Dissemination model of understanding climate change using knowledge management systems

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Abstract. Climate change becomes a very complex and multidimensional issue, climate change will continue to be an interesting issue to study in relation to local policies, because besides climate change has global to local impacts, climate change can directly affect the condition of the natural environment and human behavior. The presentation in this paper aims to provide an overview of how the socialization of climate change issues carried out using information systems and technology can be successful by referring to knowledge development with data formed based on community perspectives. Factor analysis method is used to find the success factors of socialization in the face of climate change, then the regression analysis method is used to build a model of a number of variables that are formed from the analysis of output factors. The results of the study provide a number of new factors that can be represented as variables of public awareness of climate change, the process of socializing climate change and global warming, the availability of information systems and technology, and the management of knowledge management about climate change. The conclusion obtained from this research is that the momentum of the industrial revolution of the 4.0 era can be utilized to support the process of climate change socialization that is measured independently.

1. Introduction
Based on the 5th Study Report (Assessment Reports 5 or AR5) Intergovernmental Panel on Climate Change (IPCC), at the end of 2100, global temperatures are expected to be 1.8-4 °C higher than the average temperatures in 1980-1999. The process of global warming is mainly caused by the entry of heat energy into the ocean (approximately 90% of total warming), and there is evidence that the sea continued to warm during this period. The last three decades in a row warmer conditions than the previous decade. When compared to the pre-industrial period (1750), the increase in global temperature is equivalent to 2.5-4.7°C [1]. In addition to the increase in the earth's temperature, there has also been an increase in the frequency of heat waves and the intensity of rainfall in various regions. There is strong evidence that extreme temperature conditions, including hot days and heat waves, have become more common since 1950. Global drought trends are difficult to identify, but a number of regions clearly show more severe and more frequent droughts. Tropical storms of scale 4 and 5 are expected to increase in frequency globally. This expert's report specifically mentions that in the last ten years, in several regions in Indonesia has decreased the annual rainfall rate. While the average sea level rise in 1901-2010 was only 0.19 mm/year to 3.2 mm/year in the 1993-2010 period [2].
Climate change has an impact on global food security, in this case causing a decrease in global food crop production. Without adaptation efforts, production of key crops (such as wheat, rice, and corn) are projected to fall. Climate change is also projected increase the incidence of human movement
migration) and trigger conflict, triggering economic shocks and poverty. Climate change will also worsen human health problems and cause them health problems in various regions, for example through improvement heat wave and fire. The impact of climate change is projected slowing economic growth and making efforts to reduce poverty rates will be more difficult. Figure 1.

![Figure 1. Global Warming Impact](image)

On the other hand as we already know, knowledge management is known as systematic knowledge asset management in an organization that aims to create new innovations for organizational strategy development [3]. Another implication is that systems that support knowledge within organizations do not need to look. [4] defines KM as a collaborative tool for companies that facilitate organizations. Information flows both formally and informally within the organization. To support the government's program in anticipating climate change which will also have an impact on the community, it is necessary to conduct a socialization of awareness of climate change issues so that the community can further adapt to climate change. Socialization can also be built based on participants by implementing a knowledge management system (KMS) with specific substance on climate change [5].

2. Literature Review

2.1. Definition of Knowledge

Knowledge according to Nonaka and Takeuchi [6] is how that knowledge is produced, used, and disseminated in organizations and how that knowledge contributes to the spread of innovation. Meanwhile, according [7] Knowledge is the process of translating information and experiences of the past that can be used as a relationship, can be understood and applied by each individual. So that knowledge is considered an important thing by most organizations, because with existing knowledge an organization can continue to improve services to its customers. Knowledge can be divided into 2 types, namely tacit knowledge and explicit knowledge.

1. Tacit knowledge.

   Tacit knowledge is knowledge that is obtained based on experience or can also come from chats delivered by others without having a physical form. Usually this is like an idea or ideas.

2. Explicit knowledge.

   Explicit knowledge is knowledge that can already be expressed in the form of data, manuals, formulas, and so on. Explicit knowledge is obtained from sources that have physical or other delivery media such as notebooks, recordings, or even computer files.
2.2. Knowledge Management Theory
According to [8] Knowledge Management is one solution to help knowledge processing, so that an individual in an organization or company can have the same knowledge, then with the same knowledge it can help develop an organization or company [9]. This coordination can be achieved by creating, sharing, and applying knowledge by using the experience and actions taken by the company for the continuity of organizational learning. SECI Model is a knowledge framework created by Ikuijro Nonaka and Irotaka Takeuchi. The SECI Framework Model was created and used by Japanese companies [10].

![SECI Model](image)

**Figure 2. Knowledge Management Development**

3. Methodology
Literature studies are carried out using several sources from articles and books and general journals related to research. This literature study is useful to find out the theoretical basis and knowledge of external environment information and the internal environment within the company [11]. This research is quantitative research conducted to support of the climate change awareness through implementation of the knowledge management system base on Knowledge Management Life Cycle theory. Figure 3.

![KMS Life Cycle](image)

**Figure 3. KMS Life Cycle**

This study uses the factor analysis method with several stages as follows:
1. Make a Reliability Test based on the results of the questionnaire using SPSS software to find out whether the questionnaire is worthy of being used as research data or not.
2. Arranging the correlation matrix between each variable by determining the value of the Barlett Test of Sphericity used to determine and the measure of sampling adequacy test using Keizer Meyers Oklin.
3. Perform factor extraction against a set of variables that are formed so that one or more factors are formed.
4. Rotating factors to change factor matrices into simpler matrices so that it is easier to interpret using the varimax rotation method.
5. Naming new factors that have been formed based on predetermined variables.
6. Making factor scores for the needs of further analysis needed in this study.

Factor analyzes a number of independent variables from measurements and observations that emphasize the actual reality and analyzes the relationship between variables to determine whether the variations that appear on these variables are based on a number of basic factors of the existing variables [12].

4. Results and Discussion
The results of data processing carried out using the factor analysis method obtained optimal solutions to a number of independent variables resulting in the formation of 4 (four) variables that are eligible to become new variables. Table 1.

| Component | Total Eigenvalues (initial) | % of Variance | Cumulative % |
|-----------|----------------------------|---------------|--------------|
| 1         | 7.934                      | 33.060        | 33.060       |
| 2         | 2.791                      | 11.630        | 44.690       |
| 3         | 1.582                      | 6.593         | 51.283       |
| 4         | 1.262                      | 5.257         | 56.540       |

In developing climate resilient development systems, in addition carry out activities that can prevent and reduce risk current disasters must also be directed to anticipate changes in risk that will occur in the future through climate change adaptation efforts. Adaptation actions need to be done as early as possible so that the impacts of climate change in the future can be reduced. Delay in implementing adaptation efforts, will cause the impact of climate change in the future will be very large and the costs to be incurred in the future to overcome the effects of climate change will be far greater, even able to exceed the limits of existing capabilities. Strengthening synergies and coordinating climate change adaptation programs continue to be built both vertically between the central and regional governments, as well as horizontally by involving all sectors / parties concerned in the local area so that efficiency in the use of resources including budgets can be realized parties including governments, scientists, academics, non-governmental organizations, the business world and the general public. To ensure the sustainability of integrated climate change management programs and actions, the mainstreaming of climate change adaptation and mitigation issues into the preparation of the Plan Medium and Long Term Development, both in terms of national or regional.

The Kyoto Protocol regulates the mechanism for reducing GHG emissions implemented by developed countries, namely: (1) Joint Implementation, (2) Emission Trading; and (3) Clean Development Mechanism (CDM). joint implementation (JI) is a mechanism for reducing emissions across countries to divert emissions reductions through joint projects with the aim of reducing GHG emissions. Emission Trading (ET) is an emission trading mechanism conducted between industrial countries, where industrial countries whose GHG emissions are below the permitted limit can sell the excess emission shares to other industrialized countries that cannot fulfill their obligations.

Interpretation of the third factor related to systems availability. The 4.0 industrial revolution produced many sophisticated technological inventions. The technology brings the impact of rapid changes that can change human civilization. human daily activities can be greatly helped, time and cost efficiency makes the production process more profitable, etc. However, behind these advantages also have a
negative impact on human life, one of which has a negative impact and threatens the ecological sphere. Some of the threats posed include mass unemployment, economic imbalances and environmental damage.

Representation of the fourth factor related to knowledge management governance on climate change. Through a series of climate change policies, Indonesia has prepared several strategic documents related to handling the effects of change climate that focuses on mitigation, adaptation, and financing climate change programs in Indonesia. The nature of this strategic plan is a decentralized strategic plan, where the policy implications in such a system have its own challenges and potential in Indonesia.

In this case, in some provinces also included mitigation activities as part of the national action plan - greenhouse gas previously listed in the national action plan - greenhouse gas. Proposed national action plan - greenhouse gas activities are also generally proposed designed to involve funding sources not only from the budget but also from the government or from the private sector. These two action plans govern national and regional plans to compile emissions inventory data for each region which will later be used as a basis for calculating national emission reductions and priorities regional development. In the plan. Each region is required to design their regional emission reduction plan while adhering to regional development priorities. Sources of funds for national action plan - greenhouse gas activities come from various sources, including the National Budget, Regional Budget, private sector, community, and international donors. Figure 4.

![Figure 4. Factors that influence climate change by utilizing a KMS.](image)

And the predictive every variable can be shown at the Table 2.

| Variabel | Predictive Sign | \( \beta \) | Minimum | Maximum |
|----------|----------------|------------|---------|---------|
| (Constant) | + | 4.753 | 0.000 | 10.000 |
| \( X_1 \) | + | 0.258 | -2.024 | 2.913 |
| \( X_2 \) | + | 0.164 | -2.357 | 2.981 |
| \( X_3 \) | - | -0.036 | -2.213 | 2.266 |
| \( X_4 \) | + | 1.372 | -2.275 | 2.884 |

\[ Y = 4.753 + 0.258 \ X_1 + 0.164 \ X_2 - 0.036 \ X_3 + 1.372 \ X_4 \]
With the following conditions:

\begin{align*}
-2.024 \leq X_1 &\leq 2.913 \\
-2.357 \leq X_2 &\leq 2.981 \\
-2.213 \leq X_3 &\leq 2.266 \\
-2.275 \leq X_4 &\leq 2.884
\end{align*}

\[ Y = \text{Critical success factor of climate change} \]
\[ X_1 = \text{Community awareness} \]
\[ X_2 = \text{Un-Sosialized} \]
\[ X_3 = \text{Systems Unavailability} \]
\[ X_4 = \text{Climate change knowledge} \]

And the result of Model simulation can be shown at the Table 3.

**Table 3. Model Simulation of Climate change awareness**

| Simulation   | Average | X1  | X2  | X3  | X4  | Y   |
|--------------|---------|-----|-----|-----|-----|-----|
| Current      | 4.753   | 0   | 0   | 0   | 0   | 4.753 |
| Optimum      | 4.753   | 2.913 | 2.981 | -2.213 | 2.884 | 9.279 |
| Unexpected   | 4.753   | -2.024 | -2.357 | 2.266 | -2.275 | 0.640 |

5. CONCLUSION
Model simulation results show that the current understanding of society related to climate change is at a low level or is at a value of 4.753 on a scale of 0.000 – 10.000. However, these conditions can be improved by taking into account the factors of public awareness, the process of socialization, the availability of socialization aids, and the management of socialization materials related to climate change, so as to reach the optimum value of 9.279 on a scale of 0.000 – 10.000. Conversely, if climate change socialization is not carried out, then community understanding will decrease and the value decreases until it reaches 0.640 on a scale of 0.000 – 10.000. By looking at this condition, it is necessary to immediately make an effort to socialize by utilizing all available resources including artificial resources, namely information technology to accelerate the level of understanding of climate change that is controlled and sustainable.

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