. These negative comments are directly associated with the precarity intensified by neoliberal labour relations. As previously stated in

⁴ Comments are quoted in the same manner. Grammar and word mistakes belong to the users.

Table 2 Comparative BERT scores

	nlptown/bert-base-multilingual-uncased-sentiment	cardiffnlp/twitter-roberta-base-sentiment	cardiffnlp/twitter-roberta-base-sentiment-latest
BERT score	0.50	0.74	0.75

Fig. 4 Confidence score**Fig. 5** The distribution of sentiments**Fig. 6** Satisfaction statuses

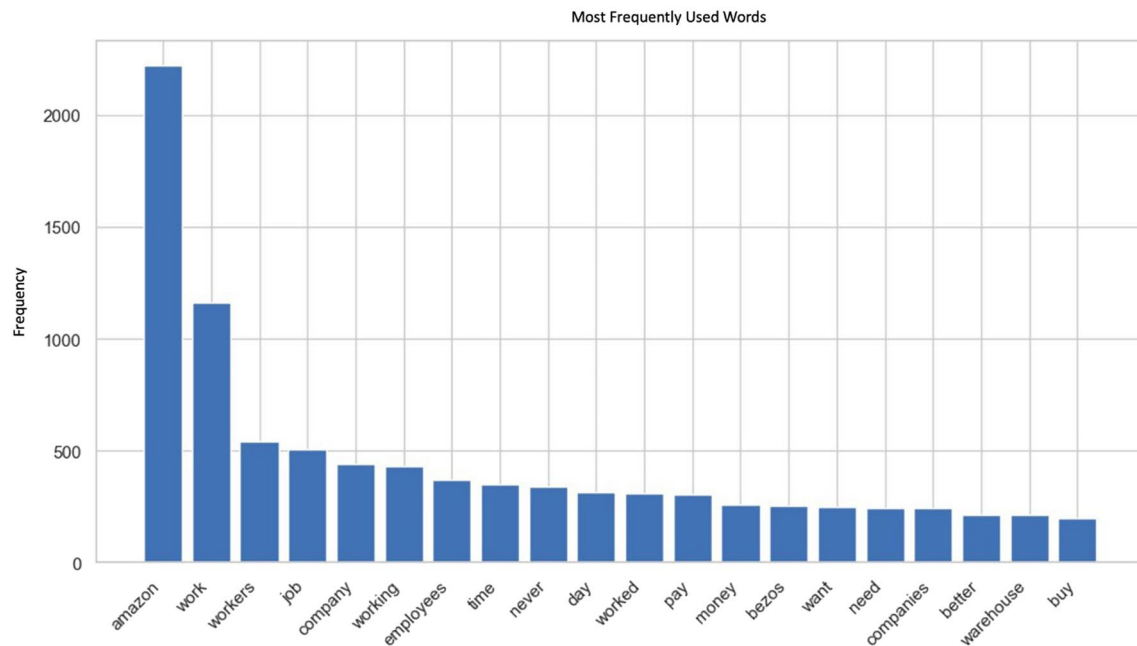


Fig. 7 The most frequently used words

Fig. 8 Word cloud chart showing the most repeated words



this study, the characteristics that typify non-standard work and precariousness in the contemporary labour market, including low wages, flexible work arrangements, occupational health and safety concerns, and a dearth of social rights, have become the norm in industry relations under the influence of neoliberal policies. In the negative comments, these norms have been equated with slavery, and the working conditions of those employed in such circumstances have been subjected to negative criticism.

Some of the comments of the opposite nature are as follows: "The robots are coming, so don't worry!," "Everyone I know loves working Amazon. Everyone!!! Maybe they are just lazy!!," "These people already get \$15/h or more. What more do they want?". Examples of neutral comments "We do have alternatives to Amazon, but research is needed. I order books mostly. They own ABE Books, since 2008. They must have picked up many online businesses. It's worth it to me to pay a little more, even, and not support this. But I'd love a list of the companies they own.," "Could be better" are quotes.

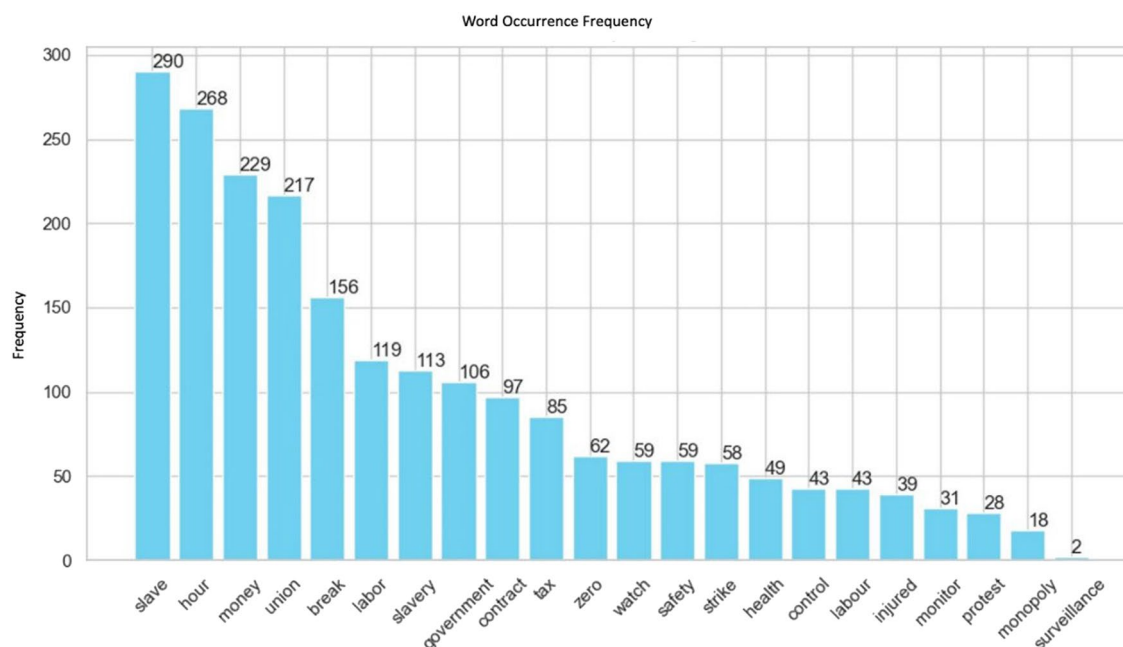


Fig. 9 Word occurrence frequency

4.2 Examining the most frequently used words

Figure 7 displays the most frequently used words, while Fig. 8 presents a word cloud table illustrating the most repeated words. These data reveal which words are commonly used in the comments and their frequency.

When the data in Fig. 7 and Image 1 are analyzed together, it can be easily seen that words directly related to the general topic, such as “Amazon”, “work”, “company”, “worker”, and “job”, are written more in the comments. This is quite normal, as different users comment on a specific topic. Therefore, the frequency of words that can be linked to working conditions and the demands of the [73]⁵ movement will make it easier to evaluate YouTube comments.

4.3 Discussion of results

Figure 9 shows how often the words we selected were used in the comments. Words such as “slave”, “slavery”, and “labor” that stand out in these comments were mostly used to criticize the working conditions at Amazon. In these comments, it was observed that the current working conditions were likened to slavery. For instance, “Today’s version of slave labor!” “I worked there, I left after a couple of weekly, Slave Labor. They still owe me wages”, “they say slavery was abolished”, the working conditions in the Amazon are described with these expressions.

The word “hour”, which is the most frequently used word after “slave” in the graph, is mainly used in comments about zero-hours contracts. The comments on this issue emphasized that zero-hours contracts should be banned and that governments are responsible for this practice, which is in the interest of companies. Some of the comments are as follows: “Zero hours contracts need to be outlawed. Combined with the benefits system it creates a poverty trap that is enslaving us.”, “zero hours—is it Amazon fault or your government for allowing it !!” “Zero hours contracts should be illegal, they’re not real jobs, companies just take advantage of people, disgusting”.

Another prominent topic in the comments on YouTube videos is the critical views on the intense discipline imposed on employees. Words such as “break”, “watch”, “control”, “monitor”, and “surveillance” were found in the comments of

⁵ The Make Amazon Pay movement has been organizing global actions against Amazon since 2020, particularly on Black Friday. According to its website, the movement comprises over 80 organizations targeting labor, tax, climate, data, and racial justice, as well as over 400 parliamentarians. It is defined as an organization that unites people and has tens of thousands of supporters. For more information, visit <https://makeamazonpay.com/>.

YouTube users on this topic. An important detail that stands out in the comments containing these words is that some of the YouTube users who commented are those who have worked or are currently working at Amazon. Therefore, these comments have also gained the characteristic of sharing experiences. Below are examples of comments made in this way:

- “I lasted 5 days working at an Amazon warehouse in Gourrock, Scotland. It’s appalling. Every toilet break is monitored, you’re constantly on your feet, and supervisors are constantly on your back”.
- “Everything is true, yes they monitor your bathroom breaks, yes you only get two 8 min breaks and 30 min for lunch, yes big brother is watching you at amazon all the time, make no mistake”.
- “I work as customer support. And it’s no better. We are constantly under surveillance. Even going on a bathroom break is a risk. We are told we are entitled to annual leaves but there’s no guarantee that they’d be approved. We get 30 min lunch break but it should be taken when they allow us to take. We just can’t go on a break whenever we feel hungry or tired. After being loyal for years, you won’t even be promoted. Instead, they just hire a young recent graduate who has no job experience whatsoever from top B school for managerial position”.

The deterioration of Amazon workers’ health and lack of occupational safety due to unfavorable conditions in the workplaces is often mentioned in the comments where words such as “injured,” “health,” and “safety” exist. “The real injury rate is probably double or triple what is recorded, half the people walking around the warehouse are injured and haven’t reported it yet,” “Stop trusting supervisors, managers, hr, and anybody else that isn’t prioritizing your safety when it comes to hard labor; walk out/away before it gets to the point of injury.” quotes are samples of comments on this issue. Below is a comment from a former Amazon employee about her own working experience:

“As a former amazon employee for 3 years at a fulfillment center (inbound packages to delivery). I worked in safety. The warehouses are dirty. Pink eye and or respiratory issues are really common from the dust in the air. If you work hard and exceed your rates you wont move out of the position. If you slow down management will have questions. I’ve seen people break bones and turn into zombies. People dont stay longer then 3 months usually and those who stay suffer from mental and or physical pain. If your going to work for amazon take care of your health. Ice baths, stretching, and not going above your obligation and rates is important or you’ll burn out. Short term (3 months) not too bad if you need a job, but the physical demand catches up to you. The biggest problem is the labor on hand. We often didn’t have enough people to had large volume. The strain to finish the work day ends up with people getting hurt.”

Against all these negative conditions, it was observed that union organization was widely advocated as a solution in the comments examined in the study. “They should all strike world wide!!! The day the earth stood still!!! Unionize,” “Typical employer stuff, Check history. maybe a UNION would help,” “This is why Unions are important,” “They should ALL walk off the job and Unionize. Stand in solidarity” The comments are some of the instances that highlight the importance of Amazon workers exercising their union rights.

One of the main demands of the “Make Amazon Pay” movement, apart from the working conditions of workers, is the enforcement of fair tax policies. The movement pointed out that although Amazon generated 50 billion euros in revenue in 2022, it has not paid any taxes for 5 consecutive years at the European headquarters in Luxembourg. In the comments where the word “tax” was mentioned, YouTube users objected to this situation. Besides, comments containing the word “monopoly” criticized Amazon’s monopoly power and said smaller companies should be supported. Here are some examples of comments on this topic: “Mean while, in America they pay no taxes !!”, “I won’t use amazon, because he gets away with not paying his taxes, he should be made to close his company & pay all taxes he owes”, “I stopped shopping with Amazon 3 years ago because there are a Monopoly who are trying to destroy other businesses and they’re trying to destroy small businesses like my shop”, “Boycott Amazon movement has to start and government has to encourage family businesses cooperatives to set up their community distribution hubs with tax breaks and loans.”

The Make Amazon Pay movement also demands that Amazon operate sustainably by meeting its zero-emission target. The movement claims that Amazon’s current net zero-emission target for 2040 is unrealistic. According to the movement, a 0.4 percent reduction in its total emissions in 2022 will only result in meeting the 2040 target in 2378. However, limited opinions were shared on this issue in YouTube comments. The use of terms such as “climate,” “environment,” “planet,” “carbon,” and “sustainable” was infrequent in these comments. The words “climate” and “environment” were mostly used in reference to workplace conditions. This situation can be attributed to the focus of YouTube news on working conditions. “How disgusting not only do they mistreat people they also destroy the environment all the while saying they are going to work towards zero carbon. The only way to stop this is to boycott,” “As a company

that supports not only sustainable products and services but a sustainable environment, we stand against such a company that has no concern for the environment and its workers. We would add your video to one of our playlists to inspire consumers & businesses to choose the right products and services. -Team PlanetCents", "... He means to pollute our planet into oblivion and not pay his workers, then leave us to burn up, drown, starve and thirst while he watches us from space with his billions. Don't use or work for this company." quotes are among the few comments on climate. On the other hand, there are examples of Amazon workers protesting the company's climate impact [74].

A thematic analysis of YouTube comments revealed several key issues concerning working conditions. These include discussions about "slave" labour, vague zero-hours contracts, intensive surveillance, workers' health and occupational safety deficiencies, and the necessity for union organization. Additionally, demands for fair tax and sustainable climate policies, as articulated by the Make Amazon Pay movement, have been mentioned, though to a lesser extent than the issues pertaining to working conditions. In light of these findings, it becomes evident that this study's conclusions align with those of other studies that have examined the gig economy and companies within it, particularly in relation to the concepts of precarity and the absence of decent work. For instance, [35] argued that the gig economy boosts precarity in the working life, as evidenced by the case of Uber. [42] investigated the detrimental effects of zero-hours contracts on workers. [52] examined the processes of deunionization exacerbated by the weakening of labour law as a consequence of the gig economy. [45] explored the surveillance concerns of digital platform workers. The Strategic Organizing Center [48] revealed the occupational accident rates of Amazon and other warehouse workers. Consequently, the studies conducted in the literature within this scope have yielded similar results. These results are closely correlated with the rise of non-standard work forms enabled by neoliberal policies, the decline of the concept of secure employment, the prevalence of independent contractors status in the gig economy, non-unionized work, and the curtailment of labour law protections for gig workers and other informal workers, which are essential for establishing labour standards in workplaces.

5 Conclusion and policy recommendation

It is well known that developments in computer technologies in recent years have made a qualitative contribution to scientific research methods. In this study, we brought a new perspective to the dimension of the relationship between working conditions and social sustainability by applying CMSS machine learning. We investigated Amazon, one of the largest companies in the world, particularly in the context of the gig economy. Our findings conclude that Amazon's working conditions do not provide the definition of decent work. We found that slavery wages and zero-hours contracts were the main issues protested by Amazon workers. In addition, we concluded that the pressure of control and surveillance on workers was intense. In addition to high working hours, this surveillance and control mechanism significantly increases the working intensity of employees. Or it causes employees on zero-hours contracts to receive a wage below the wage they need to live. On the other hand, another problem highlighted by Amazon workers is the weakness of occupational safety. In the face of these conditions, Amazon workers stressed the need for trade union organization and the right to strike. At the same time, we observed that Amazon workers were sensitive to environmental problems such as global warming and climate change in their protests.

5.1 Limitation of the study and future studies

One of the limitations of this study is that it focuses only on Amazon, one of the largest companies in the world. In addition, only YouTube data was used in the sentiment analysis. However, other social media platforms could be used. It is very important to study the impact of the gig economy on working life. In this respect, it can be studied in different countries and companies, and the link between international migration movements, women's and children's work, different types of insecurity and the gig economy can be shown in future studies. In addition, different sentiment analysis approaches can be considered in future studies as an alternative to the BERT model used in the analysis.

5.2 Policy recommendation

Following the 2015 session of the UN General Assembly, decent work will be an important part of the new 2030 Agenda for Sustainable Development. With contributions from the ILO and its constituents, the 2030 Agenda aims to promote

full and productive employment and decent work. In addition, the objectives of many of the other 17 goals of the UN's new vision for development broadly reflect key aspects of decent work [22]. Because in order to ensure social sustainability, which is one of the main focuses of sustainability, the necessary basis for decent work must be created. Failure to provide the basis for decent work will lead to an increase in poverty and a deepening of existing inequalities, resulting in serious social problems, social tensions and potential instability. It is essential that the ILO, the UN and other international organizations play a proactive role in enhancing social welfare, in particular decent work, and preserving the gains made in this area. However, insufficiency of international institutions, especially for improving working conditions, makes it difficult to achieve sustainability goals. Finally, in this context, the employment opportunities provided by the gig economy need to be completely reviewed and radical changes must be made. Long working hours or indefinite working time, zero-hours contracts, low wages, inadequate occupational health and safety, deunionization, and advances in surveillance and control mechanisms that increase workers' work intensity are factors that reduce workers' working standards. These conditions pose an obstacle to social sustainability. Thus, changing these conditions in favor of employees is a vital necessity in achieving social sustainability goals. In order to reach these goals for Amazon and other gig workers, it would be beneficial to consider the expansion of secure and standard employment forms and the legal status of employees as "workers" instead of "independent contractors". In addition, governments should prohibit zero-hours contracts and guarantee a certain number of hours per week that would provide a regular income. Moreover, rather than increasing surveillance and control over workers, digitalization should be used to improve their working conditions. Furthermore, national regulations should promote trade union activity and collective bargaining and take the required measures to prevent occupational accidents in the labour markets. On the other hand, due to the nature of their work, those in independent status should be included within the scope of labour and social security laws. Policy makers, non-governmental organizations and all actors within the state must consider such proposals and make the necessary efforts, taking into account the new business order, in order to achieve social sustainability goals.

Author contributions AÇ: Conceptualization, Review and Editing, Methodology, Formal Analysis. NG: Conceptualization, Data curation, Methodology, Literature Review. EY: Writing—Original draft, Data curation, Formal Analysis.

Data availability Data are available upon request from the corresponding author.

Declarations

Competing interests The authors declare no competing interests.

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