Text Analysis Study on Urban farming News Toward Food Security in Indonesia: Sentiment Analysis, Named Entity Recognition, Topic Modelling, and Social Network Analysis

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Abstract. Urban farming is an increasingly popular trend in agricultural activities. Urban farming is an attempt to achieve urban sustainability from an environmental, social and economic perspective. In order to understand the phenomenon of urban farming in society, one of the media used is a news portal. This research aims to gain an in-depth understanding of community perceptions, social networks and issues related to the urban farming phenomenon. Data was collected using the web-scraping method on three national news portals in Indonesia. Data analysis was carried out using sentiment analysis, NER, topic modelling and social network analysis methods. Sentiment analysis shows that there is a generally positive sentiment towards urban farming. Government officials and environmental activists are frequently mentioned as supporting and promoting urban agriculture. Social network analysis reveals interactions between government agencies, non-governmental organisations and the media. The relationships between these stakeholders form a network that plays a role in building awareness, cooperation and knowledge exchange to strengthen food security through urban agriculture.

1. Introduction

Agricultural activities can be carried out in both rural and urban areas (Foeken, D., & Mwangi, A. M, 2000). Various urban agricultural activities such as the cultivation of food and crops, horticulture, animal husbandry, forestry, floriculture and horticultural crops are often referred to as urban farming (Foeken, D., & Mwangi, A. M, 2000). Urban farming activities can take place at different scales, from small community gardens to vertical farming in skyscrapers. Agricultural activities can be carried out in any open area, such as parks, green spaces, roadsides, river banks or in the backyard. In some large cities, people are installing modern agricultural equipment on the roofs of their houses (Hui, S. C., 2011).

Urban farming is an increasingly popular trend in urban agricultural activities. Urban farming is an attempt to achieve urban sustainability from an environmental, social and economic perspective (Hui, S. C., 2011). The aim of urban farming is to improve the agricultural function of urban communities and to develop urban food systems. (Yusoff, Hussain, & Tukiman, 2017). Urban communities can produce local food, facilitate access to fresh produce, and reduce dependence on food troops from other areas. The benefits and potential of urban agriculture are related to how to improve the quality of life for urban communities in the midst of very limited urban space and an ever-increasing urban population. (Yusoff, Hussain, & Tukiman, 2017).

Advances in agricultural technology allow for a variety of urban farming techniques. Several urban farming techniques that are widely used include vertical farming, indoor farming, hydroponics and aquaponics (Ng, & Mahkeswaran, 2021). The concept of vertical farming combines several types of

farming that are arranged vertically, such as a pond at the bottom for raising fish and different types of vegetable plants at the top (Benke K & Tomkins B, 2017). Vertical farming is often used in various commercial buildings such as offices, supermarkets, shops and homes. Hydroponics is a planting technique that allows plants to grow in a medium without soil, where the roots are directly submerged in a nutrient-rich solution (Jai N. et al, 2018). Aquaponics combines hydroponics with fish farming in the water below (Alyssa. et al, 2019). However, some Indonesians still use traditional farming techniques in their backyards.

Urban farming activities have implications for food security (Van Averbeke, 2007; Anggrayni, 2015; Wardah & Niswah, 2021). The increasing number of urban populations makes the problem of food security in urban areas. The growth of urban population has implications for the food system, especially with regard to the challenges of access to safe, fresh and affordable food for urban dwellers. Through urban agriculture, urban communities can provide their own food. This shortens the flow of food distribution from other cities (Mincyte & Dobernig, 2016). Providing an independent food supply increases the economic access of urban households and increases the income of urban farming managers (Anggrayni, 2015).

Research conducted by Yusoff, Hussain, & Tukiman (2017) revealed several benefits and potentials of urban farming such as structuring the urban environment, economic benefits, improving social aspects and improving health by providing high food nutrition. Structuring the urban environment means that there is an effort to utilize vacant and abandoned land in urban areas into productive land (Veenhuizen, 2006). Another environmental aspect is the arrangement of greener spaces that provide better air quality (Wackernagel & Rees, 1996). From an economic perspective, urban farming utilizes the labor of urban communities to generate income from urban agricultural economic activities (Giedych, 2013). The social aspect of the impact of urban farming activities such as strengthening the community environment by learning together related to modern agricultural techniques or related to the distribution of agricultural sales (Alkon, 2008; Scott, 2012). Agricultural products from urban farming make urban communities get better and fresher high food nutrition (Kumar, 2012).

Urban farming has become a popular topic in society, especially in urban communities (Parillas et al., 2022). This indicates a growing interest in the adoption of urban farming (Yadav et al., 2022). However, there is currently no effective way to measure and evaluate the implementation of urban farming in Indonesia and how urban farming can contribute to addressing food security issues. To understand the phenomenon of urban farming in society, one of the media that can be used is news portals. News portals provide in-depth information about what urban farming is, its benefits, and how it is being implemented in communities. Articles, reports, and interviews conveyed through news portals can help assess the extent to which messages and communications related to urban agriculture successfully influence public opinions and perceptions. Therefore, it is important to conduct research on the urban farming phenomenon using data sources from online news portals.

This research aims to provide a comprehensive understanding of the issues, public perceptions, social networks, and topics related to the phenomenon of urban farming by combining four methods of textual data analysis. Using these analytical methods, the results can help evaluate the extent to which the urban farming phenomenon is progressing in Indonesia and can be considered as one of the alternative solutions to food security issues. Consequently, this study is expected to provide guidance and additional information to decision-makers in formulating more objective, balanced, and informative policies regarding urban agriculture. It also aims to enhance public awareness and understanding of the importance of farming practices in urban environments to achieve sustainability and food security.

2. Methods

The research method used in this study is a qualitative research method. This research collects data with the web scraping method and analyses it with several machine learning methods. Figure 1 shows the research method used in this study.

2.1. Data Collection Phase

The data used in this study came from three online news outlets in Indonesia, namely Detik, CNBC Indonesia, and Okezone. Data collection was carried out using the web scraping method using the keyword "urban farming". Online news was chosen as the data source because it can provide in-depth information regarding the benefits of urban farming and its implementation in communities. Articles, reports, and interviews conveyed through online news portals can also aid in assessing the extent to which messages and communications related to urban farming are being implemented. News data was collected in the time span between January 1, 2018 and June 5, 2023. This research uses the Python programming language by using the Scrapy library to perform web scraping. Scrapy is a Python library that is open, flexible, and can extract HTML documents by selecting certain parts of the page (Chaves, 2020). The data retrieved includes news content, additional information such as news date, news title, and news link/address on the portal. All data collected is then stored for further analysis. This process follows previous research by Satriaji, et al (2020) who collected crime news data from the Detik portal.

2.2. Data Preparation Phase

Text cleaning is a crucial step in text processing. Its purpose is to remove irrelevant information, organize the text format for uniformity, and prepare the raw text to be ready for further analysis. The steps in text cleaning include text normalization, tokenization, and stopword removal.

- Word standardization: involves steps to change the format of the news text to a uniform one. This includes removing unwanted characters such as special characters, emoticons, or irrelevant symbols. In addition, text standardization also involves converting the entire text to lowercase.
- Tokenization: the process of converting sentence text into smaller tokens, such as words or phrases. At this stage, the text is split into meaningful units, such as individual words or short phrases. For example, the sentence "I want to go on vacation to Aceh" can be tokenized into ["I", "want", "go", "vacation", "to", "Aceh"]. Tokenization can be done using space-based separation methods or by using more complex natural language processing techniques.
- Removal of stopwords: the process of removing words that are common and have no special meaning in the context of text analysis. These words are often removed because they do not contribute significantly to the understanding of the text. Examples of stopwords in Indonesian include "kamu" (you), "atau" (or), "adalah" (is), "dan" (and), and so on. By removing stopwords, the dimensionality of the data can be reduced and relevance in text analysis can be increased.

2.3. Data Analysis Phase

The data that has passed the text cleaning process will be analyzed using several methods, namely Sentiment Analysis, Named Entity Recognition (NER), Social Network Analysis, and Topic Modeling.

- Sentiment Analysis

  In this study, the sentiment of the "urban farming" news was classified using a lexicon approach using the Indonesian sentistrength (SentiStrength.ID) developed by Wahid and Azhari (2016). Sentistrength uses a lexicon containing words that are classified based on the degree of positive or negative sentiment they carry. The Sentistrength algorithm evaluates each word in the text based on this lexicon and assigns a sentiment score that reflects its polarity. Typically, sentiment scores range from -5 to +5, with negative values indicating negative sentiment and positive values indicating positive sentiment. SentiStrength.ID was also chosen in this study because this lexicon also takes into consideration the assessment of other aspects of a sentence, including.

  1. Idiomatic phrases, such as "banting tulang" (literal translation: "bone-breaking," meaning hard work) with a positive value or "besar kepala" (literal translation: "big head," meaning arrogant) with a negative value.
  2. Emoticons in the text, such as ":)" with a positive value or ":(" with a negative value.
  3. Booster words, such as "sangat" (very), "banget" (very), or "paling" (most), which will boost the score of the word after/before them.

4. Negation words, which will invert the score of a word, such as "bukan" (not), "belum" (not yet), and "tidak" (not).

- Named Entity Recognition (NER)
  The NER method is used in this research to identify named entities of public political figures that appear in the news text "urban farming" by using the Spacy library. Spacy is a Python library used in natural language processing/NLP (Neumann. et al, 2019). The algorithm used in SpaCy's NER model is a neural network algorithm known as Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN). It's an algorithm that is combined with various feature extractors, including characters, words, previous words, and next words in the text
- Topic Modeling
  Next, the topic modeling method was used to identify the main topics in the "urban farming" news data. Topic modeling was performed using the Latent Dirichlet Allocation (LDA) algorithm through the Gensim library in the Python programming language (Řehůřek & Sojka, 2011). The LDA algorithm can categorize news into interrelated topics based on the distribution of words in them.
- Social Network Analysis (SNA)
  SNA was conducted in this study to look at the relationship between character name entities (the result of the NER method) in social networks (Wasserman & Faust, 1994). This method helps to understand the structure, interaction patterns, and social dynamics in the network related to the topic of "urban farming". The Gephi application is used to visualize the SNA results that have been processed using the Python programming language.

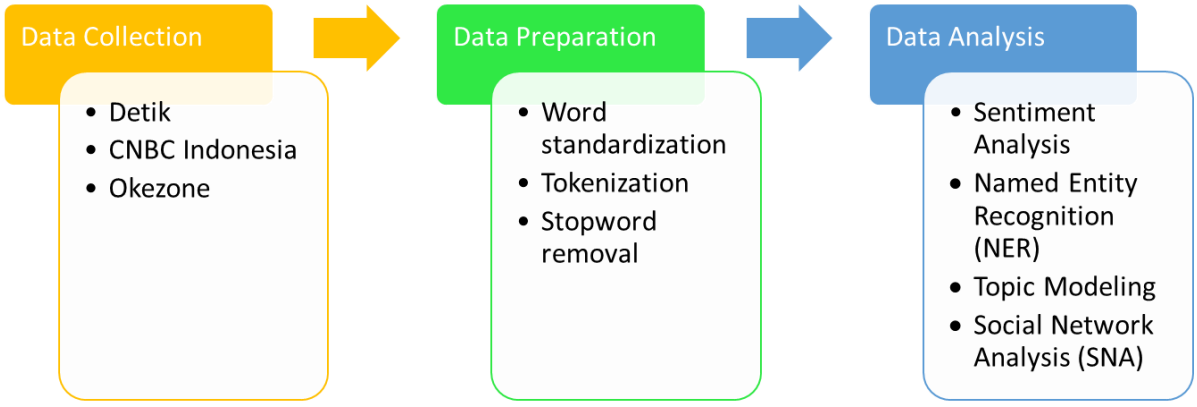

Figure 1. Research Methods.

3. Results and Discussion

In this study, data related to urban farming was collected from January 1, 2018 to June 5, 2023. Figure 1 shows the distribution of the number of news reports on online news portals per month. The data collected in this study amounted to 564 news, which were collected from three online news portals namely Detik (379 news), CNBC Indonesia (23 news), and Okezone (162 news). From Figure 1, it can be seen that the highest number of news is in the final months of the year, such as November 2020 and October 2022. In November 2020, the number of news was 28 news. During this period, the Indonesian government through the Ministry of Agriculture conducted a campaign related to Sustainable Food Yards (P2L) or popularly known as urban farming. Minister of Agriculture Syahrul Yasin Limpo revealed that urban farming is an effort to support food security (Alhikam, 2020). In October 2022, coinciding with the G20 event, PT Bank Rakyat Indonesia (BRI) socialized the Environmental, Social, and Governance (ESG) program. In this project, BRI Bank distributes horticultural seeds to customers, so that each customer can do urban farming in their respective homes (Dyah, 2022).

Further analysis was conducted to see the sentiment of news related to the urban farming issue. Figure 2 shows the results of the sentiment analysis. From the figure, it can be seen that many news reports related to urban farming have positive sentiments, which amounted to 55.85%. Meanwhile, 38.65% of the news has a neutral sentiment. However, there are still news reports related to urban farming that have negative sentiments, which amounted to 5.5%.

Some news highlighted the benefits of urban farming in improving food security in cities. They emphasized that urban farming can help reduce dependence on food supplies from outside the city and increase the availability of fresh food for urban residents. Such news stories tend to express positive sentiments towards urban farming and appreciate its important role in ensuring local food security.

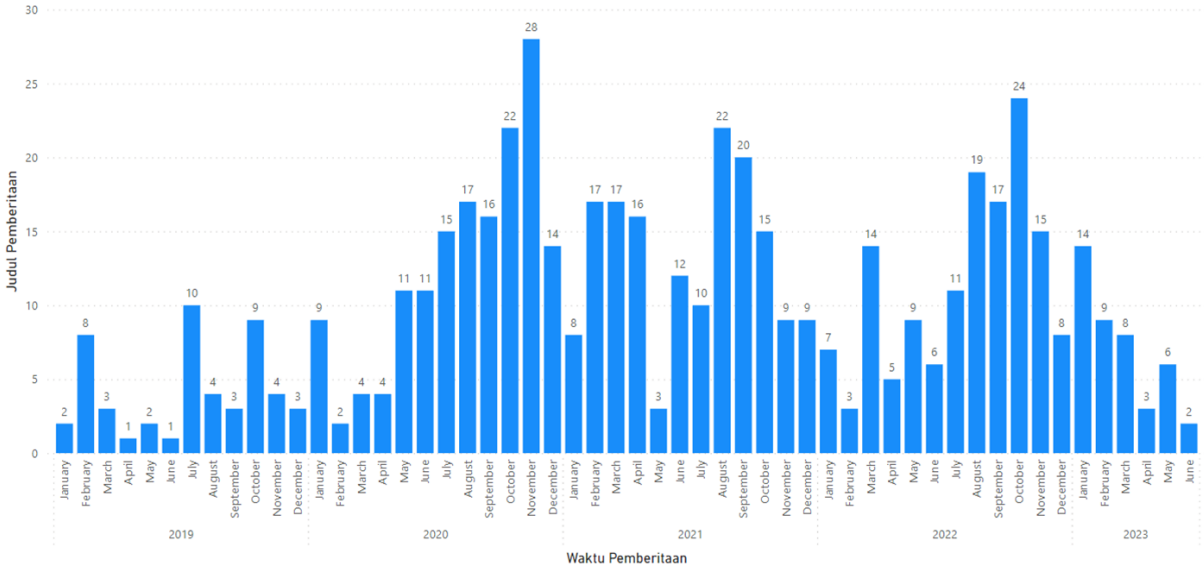

Figure 2. Number of Reports on Online News Portals.

However, not all news is entirely positive. Some news reports noted challenges and obstacles in implementing urban farming. For example, issues of limited space in urban areas, complex regulations, and limited resources such as water and land. Such news may express a neutral or even slightly negative sentiment towards urban farming, highlighting the challenges that need to be overcome to achieve better food security.

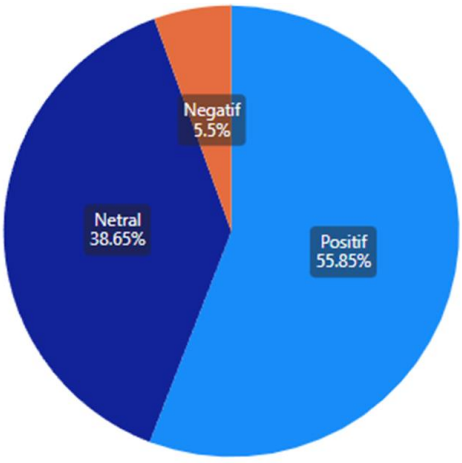

Figure 3. News Sentiment Analysis.

In general, although there were some neutral or negative sentiments expressed in the news reports, the sentiment analysis indicates that urban farming is widely perceived as a potentially positive solution

to improving food security in cities. In the news, urban farming is often associated with efforts to achieve food self-sufficiency, increase access to fresh food, and promote sustainability as can be seen in Figure 3 that the phrase "food security" is one of the most frequently occurring words in urban farming news.

Figure 4. News Word cloud

Furthermore, the Named Entity Recognition (NER) analysis of public figures who often appear in the news about urban farming reveals several names that are often mentioned. In Table 1 are some of the public figures that are often associated with urban farming in the news:

Table 1. The most mentioned figures in the news.

Figure Name	Position	Number mentioned in the news
Joko Widodo	President RI	42
Anies Baswedan	Former Governor of DKI Jakarta	29
Ali Maulana Hakim	Mayor of North Jakarta	20
Imam Budi Hartono	Deputy Mayor of Depok	16
Tri Rismaharini	Indonesian Minister of Social Affairs / Former Mayor of Surabaya	12

It should be noted that this list is not exhaustive and may vary depending on the context of the news coverage and geographical location. There are many other public figures who also play an important role in the promotion and development of urban farming, and these names may appear in the news with other keywords.

The next analysis involved classifying the topics in urban farming using the LDA modeling method. The news topics were grouped into 4 major groups of conversations. In Table 2, there are 5 words associated with each of these topic groups. In general, the major topics that appear in the news about urban farming from online news portals are:

- Topic 1, about the urban farming work program that has been running in North Jakarta City related to waste management.
- Topic 2, about the environmental governance in Surabaya that has practiced urban farming
- Topic 3: socialization of urban farming by the People's Coalition for Food Sovereignty (KRKP)
- Topic 4, about the government and urban farming program as one of the solutions for food security

Table 2. Top five words in each topic.

Topic 1	Topic 2	Topic 3	Topic 4
Farming	Food	Farming	Farming
Program	Surabaya	Vegetables	Resilience
Garbage	Economi	Program	Land
Land	Program	Role	Vegetables
Food	Land	Activates	Program

The topic modeling analysis shows that news coverage of urban farming and food security reflects significant interest in developing sustainable urban agriculture and contributing to local food security. Emerging topics include agricultural practices, sustainability, community, policy and community socialization. A better understanding of these topics can lead to a deeper understanding of the potential and challenges in developing sustainable urban farming that positively impacts food security.

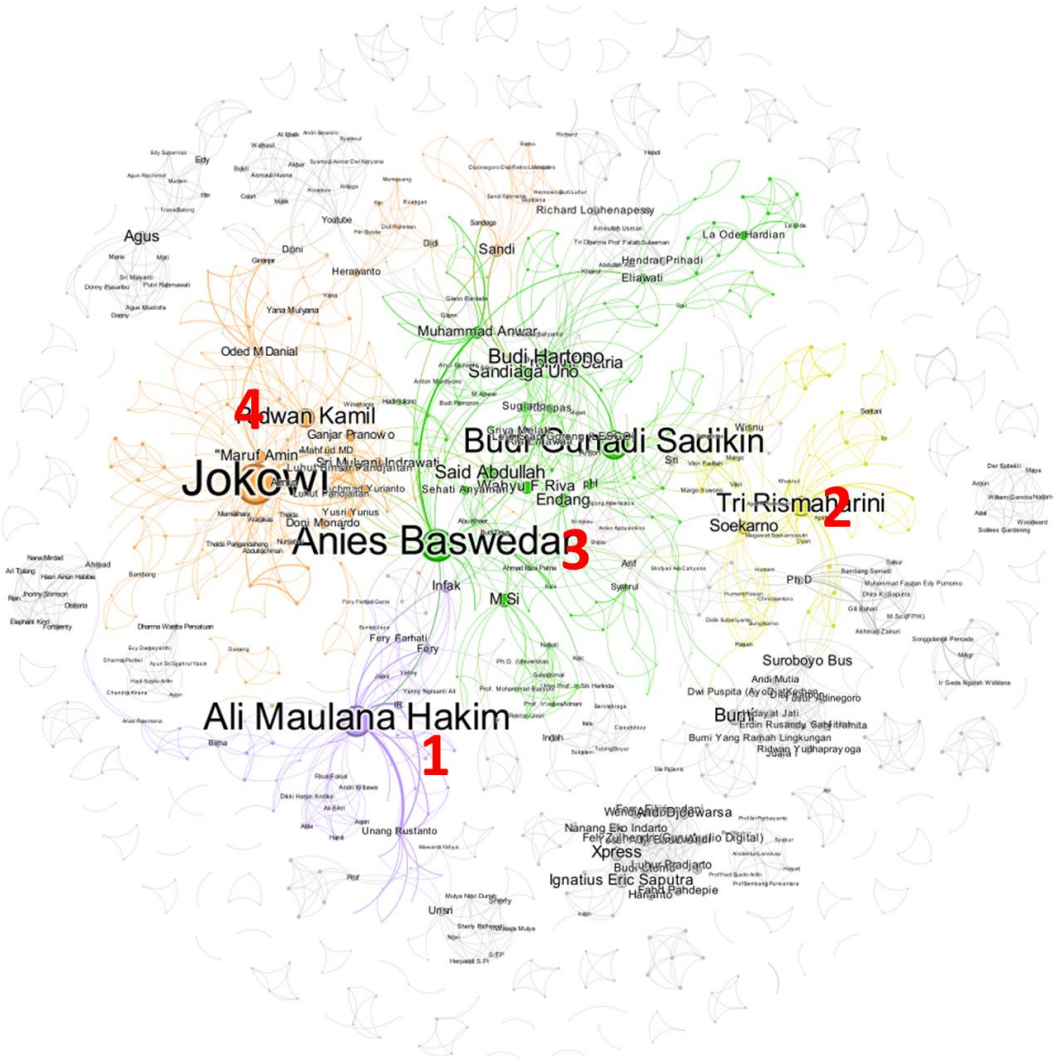

Figure 5. Social Network Analysis (SNA).

4. Conclusions

Based on the Study of Text Analysis of Urban Farming News in Indonesia which includes sentiment analysis, NER, Topic Modeling, and Social Network Analysis, several conclusions can be drawn to support food security. Sentiment analysis shows a general positive sentiment towards urban farming in Indonesia. News stories tend to highlight the benefits and potential of urban farming in improving food security, such as access to local food, cost savings, and reduced dependence on foreign food supplies. The NER analysis identified several public figures that frequently appear in news reports on urban farming in Indonesia. These figures include state officials and environmental activists who support and promote urban farming as a solution for food security.

Topic Modeling analysis generated a range of topics related to urban farming in Indonesia. These topics include urban farming practices, sustainability, community empowerment, policy and regulation, and public education and awareness. This shows a broad focus and attention to important aspects of urban farming development to support food security. The social network analysis revealed interactions between stakeholders in the urban farming domain in Indonesia. This includes a community of relevant government agencies, non-government organizations, and the media. The relationships between these stakeholders form a network that plays a role in building awareness, cooperation and knowledge exchange to strengthen food security through urban farming.

In conclusion, the study of news text analysis on urban farming in Indonesia through sentiment, NER, Topic Modeling, and Social Network Analysis provides a picture that supports the importance of urban farming in the context of food security. There are positive sentiments, identification of public figures who play an important role, identification of key topics related to urban farming, and mapping of social networks that support urban farming. The results of this study provide important insights for policy makers, practitioners, and communities in developing urban farming as one of the solutions to strengthen food security in Indonesia.

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