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An Analysis of Effective Factors in Public Awareness Campaigns through Facebook: Focus on Fine Dust Issues

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Abstract: *In this study, we analyzed the factors that affect public awareness campaigns on social media platforms and developed an integrated model for measuring the persuasiveness of environmental social media campaigns. A survey questionnaire was created and distributed on Facebook with the goal of reaching individuals in their 20s and 40s in Vietnam, and 395 valid replies were gathered. The findings showed that the STOPS was reconfirmed as a suitable theoretical framework for analyzing the public's behaviour intention to conduct information related to the issue of fine dust, especially on social media. Furthermore, it also showed that social media efficacy has a moderating effect on the relationship between public's situational recognition and informational behaviour intention. This suggested that through social media platforms, personal characteristics play a vital part in developing effective environmental campaigns. Implications for both theory and practice were discussed.*

Keywords: Risk communication; Situational theory of problem solving; environmental campaign; Fine dust issue; Social media campaign; Facebook

1. Introduction

After the Industrial Revolution, day by day human economic activities make more and more, of a bad effect to nature and occur plenteous serious environmental issues such as climate change (global warming), air pollution, water pollution, etc. These environmental risks are very important problems that can lead to serious disasters if left unattended for a long period of time. However, these consequences are gradual and cumulative. Therefore, the public has not received much attention in the past, but in recent years, awareness of environmental issues and risks have increased, including interest in environmental risks.

Among various of environmental risk issue, in recently, the most attention has been given to the air pollution and fine dust issue. According to the World Health Organization (WHO)'s global health crisis report, nobody is safe from air pollution, the United Nations warned on World Environment Day, with nine out of 10 people on the planet now breathing polluted air. This has led to a growing, global health crisis, which already causes about 7 million deaths per year [1]. According to IQAir's world air quality report in 2019, 97% of cities in low- and middle-income countries with more than 100,000 inhabitants do not meet the WHO minimum air quality levels. Especially, air pollution levels remain dangerously high in many parts of Asia [2].

Among various developing countries, especially in Asia where air pollution levels remain dangerously high, the status of air pollution in Vietnam is alarming. The 2014 Environmental Performance Index (EPI, as developed and monitored by Yale University) ranked Vietnam 170 out of 178 countries for air quality, thus including Vietnam among the 10 worst countries for air pollution [3]. According to the data reported by World

Health Organization (WHO) in 2016, it showed that more than 60,000 deaths were from heart disease, stroke, lung cancer, chronic obstructive pulmonary disease and pneumonia in Viet Nam were linked to air pollution [4]. In addition, based on IQAir's report in 2019 about worldwide air quality, it said that Hanoi city – capital of Vietnam, ranked 3th in the top 10 most polluted cities in the world [2]. By analysis case study about fine dust issues in Vietnam, it is hoped that the results of this study can be generalized and applied practically in the field of risk communication related environmental issues in other countries.

In recent years, with the high internet dissemination, social media users have rapidly increased. The general public is not only passive audience that receipt information from mass media by one-way, but also much more actively in producing information and sharing information through exchanges with others. Therefore, nowadays social media is not only media channel, it can also be perceived as a source of information by the audience. Such changes in the media environment and the audience's usage behavior ask public campaign communicators to understand social media characteristic, and to consider specific communication strategies. Therefore, this study purposes to empirically analyze the factors impact on public awareness campaigns in social media platforms, and develop an integrated model for measuring the persuasion effect of environmental social media campaigns.

2. Materials and Methods

2.1 Literature Review

Given that many environmental problems are due to human activities, scholars and policymakers alike have urged individuals to take responsibility in mitigating environment pollution [5]. Individuals can adopt various environmentally responsible behaviors, such as a shift in consumption patterns and environmental activism, in order to sustain the environment [6, 7]. Other than a few notable exceptions, many existing studies did not consider other potential factors that may influence behaviors, such as subjective norms, mass media use, interpersonal communication, and media dependency [8,9].

On the other hands, several studies have shown that providing more and better information is not sufficient to shape an effective communication in terms of raising awareness and promoting active engagement [10, 11]. Trolliet et al. (2019)'s research based on Prochaska's behavioral stage of change model, also shown that to making public move from awareness of risk issue to concrete action, communicators should not only focus on providing information, but also taking into account emotions and cognition mechanisms in order to accompany people to better process the information and integrate it [12].

Environmental communication through the mass media is tremendously important in imparting this knowledge, consolidating these frames and values, as well as showing various possibilities of action. Recently, with the fast generalization speed of the internet, social media became a new media channel and has been becoming more and more integrated within the distribution and consumption of news and information. Molodtsova et al. (2013) show that the number of tweets on climate change correlates with extreme weather events, a correlation that also holds for opinion polls on climate change [13]. Olteanu et al. (2015) had tried to compare environmental issues news coverage, in mainstream news and social media and found that there are many gaps between two types of media channels [14].

In the meantime, communication research on environmental risk issues has been mainly discussed on the subject of nuclear power generation or global warming, but as the technology development is intensifying, new types of environmental risk problems are increasing, so the need for research on these new environmental risk problems is raised. In particular, in the case of fine dust, the interest and perception of the public are increasing

rapidly, so it can be considered as a very timely study to see what communication behaviors are appearing according to the public's perception of danger.

In risk communication field, Kim & Grunig (2011)'s Situational Theory of Problem Solving has been proven and applied to various social issues, based on the merit of being able to explain the public's perception and information behavior intention that can be formed differently according to a problem [15]. Example, Kim, Shen, & Morgan (2011) analyzed problem synchronization and information behavior intention by applying Situational Theory of Problem Solving to public health issues on organ donation and bone marrow deficiency [16]. It has been verified that constraint recognition has a significant impact on the public's intention to act on information. In addition, related to organ donation issues, problem chain recognition effect is recognized when the public becomes active public. Kim et al. (2012) applied Situational Theory of Problem Solving to the controversy over US beef imports and mad cow disease issues, created hot issue publics through public situational awareness of issues [17].

Based on the previous studies, it can be seen that Situational Theory of Problem Solving is a very useful theoretical framework for explaining public perception and dynamic communication behavior that can be formed differently according to social issues. It is also possible to discuss the application of the Situational Theory of Problem Solving to the issue of fine dust as an environmental risk factor, which is the social problem to be addressed. As discussing above, the following research model and research hypotheses are presented.

Hypothesis 1. The higher problem recognition, involvement on fine dust, and the lower constraint recognition, the more positive effect on the situational motivation of problem solving.

Hypothesis 2. The higher situational motivation of problem solving, the more positively it will have an impact on informational behavior intention (information acquisition, information selection, information transmission) on fine dust problem.

Hypothesis 3. The higher referent criterion on fine dust problem, the more positively it will have an impact on informational behavior intention (information acquisition, information selection, information transmission) on fine dust problem.

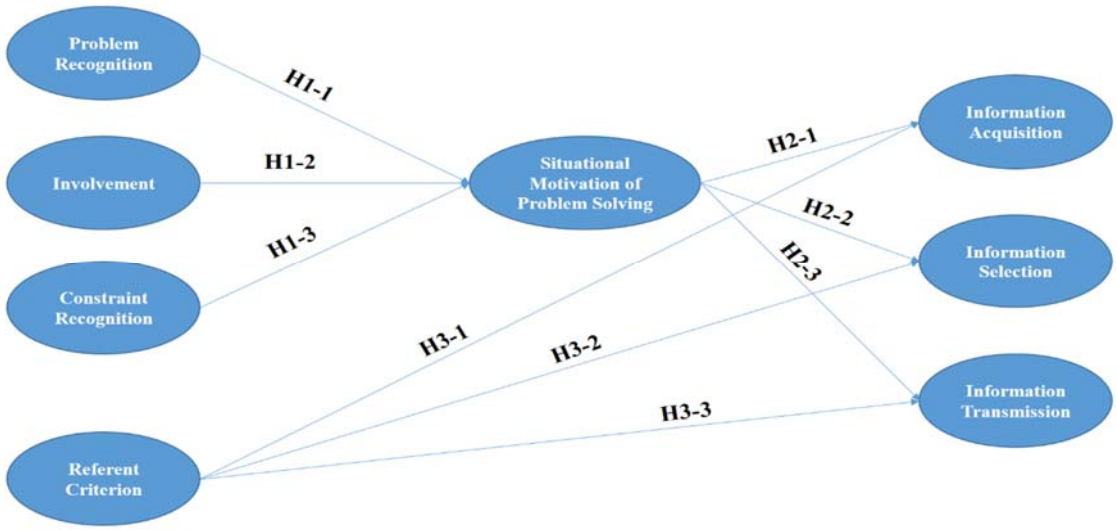

Figure 1. Research model.

In additionally, it is necessary to examine not only the perception of the risk situation, but also the various out-of-context factors that may affect the public, in order to enhance the explanation of the intention of

information behavior in the public. In this study, I will extend the meaning of the theory by including the self-efficacy of the study in discussion.

Among the various inclinations of the individual who can influence the problem situation, the main concept of psychology and pedagogy is the self-efficacy. Efficacy is a judgment and belief about an individual's ability to perform an action successfully when an individual wishes to achieve something [18]. In applying to problem situations, self-efficacy is a belief in one's ability to do the necessary actions to solve a problem. Ultimately, this study intends to examine the public's intention of information behavior in risk, so it is necessary to examine in detail the personal characteristic factors that may influence this from a communication perspective. In order to elaborate the explanatory power of public information behavior intention in the problem situation by including social media efficacy, which has been mainly dealt with as factors of personal characteristics, which can affect public's information behavior in previous studies. Therefore, in this study, social media efficacy, which is personal characteristic factor was examined to further verify the effects of these personal characteristic factors on the relationship between public recognition of problem situation and intention of information behavior.

With the proliferation of social media, many scholars are suggesting media literacy, ICT literacy, information literacy, etc., which are necessary in the environment of social media. Cho (2012) defined that social media efficacy is the ability to read and write media messages, which not only increases the usability of social media, but also drives new social values and changes that can reduce the negative effects of social media [19]. Accordingly, social media efficacy can be divided into two main categories: the first is the instrumental or technical view of whether you can get the information you need correctly and sufficiently, and the second is the correct information from various sources. In order to explore the moderating effect of social media efficacy on the relationship between public's situational recognition and informational behavior intention, the following research question was conducted.

Research Question 1. What is the effect of social media efficacy on the relationship between situational recognition on fine dust problem (problem recognition, involvement, constraint recognition, referent criterion, solving motivation) and informational behavior intention (information acquisition, information selection, information transmission)?

2.2 Methods

This study investigates the public's online informational behavior intention in social media platforms according to the situational awareness on fine dust issue and the personal characteristics factors. Among plenty social network platforms, according to Statista report in 2021, Facebook is the largest social media platform in the world, has over 2.7 billion monthly active users [20]. Therefore, I chose Facebook as target of examination about social media platform by online survey method for the general public, and the survey will be conducted using the structured questionnaire that be extracted through prior researches. Investigation by a questionnaire survey is conducted and randomly sent through Facebook messages, counting towards 863 users, who following and participating in the environment community on Facebook. The investigation got 431 responses and a total of 395 responses are used for final analysis after excluding unfaithful responses.

All of the measures scales that used by Kim & Grunig (2011)'s Situation Theory of Problem Solving – problem recognition, constraint recognition, referent criterion, involvement, situational motivation, communication behavioral intention will be used in this study. In this study, the questions used by Kim and colleagues (Kim et al., 2012) were modified to fit this paper and used to measure the public's awareness of fine dust issues as environmental risks. Thus, the following questions: 1) problem recognition ("I think fine dust

problem is a serious social problem",," Governments and related organizations should pay more attention to fine dust", "Something needs to be done to reverse the fine dust problem trend"); 2) involvement ("Fine dust problem is related to me", "Fine dust problem can affect me and people around me", "I am interested in the matters related to fine dust problem"); 3) constraint recognition ("I can't impact fine dust problem through the actions I take in my everyday life. ®", "The actions I take won't matter unless people in other parts of the world change their ways first. ®", "I think the government and related organizations don't have reflected my personal opinion on the fine dust problem. ®"); 4) referent criterion ("I know enough about fine dust problem to know what needs to be done – or not done", "I am very confident about my opinion regarding fine dust problem", "Direct and indirect experience in the past has provided me directions to solve the fine dust problem"); 5) situational motivation ("I am curious about fine dust problem", "I frequently think about fine dust problem", "I would like to better understand fine dust problem") were used as specific measurement.

Additionally, for the measurement of personal characteristic variable such as social media efficacy, the items used in the research of Kim et al. (2012) were modified to fit this paper [17]. Thus, the following questions "I can find the information necessary for fine dust problem through social media", "I can understand exactly what information about fine dust problem from social media conveys", I know how to get the information needed for fine dust problem on social media" were used as specific measurement. All of the measures scales has reliability coefficient was higher than 0.7, indicating a suitable criterion (Cronbach's $\alpha > .7$).

In order to verify the validity of the measurement tool for independent variables and dependent variables, the centralized validity was evaluated. As a result of the analysis of each potential factor, all of them have average variance extracted (AVE), and construct reliability (CR) values met the evaluation standard (AVE > 0.5, CR > 0.7) to ensure the concentration validity, so it was judged that all of measurement tools had been verified.

Next, to evaluate the fit of the structural equation model, it is recommended to present as many indexes as possible such as the absolute fit index and incremental fit index. Among them, RMSEA (Root Mean Squared Error of Approximation) and CFI (Comparative Fit Index) are recommended as relatively desirable fit index. The fit indexes of the research model are shown as follows: χ^2=210.459, df=64, p=.000, RMR=.160, GFI=.933, AGFI=.89, RMSEA=.076, NFI=.944, TLI=.943, CFI=.960. As this results, the RMSEA (RMSEA = .076) and CFI (CFI = .960) indexes met the acceptance standard [21].

3. Results

In this study, to investigate the public's online information behavior intention in social media platforms according to the situational awareness on fine dust issue, an online survey is conducted on Facebook from 2020 April 10 to 2020 April 20. After conducting online survey, the researcher obtained 431 responses and a total of 395 responses are used for final analysis after excluding unfaithful responses. The demographic characteristics of the 395 survey participants in this study were as followed. The gender of respondents is 224 males (56.7%) and 171 females (43.3%). About the age of respondents is 192 people (48.6%) between 20-29 years old and 136 people (34.4%) between 30-39 years old and 67 people (17%) between 40-49 years old. About education of respondents is 36 people (9.1%) graduated from high school, 221 people (55.9%) graduated from university and 138 people (34.9%) graduated from graduate school or higher. About occupation of respondents is 139 government employees (35.2%), 126 office workers (31.9%), 39 self-employees/freelancers, 77 students (19.5%), 6 farmers/fishermen (1.5%), 7 housewives (1.8%), and 1 unemployed/other (0.3%). Monthly average income of respondents is 85 people (21.5%) earn less than 5 million vnd (approx. $214), 116 people (29.4%) earn from 5 million to 10 million vnd (approx. $214 ~ $428), 82 people (20.8%) earn from 10 million to 15

million vnd (approx. $428 ~ $642), 38 people (9.6%) million from 15 million to 20 million vnd (approx. $642 ~ $856) , and 74 people (18.7%) earn more than 20 million vnd (approx. $856). About residence of respondents is 336 people (85.1%) live in city and 59 people (14.9%) live in rural.

3.1 The causal relationship between situational recognition and informational behaviour intention

The text continues here. To verify the causal relationship between the situational recognition, the informational intention, and public's communication intention on social media the structural equation model analysis was conducted. Hypotheses verifying results were shown in Table 1.

Table 1. The causal relationship between situational recognition and informational behaviour intention

Path	Hypothesis	Standard path coefficient	S.E.	C.R.	P	Results
1-1	problem recognition → situational motivation	.068	.055	1.252	.210	not supported
1-2	involvement → situational motivation	.586	.055	8.594	***	supported
1-3	constraint recognition → situational motivation	.074	.054	1.656	.098	not supported
2-1	situational motivation → information acquisition	.891	.086	11.639	***	supported
2-2	situational motivation → information selection	.829	.073	11.171	***	supported
2-3	situational motivation → information transmission	.697	.093	10.387	***	supported
3-1	referent criterion → information acquisition	.103	.033	2.475	.013	supported
3-2	referent criterion → information selection	.046	.031	1.015	.310	not supported
3-3	referent criterion → information transmission	.186	.045	4.010	***	supported

*** p<.001

The research results can be confirmed with the following model.

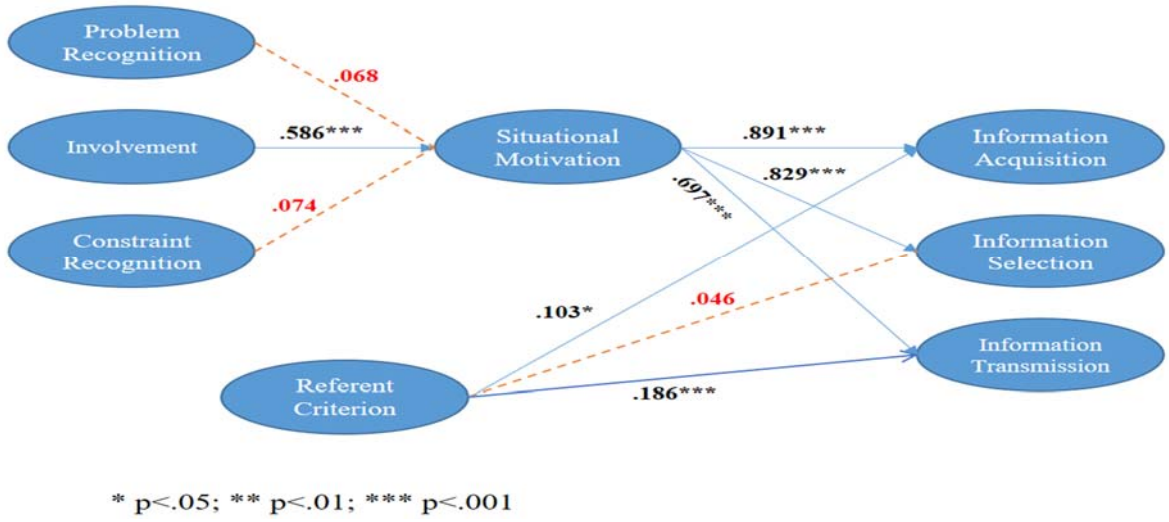

Figure 2. SEM analysis result of Research Model.

3.2 Moderating Effect

All figures and tables should be cited in the main text as Figure 1, Table 1, etc. Firstly, before examining moderating effect, measurement equivalence was verified. Measurement equivalence is t o judge whether measurement models obtained from different populations show the same result [22, 23]. As analysis results, in the case of social media efficacy variable, there were no significant difference between unconstrained model (model 1) and factor loading constrained model (model 2) ($\Delta\chi^2$=6.329, df=6; <12.59). Since this means that the two groups (high efficacy – low efficacy) recognized the measurement tools equally, so the measurement equivalence of the factor loading was verified, therefore the next step, multi-group path analysis, was performed.

Secondary, to testing the moderating effect of these variables, multiple group structural equation modeling analysis was conducted. Each moderating variable was divided into two groups, high and low collective, and comparisons were made between groups for each route in research model. In order to examine whether the differences in the paths between groups are statistically significant, there are several methods such as the method of confirming by conducting a structural model analysis on the free model and constraint model and then performing χ^2 difference verification or the method of checking the C.R. value between path in analysis result provided in Pairwise Parameter Comparisons of Amos output. If the C.R. value between path is over than ±1.965, it shows that analysis result was statistically significant [24]. A comparison of unconstrained model and constrained model for a total of 9 paths was performed and analysis results to be shown in Table 2 as follow.

Table 2. The moderating effect of social media efficacy

No.	Path	Standard Path Coefficient		C.R. Between paths
		High Efficacy	Low Efficacy	
1-1	problem recognition → situational motivation	**.335*** **	-.050	**-3.738***
1-2	involvement → situational motivation	**.363*** **	**.619*** **	.841
1-3	constraint recognition → situational motivation	-.005	.004	.106
2-1	situational motivation → information acquisition	**.850*** **	**.909*** **	**2.315***
2-2	situational motivation → information selection	**.823*** **	**.810*** **	.492
2-3	situational motivation → information transmission	**.754*** **	**.640*** **	-.696
3-1	referent criterion → information acquisition	**.169***	.020	-1.29
3-2	referent criterion → information selection	-.015	.014	.301
3-3	referent criterion → information transmission	.097	.082	-.244

* p<.05, ** p<.01, *** p<.001

As analysis results shown in Table 2, based on C.R. value between paths, it found that social media efficacy was found to play a moderating role in the influence of problem recognition on situational motivation of problem solving. Further, social media efficacy was also found to play a moderating role in the impact on the casual relationship between situational motivation and information acquisition.

The different of impact on all regression paths of each group can be performed in following model.

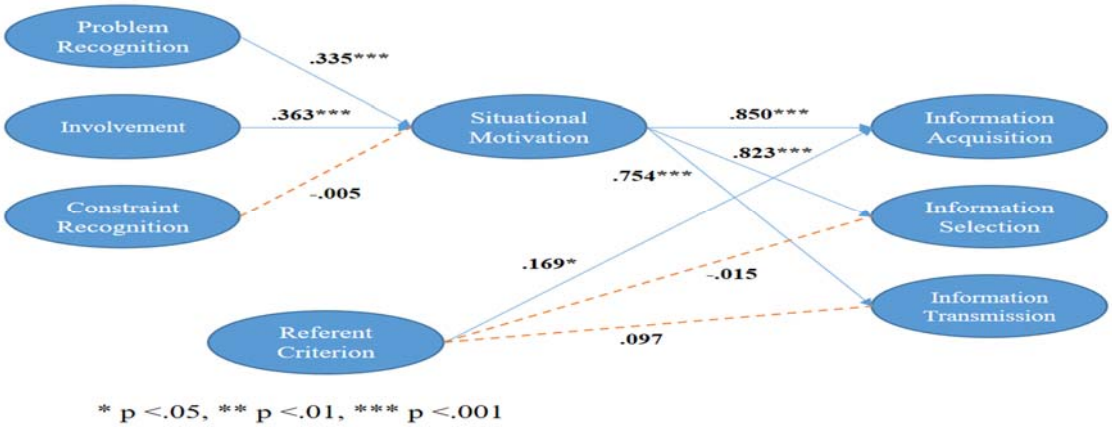

Figure 3-1. SEM analysis result of social media high efficacy group (N=209).

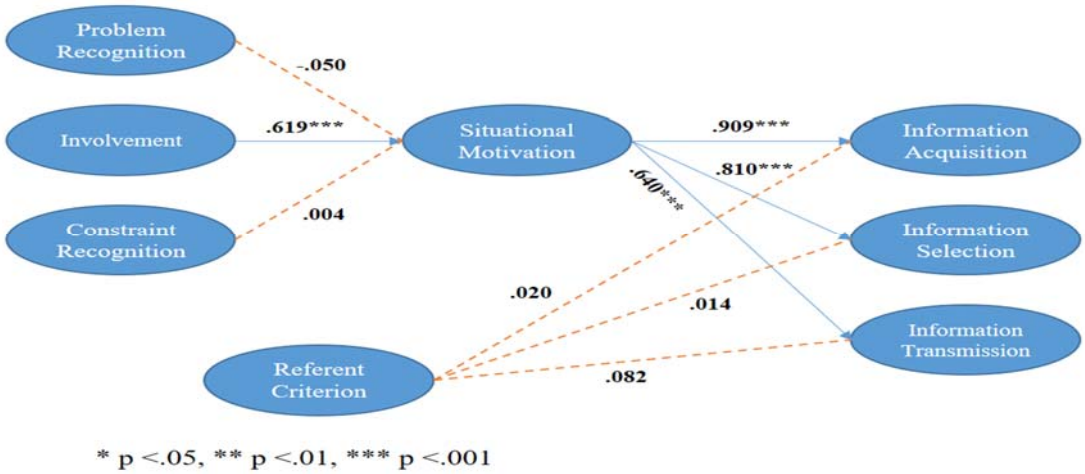

Figure 3-2. SEM analysis result of social media low efficacy group (N=186).

4. Discussion

By applying Situational Theory of Problem Solving, this study examined the effect of situational recognition related problem on the public's informational intention and communication intention on social media platform. In addition, personal characteristic is additional analyzed as moderator variable in order to verifying the influence of the variable outside the context. The main findings can be summarized as follows.

First, it was confirmed that the higher degree of involvement between fine dust problem with oneself, the more motivation of solving fine dust problem increased. It means, in order to increase the effectiveness of campaigns on fine dust issue, it is necessary to improve the public's involvement on this problem. Since, if they feel that this problem has effect directly on themselves' life, they will get more actively motivation to solve it. Specifically, different to existed Situational Theory of Problem Solving's hypothesis, in this study, it was not found the significant effect of public's problem recognition and constraint recognition on solving problem motivation. To explain this result, the public's perception of risk is not only merely judged by itself, but also appears differently according to involvement and optimism bias [25]. Public have a tendency to evaluate positively for themselves and negatively for others when making judgments, which is called optimistic bias for risk. Therefore, in this study, the risk recognition of the fine dust problem was influenced by the optimistic bias and involvement. Therefore, it did not effect on the motivation of solving problem according to the existed

theory. This result suggests that in Vietnam, when conducting campaigns on fine dust issue or other environmental issues, communicators need to enhance public's involvement and control optimistic bias to increasing the seriousness of risk problem which public recognized.

Secondary, the situational motivation of solving fine dust problem was found to have a significant effect on all factor of public's informational behavior intention. In other words, if situational motivation of solving fine dust problem increase, there is a tendency to actively handle information related to fine dust in social media. It means, the more situational motivation it has, the more actively behavior intention of information related fine dust problem on social media it makes. Such as increasing acquisition intention to paying more attention or finding information related to fine dust, increasing selection intention to accepting information or screening useful information, increasing transmission intention to communicating or discussing to others about fine dust problem on social media. Especially, situational motivation of solving fine dust problem has the most impact on information acquisition and the less impact on information transmission. Therefore, in the first step of campaigns on fine dust issue, in order to attract public's concern or persuade public to accept the information on social media related fine dust issue, it is necessary to increase the situational motivation, that means, need to increase public's involvement on this issue as the above result suggested.

Thirdly, the referent criterion which is the knowledge or experience public have about the fine dust problem, was found to have a partly significant effect on public's informational behavior intention. Concretely, the higher referent criterion related to solve the fine dust problem make the intention of public to acquire information and transfer information about fine dust problem in social media increase. In other words, public's existed knowledge or experience about fine dust issue also has positive effect on behavior intention of information processing on social media. Therefore, it requires effort to improve public's knowledge about fine dust issue or increasing experience on this issue through online or offline conferences, making experience events about fine dust's damage by VR technology or host the talk shows of the reality victims who got diseases because of fine dust. Since public's refer criterion about fine dust issue increased, they will have more positively behavior intention on finding useful information about this problem and sharing it to surroundings on social media.

Finally, the moderating effect of social media efficacy was found. When comparing the change of the statistically significant of paths on structural equation model, it found that high social media efficacy group has stronger impact on the relationship between problem recognition and motivation in solving fine dust; also, between referent criterion and information acquisition than low efficacy group. This result suggests that, with the public target who have high social media efficacy, can consider as social media users who often comment to express their perspective or participate on discussing actively, communicators need to focus on enhancing their problem recognition and referent criterion by providing more knowledge on fine dust issue. So that, they can feel and recognize this issue more seriously and they will get stronger motivation to solve it and it leads to behavior intention of finding more useful information related this issue. Moreover, social media efficacy also was found that it has moderating effect on the relationship between situational recognition and informational intention. It means, personal characteristics play a very important role that can have a direct influence as well as a regulatory effect in the activeness of online information behavior of the public on the problem of fine dust. Accordingly, in order to induce the public to actively act on information related the fine dust problem, it requires the efforts to increase the public's social media efficacy on environmental issues as well as the public's situational awareness of the risk problem.

5. Conclusions

In this context, this study is meaningful in that it has drawn and verified an integrated model based on existing theories of factors that can affect public communication behavior on social media after public have contacted with campaigns. In particular, through consideration of the suitability of the structural model for the transition paths to induce the actions to mitigate environmental problems, consideration of specific communication behaviors of the public, and the causal relationship between factors related to problem recognition and the media. It gave implications for conducting customized campaigns of the specific targeting social media public. It made guideline for deducing the message to be emphasized and the effective strategic plan in order to induce specific online information behavior and communication behavior during the campaign.

Despite the various implications of this study mentioned above, this study has some limitations. Since the fine dust issue has a geographical and environmental specificity, it is necessary to additionally examine the influence of various variables and various countries reflecting this specificity in subsequent studies. Accordingly, in the future, cultural and economic factors can be found through comparative analysis between countries that are being affected by the problem of fine dust, this can provide useful practical implications to communicators when establish environmental campaigns. Secondary, this study was conducted survey examination only on the Facebook platform and generalized for social media application. However, on social media, each platform has itself characteristics and different target so in the future, subsequent studies need to diversify investigation platforms or make comparison analysis between online and offline campaigns to expand the theoretical framework on understanding public's behavior intention on social issues solving.

Conflicts of Interest: The authors declare no conflict of interest.

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