Information needs and behaviour on climate change for sustainable farming among farmers

E Widiyanti1,2,4,5, R Karsidi1, M Wijaya4 and P Utari4

1Communication Doctorate Program, Faculty of Political and Social Science, Universitas Sebelas Maret, Jl. Ir. Sutami 36 A, Surakarta, 57126, Indonesia
2Extension and Agricultural Communication, Faculty of Agriculture, Universitas Sebelas Maret, Indonesia
3Faculty of Education, Universitas Sebelas Maret, Indonesia
4Faculty of Political and Social Science, Universitas Sebelas Maret, Indonesia
5Corresponding author: emi_widiyanti@student.uns.ac.id

Abstract. As the main actors in the food supply, farmers’ knowledge regarding climate change and sustainable agriculture is essential. This study aims to identify farmers’ information needs, information use level and information-seeking behavior on climate change for sustainable agriculture. This research was conducted on three farmer groups in areas affected by Mount Merapi eruption and global climate change, namely Karya Muda and Sekar Dewani farmer groups in Mriyan Village, Tamansari District, and Margo Mulyo farmer group in Mundu Village, Tulung District, Klaten Regency. The data were collected purposively through structured interviews with 43 farmers from the groups. The analysis results of the Standardized Information Need Index (SINI) and Information Use Index (IUI) showed that information related to crop protection (SINI-96, 90), climate (SINI-92, 25), and commodity selling prices (SINI-89, 92) is the information most needed by farmers. The information sources mostly used by farmers were friends or neighbours (IUI-84), farmer groups (IUI-65) and mass media (IUI-49). The results concluded that farmers seek information on climate change and sustainable farming more actively from their fellow farmers and farmer groups. Therefore, to further support sustainable agriculture and deal with climate change, it is recommended to provide the information needed by farmers through such sources

1. Introduction
One of the UN's sustainable development agendas in 2030 is to end hunger by providing food for the world community. However, in the provision of food, the World faces demands in the future including the issue of scarcity of natural resources and climate change, in addition to the demographic problem of food waste [1]. The climate change bears an impact on increased rainfall variability and droughts and flood frequency, thus reducing crop yields. Further, climate change contributes to long-term environmental problems that have existed, such as the depletion of groundwater and soil degradation, which will also affect food production and agriculture systems [1]. Thus, climate change can threaten the sustainability of the agricultural system as a food provider.

Sustainable agriculture is oriented towards three dimensions of sustainability that should be balanced, namely the sustainability of economic enterprises (profits), human social life (people), and natural ecology [2]. As the main actors in the farming system, farmers are expected to be able to implement agricultural practices that can preserve nature, adapt to climate change and the limitations of natural resources, while still earn income from their farming to maintain the economic stability of
their families, as well as the social and cultural stability of the surrounding community. For this reason, information related to farming becomes essential for farmers in making decisions for their farming practices.

Indonesia is a country with volcanic lines that are prone to eruptions. One of the volcanoes is Mount Merapi. Mount Merapi is the most active volcano in Indonesia and as a result, the farmer community living in Mount Merapi area often faces land damage due to eruption [3]. To be able to adapt to environmental changes due to eruption and climate change, the farmer community in the area needs complex information for their farming decisions.

The study on farmers’ information needs and information-seeking behaviour in Mount Merapi area is interesting, considering that they often have to face natural changes during of their efforts to maintain their farming sustainability. According to [4] information access and use are important for farmers to support a sustainable farming system and important in agricultural information dissemination programs. Research on farmers’ information needs and information behaviour is based on Thomas D. Wilson’s theoretical framework of information behaviour. Information behaviour is the totality of human behaviour about sources and channels of information. This includes active behaviour such as face-to-face communication with others, passive behaviour such as watching TV commercials without any intention to act on the information provided, and the use of information [5]. The information itself is any material properties, messages, documents or any information resources, as well as any data that have the potential to be useful for decision making [6]. Agricultural information needed by farmers is all forms of material, messages, documents and other information resources that can meet the need for knowledge about agricultural practices, climate, marketing and other information that farmers obtain through the process of seeking information using various sources and communication channels.

This study aims to identify farmers’ information needs, sources of information that they often use and the ways they obtain the information.

2. Method

This research was based on a descriptive study that sought to describe farmers’ information needs and behaviour. The study was conducted in three farmer groups in the Mount Merapi area, namely Karya Muda farmer group and Sekar Dewani Farmer Women Group in Mriyan Village, Tamansari District, Boyolali Regency, and Margo Mulyo Farmer Group in Mundu Village, Tulung District, Klaten Regency. The three farmer groups were selected by considering that their farming locations are located in areas prone to the effects of Merapi eruption that often affects their farming practices. The primary data were collected purposively through structured interviews with 43 members of the farmer groups consisting of 15 members of Sekar Dewani farmer group, 18 members of Karya Muda farmer group and 10 members of Margo Mulyo farmer group.

The data collected in this study are data on farmers’ information needs, information-seeking behaviour and information sources related to climate change and sustainable agriculture. The data were processed in the form of frequency distribution tables. To determine the ranking or order of information needs, the data were analyzed using the Standart Information Need Index (SINI), and to determine the order of information sources used, Information Use Index (IUI) was applied with the following formula.

\[
INI = INvh \times 3 + INm \times 2 + INl \times 1 + INn \times 0 
\]

in Which,

\[
INI = \text{Information Need Index} \\
INvh = \text{Number of respondents with very high information need} \\
INm = \text{Number of respondents with medium information need} \\
INl = \text{Number of respondents with low information need} \\
INn = \text{Number of respondents with no information need} 
\]
As the total number of the respondents was 43, theINI of each dimension could range from zero (0) to 129. To express the INI in a meaningful way, it was necessary to convert it to the Standardized Information Need Index (SINI Index) by using the following formula.

\[
\text{SINI Index} = \left( \frac{\text{Computed INI}}{\text{Possible highest INI}} \right) \times 100
\]

(2)

SINI of each of the dimensions could range from 0 to 100, while 0 indicating no need and 100 indicating the high need of the farmers. For the rank order, Information Use Index (IUI) was computed by the following formula.

\[
\text{IUI} = \text{IUa} \times 3 + \text{IUf} \times 2 + \text{IUo} \times 1 + \text{IUn} \times 0
\]

where,

- \( \text{IUa} \) = Number of respondents with always used information source
- \( \text{IUf} \) = Number of respondents with frequently used information sources
- \( \text{IUo} \) = Number of respondents with occasionally used information sources
- \( \text{IUn} \) = Number of respondents with never used information sources

The IUI of each dimension thus could range from 0 to 129 where, 0 indicating no use of information sources and 129 indicating high use of information sources.

3. Results and discussion

Information is all types of material, messages or documents that farmers can use to meet their information and knowledge needs regarding any matter related to their farming practices. Regarding climate change, information and technological innovations needed to adapt to climate change include technologies related to water management, technology development on plant varieties that are tolerant of environmental stress, soil and plant management technologies to increase plant adaptability, and crop weather insurance [8]. Meanwhile, to ensure sustainable agriculture, farmers need information relating to crop protection, markets, climate, sources of farming capital and loan, information about crop production, post-harvest management and information from experts in agriculture [9].

3.1. Information needs of the farmers

This study seeks to identify farmers’ information needs about climate change for the sustainability of their farming businesses, with the following results.

The SINI analysis results presented in Table 1 show that among the 15 dimensions of agricultural information needs, there is some information that is most needed by farmers. The information related to crop protection ranked first with SINI of 96.90. Climate-related information ranked second with SINI of 92.25 and information on commodity selling prices ranked third with SINI of 89.92. Meanwhile, information on plant productivity and water-saving technology ranked fourth with SINI of 88.37 and information related to the adjustment of planting time and patterns and the information source availability such as extension agents ranked fifth with SINI of 86.82.

Information related to crop protection is the most needed information by farmers in the Mount Merapi region. This is due to the impact of Merapi eruption, which often brings ape/monkey pests that disturb farmers' crops and yields. Beside, climate change also causes an explosion of disease pests and the one most widely found is a rat pest explosion. According to information from an NGO, the Institute for Rural Technology Development which assists the farming communities, one of the efforts taken to overcome this problem is the introduction of chrysanthemums and orchids to farmers, both of which are less favoured by the monkey/ape pests. The second most needed information is information about climate change and disaster mitigation and information on market information concerning the selling price of products that are important for their economic sustainability.
### Table 1. Rank order of the information need based on SINI

| Information Needs                                      | Extent of Need | INI | SINI | Rank Order |
|--------------------------------------------------------|----------------|-----|------|------------|
| Information related to crop Protection                 | 39             | 4   | 0    | 125        | 96.90     | 1   |
| Information related to climate                         | 35             | 6   | 2    | 119        | 92.25     | 2   |
| Commodity selling price                                 | 30             | 13  | 0    | 116        | 89.92     | 3   |
| Information related to plant productivity              | 30             | 11  | 2    | 114        | 88.37     | 4   |
| Water saving technology                                | 29             | 13  | 1    | 114        | 88.37     | 4   |
| Adjustment of planting time and pattern according to planting calendar | 29             | 12  | 1    | 112        | 86.82     | 5   |
| Information related to supporting knowledge resources  | 32             | 6   | 4    | 112        | 86.82     | 5   |
| Technology of land cultivation to improve plant’s ability to adapt | 27             | 14  | 2    | 111        | 86.05     | 6   |
| Information on zero waste Technology                   | 26             | 16  | 1    | 111        | 86.05     | 6   |
| Plant varieties that are tolerant to environmental stress | 25             | 16  | 1    | 108        | 83.72     | 7   |
| Availability and price of production facilities         | 26             | 12  | 4    | 106        | 82.17     | 8   |
| Information related to experts                         | 24             | 15  | 3    | 105        | 81.40     | 9   |
| Information related to post harvest                     | 24             | 10  | 9    | 101        | 78.29     | 10  |
| Capital availability /Loan                             | 27             | 6   | 7    | 100        | 77.52     | 11  |
| Water management                                        | 24             | 10  | 8    | 100        | 77.52     | 11  |

Note: Scale; High=3, Medium=2, Low=1 and Not ever=0 Source: Field survey 2019

Several studies on farmers’ information needs have found that information related to pest and disease control, crop protection, market information and climate information is the most needed information for the farming community [9,7].

#### 3.2. Information behavior of the farmers

Information behaviour means all human behaviours in relation to the use of information sources and channels, both active information seeking such as face-to-face communication with others, and passive reception of information such as watching TV commercials [5]. In this study, information behaviour is focused on the way information sources are used by farmers, which include 10 sources of information. Information behaviours were measured by observing how often farmers use each source of information.

From the results of Information Use Index calculation (table 2), it was found that the most widely used information source by farmers is information from friends or neighbours (IUI-84), while information from farmer groups ranks second (IUI-65) and information from mass media ranks third (IUI-49). Farmers rely more on information from fellow farmers or neighbours as well as information on farmer groups because of the proximity of their residence, farming characteristics and socio-economic characteristics such as their level of education and farming experience. The mass media that is widely used by farmers to access information about climate change and farming sustainability is the television, with the "Saba Desa" program from TVRI (Indonesian National Television Station).
Jogjakarta station being the program that they often watch. In addition, farmers also began to use many kinds of social media in the process of seeking their agricultural information. They also utilize information sourced from NGO’s workers.

Table 2. Rank order of the information sources according to the way the farmers use it regarding climate change and sustainable farming information.

| Information Sources       | Degree of Use | IUI  | Rank Order |
|---------------------------|---------------|------|------------|
|                           | Always        | Frequently | Occasionally | Never |     |
| Friends, Neighbors        | 9             | 23    | 11         | 0     | 84  | 1   |
| Farmers association       | 4             | 14    | 25         | 0     | 65  | 2   |
| Mass media (TV, Radio)    | 1             | 11    | 24         | 7     | 49  | 3   |
| Internet (Social media)   | 4             | 6     | 24         | 9     | 48  | 4   |
| NGO’s worker              | 0             | 3     | 37         | 3     | 43  | 5   |
| Honorable person in society | 0            | 9     | 22         | 12    | 40  | 6   |
| Extension worker          | 0             | 3     | 31         | 9     | 37  | 7   |
| seed dealer               | 0             | 3     | 29         | 11    | 35  | 8   |
| Pesticide dealer          | 0             | 3     | 27         | 13    | 33  | 9   |
| Local leader              | 1             | 0     | 19         | 23    | 22  | 10  |

Note: Scale; Always=3, Frequently=2, Occasionally=1 and Never=0 Source : Field survey 2019

Some research related to the use of information sources by farmers also shows the tendency of farmers to use information sources that come from the mass media [7,10]. The research results in Enungu State Nigeria found the importance of mass media and interactive telephones in teaching information on adaptation to climate change and mitigation measures to farmers using the language that farmers can understand actively (interactive telephone in the program), as well as through mass media using climate change communication experts [10]. In Bangladesh, a study also found that television and radio are the media most widely used by farmers [7].

Farmers’ information behaviour can also be seen from the way they collect information. Here are some ways in which farmers gather information.

Table 3. Way of gathering and sourcing of information

| Way of gathering and sourcing information | Frequency | Percentage |
|------------------------------------------|-----------|------------|
| Visiting information sources             | 29        | 67.44      |
| Gathering information from friends and neighbours when gathering or meeting them | 43        | 100.00     |
| Listening to the radio for information related to climate change and farming | 24        | 55.81      |
| Using mobile phone to collect information | 20        | 46.51      |
| collecting information from the Whatsapp group | 18        | 41.86      |
| collecting information from YouTube      | 14        | 32.56      |
| Attending group meetings                 | 35        | 81.40      |

Source : Field survey 2019

Farmers generally get information for farming when they meet their friends or neighbours. At each meeting, there is a habit of asking the conditions of their farms. The second way that they usually do is attending farmer group meetings. Group meeting forums such as farmer group meetings and community gatherings at the village level are the forums most widely used by farmers to gather information and find solutions for their farming practices. Research in Tanzania also found that farmers tend to rely more on interpersonal and face-to-face communication [9].
4. Conclusion

To be able to adapt to climate change and implement sustainable farming, information related to crop protection, climate change and product selling prices are very important for farmers. The sources of information that are most widely used by farmers to obtain the information related to climate change are fellow farmers, farmer groups and mass media. In the process of finding information, farmers tend to rely more on interpersonal communication and group communication in building their knowledge to adapt to climate change and ensure the sustainability of their farming practices.

5. Suggestion

Farmers seek information on climate change and sustainable farming more actively from their fellow farmers, farmer groups and mass media. Therefore, to further support sustainable agriculture and deal with climate change, it is suggested that the provision of information needed by farmers be given through the sources that are most widely used by them.

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