

Underlying Gaps between Environmental Knowledge and Behavior in the City of Toyota: Phase III

Hiroshi Ito¹

¹ Faculty of Economics, Nagoya University of Commerce and Business, Nisshin, Japan

Correspondence: Hiroshi Ito, Faculty of Economics, Nagoya University of Commerce and Economics, Nisshin, Aichi, Japan. Tel: 1-613-947-3592. E-mail: hito@nucba.ac.jp

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Abstract

This study analyzes underlying gaps between environmental knowledge and behavior in the city of Toyota. A previous study suggested that citizens' environmental knowledge of some eco-items comprising the city's eco-policy significantly improved since it was designated as an environmental model city by the Japanese government in 2009. However, other studies suggested that citizens do not seem to act on these eco-items. Through a questionnaire with 133 Toyota citizens, this study explores possible reasons why citizens do not take action while knowing these eco-items. The findings suggest that the majority of respondents do not act on eco-items for economic reasons. For instance, buying a next generation car or a smart house is costly. Perhaps the city government should first focus on promoting Ecoful Town or addressing the heat island effect because they are relatively easy to deal with.

Keywords: Toyota City, Eco-policy, Environmental Knowledge, Environmental Behavior

1. Introduction

Toyota City has been making considerable efforts to promote its eco-policy. The city has long been facing and addressing environmental issues in large part because of industrial activities by the Toyota Motor Corporation (TMC) and its affiliated companies. The city government elaborated on and implemented action plans to improve the environment in the 1990s and 2000s. Toyota City was then designated by the Japanese government in 2009 as one of the environmental model cities (EMCs) (Toyota City, 2009).

A previous study on citizens' eco-awareness in Toyota City's eco-policy that took place between 2012 and 2015 showed that although many respondents recognized some eco-items comprising the city's eco-policy such as Ha:mo (a car-sharing system using compact vehicles for urban short-distance transportation) and the smart house, as will be described later, they do not act on them: they do not use Ha:mo or live in a smart house (Ito & Kawazoe, 2016).

Subsequently, a pilot research project was launched to explore possible reasons for this lack of action (Ito, 2017a). Through a focus group with members of the largest, environmental NPO based in Toyota City, this study suggested that citizens do not act on eco-items solely because of ecological or economic reasons but rather a mixture of both as well as other reasons (e.g., safety and convenience). Also, whereas citizens do not seem fully engaged in the 'eco-items' defined by the city's eco-policy, a more careful examination about their actions suggested that they actually take action in ways that approximate the eco-items. For instance, few citizens own smart houses, but some renovate their houses to make them more environmentally friendly. Installment of solar panels is a prime example. The study concluded that Toyota City perhaps would need to broaden the ways that citizens can reasonably act on the eco-items. Although the pilot study was useful as a first step to explore reasons why citizens do not act on eco-items, the study had several limitations: the number of participants was limited, as a focus group interview was employed, and the participants were from a single environmental organization in Toyota City.

Within this context, a second pilot research project was conducted to further examine reasons why citizens take or do not take action on eco-items while they are aware of them (Ito, 2017b). This study used semi-structured interviews with 29 Toyota citizens who participated in an eco-event called *Inaka to machi no bunkasai* (Cultural festival of rural and urban areas) in Toyota City in November 2016. This study confirmed the previous study. For

example, citizens do not buy next generation cars (NGCs) due to their high costs (i.e., NGCs are expensive) and safety concerns (i.e., *Kei*, light gas fuel cars, are easier to drive); citizens do not go to Ecoful Town because it is located far from their homes and they lack information about Ecoful Town; citizens do not live in smart houses because they have recently built houses or live in apartments/mansions, as well as smart houses are expensive; citizens do not use Ha:mo due to reasons of inconvenience (i.e., Ha:mo stations are not close to their homes) or the troublesome registration process; citizens do not have the Eco-Family Card because the card has a “one card per family” policy; citizens do not take any countermeasures against the heat island effect because they do not know what they can do. The study also provided some new insights into citizens’ actions: citizens go to Ecoful Town because they can try Mirai (a TMC’s NGC) and also receive eco-points. Given the research methodology, the small sample size, and characteristics of respondents (those who came to the eco-event), this study was still exploratory in nature and did not intend to generalize the environmental knowledge and behavior of all Toyota citizens. Instead, its main purpose was to help construct survey questions for a generalizable study at a larger scale in the future. The current research is the extended questionnaire research based on these pilot studies.

This study focuses on three eco-themes that Toyota City supports to promote its eco-policy: transportation, the urban center, and public welfare and livelihood because these three are the most familiar eco-themes to citizens (Ito and Kawazoe, 2016). Transportation variables consist of knowledge of next generation cars (NGCs) and Ha:mo. NGCs include electric vehicles (EVs), hybrid electric vehicles (HEVs), and plug-in hybrid vehicles (PHVs). Ha:mo is a car sharing system that uses compact EVs for urban short-distance transportation. The urban center variables consist of knowledge of Ecoful Town and the heat island effect. Ecoful Town is a pavilion showcasing eco-living that demonstrates how Toyota City tackles challenges and elaborates on eco-strategies. As in any other urban areas, the heat island effect is an issue in Toyota City because it causes air pollution and deteriorates soil quality (Toyota City, 2016). Public welfare and livelihood variables consist of the smart house and eco-points/eco-family cards. The smart house is a residential building that emits reduced CO₂ gas emission and saves energy through the use of renewable energy sources and monitoring of energy consumption (Kim et al., 2015). Eco-points can be accumulated when the eco-family card is presented at certain places such as Ecoful Town and greenly affiliated stores. These points can be exchanged for certain goods, such as stationery, bus tickets, or gift vouchers.

2. Literature Review

2.1 Environmental Knowledge

Environmental knowledge is defined as general knowledge of facts, concepts, and relationships concerning the natural environment and its major ecosystems (Fryxell & Lo 2003). Cheung et al. (2015) define environmental knowledge (EK) as the recognition of issues related to the environment and note that it is the source from which environmental attitudes are cultivated. They continue to state that “Individuals with a high level of EK would be expected to know what should be done to resolve environmental problems and understand the benefits of responsible behavior as it relates to the environment” (Cheung et al., 2015, p. 508).

The knowledge-attitude-behavior (KAB) approach assumes that behavioral changes are brought about by increasing public knowledge about an issue via positive attitudes toward the environment (McKenzie-Mohr 2012). De Haan and Kuckartz (1996), for example, describe causal relationships between these dimensions: 1) Environmental knowledge produces positive environmental attitude; 2) Environmental attitude influence environmental behavior; and 3) Environmental knowledge directly influences environmental behavior. The linear (KAB) model that environmental knowledge leads to pro-environmental behaviors has been criticized because the reality is not likely to be that simple. Nonetheless, according to Kollmuss and Agyeman (2002), most environmental actors such as governments and NGOs “still base their communication campaigns and strategies on this assumption” (p. 246).

Robelia and Murphy (2012) argue that discussing how to mitigate the greenhouse effect, for example, “may not be meaningful if one has not encountered the term” (p. 301). Gifford and Nilsson (2014) also state that “making informed pro-environmental choices is difficult if one has incorrect or no knowledge” (p. 142). Therefore, knowledge should be one of the preconditions toward pro-environmental behavior (Jensen 2002; Panth et al. 2015).

2.2 Environmental Attitudes

Boenigk and Möhlmann (2016) regard attitudes as a major predictor of behavioral intention. According to Panth et al. (2015), environmental attitudes are the collective beliefs, affect, and behavioral intentions a person holds regarding environmentally related activities or issues. Environmental attitudes involve the psychological tendency, with cognitive, affective, and behavioral elements, to favor or disfavor some environmental behaviors

(Martinez et al., 2015). Environmental attitudes consist of environmental awareness and concern (Kollmuss and Agyeman, 2002).

Environmental awareness is defined as a measure of one's ability to understand the nature of environmental processes and problems, his or her degree of concern for environmental quality, and the extent to which one is committed to environmental behavior in daily life (Yeung 1998). Environmental concern refers to "the degree to which people are aware of problems regarding the environment and support efforts to solve them and/or indicate a willingness to contribute personally to their solution" (Dunlap and Jones 2002, p. 485). Individuals with strong pro-environmental attitudes are more likely to engage in pro-environmental behavior (Kollmuss and Agyeman 2002) because as Olsson et al. (2016) note, attitudes include behavioral as well as affective aspects.

2.3 Environmental behaviors

Pro-environmental behaviors are environmentally friendly "behaviors that can contribute to reduction of current environmental burdens" (Kurisu 2015, p. 1). In addition to reducing negative impacts on the environment, some argue that pro-environmental behaviors imply behaviors or actions that intend to improve the environment. Steg and Vlek (2009) define pro-environmental behavior as a "behavior that harms the environment as little as possible, or even benefits the environment" (p. 309). Sawitri et al. (2015) also note that pro-environmental behavior is "conscious actions performed by an individual so as to lessen the negative impact of human activities on the environment and to enhance the quality of the environment" (p. 28). The ultimate purpose of eco-policies is thus to enable citizens to acquire pro-environmental behavior.

In the context of Toyota City and this study, environmental knowledge refers to the knowledge of eco-items comprising the city's eco-policy—namely, eco-policy knowledge. According to Phillips, Bonney, & Shirk (2012), only those behaviors that are relevant to project activities (eco-policy related activities) should be measured. It is assumed that at least some awareness and knowledge of these eco-items are necessary for individuals to act on them and demonstrate environmental behaviors that works toward achieving the eco-policy goals.

3. Method

3.1 Questionnaire

A face-to-face street questionnaire was administered for this study. Questionnaires are one of the available methods for obtaining reliable information on the current awareness and behaviors of citizens regarding eco-activities. The questionnaire was constructed based on relevant literature reviews and previous, related studies (Ito, 2014; Ito & Kawazoe, 2016; Ito, 2017a; Ito, 2017b). The questions included in the questionnaire are later listed in Table 2.

3.2 Sample

In this study, 212 individuals completed the questionnaires, 133 of whom were Toyota citizens, which was the final sample analyzed in this study. The questionnaires were administered in and around Toyota City Station in June 2017. The location was selected because approximately 90% of Toyota citizens reside in the city center where the station is located. Respondents were approached by one of the authors or one of their students, who explained that they were researching knowledge of the city's eco-policy. All respondents provided verbal consent to participate in the project. One of the authors later consolidated and transcribed the data using Excel.

4. Results

Table 1. Socio-demographic factors

Age	N (%)
<19	59 (44.4%)
20-29	15 (11.3%)
30-39	17 (12.8%)
40-49	12 (9.0%)
>50	30 (22.6%)
Unidentified	3
Gender	
Male	68 (53.1%)
Female	60 (46.9%)
Unidentified	5
Total	133

Table 2.

	<i>N (%)</i>
<i>Q 1. Do you consider buying an NGC?</i>	
Yes	41 (30.8%)
No	92 (69.2%)
<i>Reasons for Yes</i>	
NGCs are cost effective and economical	28 (68.3%)
NGCs are environmentally friendly	13 (31.7%)
Other(s)	0 (0%)
<i>Reasons for No</i>	
NGCs are expensive	24 (27.0%)
Normal cars are easier to drive than NGCs	12 (13.5%)
Not interested in environmental protection	8 (9.0%)
Other(s)	45 (50.6%)
<i>Q2. Do you know Ha:mo?</i>	
I know of it but do not use it	44 (33.9%)
I do not know of it	85 (65.4%)
I use it	1 (0.7%)
Unanswered	3
<i>Reasons for not using Ha:mo while knowing of it</i>	
Ha:mo stations are far from home and workplace	2 (5.9%)
I already have a car	18 (52.9%)
I do not know how to register	6 (17.7%)
The registration process is troublesome	4 (11.8%)
Others	4 (11.8%)
<i>Q3. Do you know the heat island effect?</i>	
I know of it but do not take measures	64 (48.1%)
I do not know of it	54 (40.6%)
I take measures	15 (11.3%)
Unanswered	0
<i>Reasons for knowing of it but not taking measures</i>	
I am not interested in taking measures	4 (6.5%)
I do not know what I can do	51 (82.6%)
Others	7 (11.3%)
<i>Types of measures being taken</i>	
Greening such as placing planters	6 (33.3%)
Planting trees	1 (5.6%)
Watering	8 (44.4%)
Others	3 (16.7%)
<i>Q4. Do you know Ecoful Town?</i>	
I know of it but have not been there	37 (27.8%)
I do not know of it	63 (47.4%)
I have been there	33 (24.8%)
<i>Reasons for not going while knowing of it</i>	
I am not interested in it	9 (21.4%)
I do not know what is there	21 (50.0%)
Others	12 (28.6%)
<i>Reasons for going there</i>	
I can try driving an NGC	2 (7.1%)
I can receive eco-points	5 (17.9%)
There is a restaurant <i>Hogaraka</i> there	6 (21.4%)
No particular reasons	10 (35.7%)
Others	5 (17.9%)
<i>Q5. Do you know the smart house?</i>	
I know of it but do not live in it	44 (31.7%)
I do not know of it	85 (63.9%)
I am living in it	4 (3.0%)

<i>Reasons for not living in it while knowing of it</i>	
The smart house is expensive	10 (22.2%)
I live in an apartment or mansion	14 (31.1%)
I have recently purchased a house	10 (23.9%)
Others	11 (24.4%)
<i>Q6. Do you know the eco-family card?</i>	
I know of it but not use it	30 (22.6%)
I do not know of it	80 (60.1%)
I am using it	23 (17.3%)
Unanswered	0
<i>Reasons for not using the eco-family card while knowing of it</i>	
The registration process is troublesome	12 (37.5%)
I do not know how to register	5 (15.6%)
Someone in my family has it	4 (12.5%)
I do not know how to use eco-points	4 (12.5%)
Others	7 (21.9%)
<i>Reasons for using the eco-family card</i>	
I can exchange points for goods	16 (72.7%)
It contributes to the environment	3 (13.6%)
Others	3 (13.6%)

4.1 NGCs

Approximately 30% of respondents reported that they would buy or already have NGCs. Among them, almost 70% claimed that they would buy or have NGCs for economical reasons while the other 30% would do so for being environmentally friendly reasons. 27% of those who would not consider buying NGCs said that NGCs are too expensive, and 13.5% said that normal cars, especially *kei*, are easier and safer to drive. There are some other reasons that respondents would not consider buying NGCs. For example, seven respondents mentioned that they do not like the design of NGCs. A few respondents also mentioned that they do not like NGCs because they are too quiet when driven.

4.2 Ha:mo

More than a third of respondents reported that they knew of Ha:mo but only one respondent reported that he used it. Among those who knew but do not use Ha:mo, more than half claimed that it is because they already have cars. The registration issues (e.g., not knowing the registration process or finding it troublesome) come in total to almost 30% of the reasons why respondents do not use Ha:mo. Few respondents said the long distance between Ha:mo stations and their home or workplace. One mentioned that he does not use Ha:mo because he does not have a smart phone, which facilitates the registration process.

4.3 Heat island Effect

Of the total respondents, 48.1% knew of it but did not take any measures to counter it, and 11.3% took measures against the heat island effect. Among those who knew the heat island effect but do not take any measures, over 80% said that it is because they do not know what to do. Some other reasons that they do not take measures are that they already live in greenly affluent areas and do not find necessary to take measures. Among those who take measures, some make the use of rainwater for their plants, bath water for their toilets, and save electricity by minimizing its use.

4.4 Ecoful Town

More than half of respondents reported that they knew about Ecoful Town and a quarter of the total respondents actually have been to Ecoful Town. Half of those who reported that they knew about Ecoful Town but have not been there said that it is because they do not know what is there or what they can do there. Also one fifth of those who reported that they knew about Ecoful Town but have not been there said that they are not really interested in it. Other reasons that respondents gave for why they have not been there included that they have no time to go or they do not know the location.

Among those who have been there, 35.7% reported that they have been there for no particular reasons. Over one fifth of those who have been there said that it is because they went to *Hogaraka*, a restaurant inside Ecoful Town. Those who have been there went there for school activities and work activities.

4.5 Smart House

Approximately one third of respondents reported that they knew of the smart house. Four respondents (3% of the total respondents) actually live in smart houses. Reasons why respondents knew but do not live in smart houses are the high costs of smart houses or they simply do not know enough about the benefits of living in smart houses.

About one third of respondents (31.7%) said that they do not live in smart houses because they live in an apartment/mansion. Some respondents also said: "I recently bought a house" (23.9%) and "the smart house is expensive" (22.2%).

4.6 Eco-family Cards

Around 40% of the total respondents, including those using them, knew of eco-family cards, but only 17.3% actually use them. Among those who knew of them but do not use eco-family cards, 37.5% said that they found the registration process troublesome, and 15.6% said that they did not know the registration process. 12.5% said that someone in their family members already has eco-family cards (the city government set a "one family one card" rule), and also 12.5% said that they do not know how to use eco-points. 72.7% reported that they use eco-family cards because they can exchange eco-points for some goods. 13.6% said that with eco-family cards, they feel they can contribute to the environment with eco-family cards.

5. Discussion

Previous research and existing literature indicated that the reasons for not acting on eco-items are economic, environmental, and others. The current study suggested that the majority of respondents act or do not act on eco-items for economic reasons. For those who drive NGCs, they are energy- and cost-effective. For those who do not drive NGCs, they are expensive. Given that seven respondents (15.5% of those who chose other reasons for not driving NGC) reported that they do not like the design of NGCs, car companies developing NGCs might want to work on this issue. Although more than one third of respondents knew about Ha:mo, only one respondent actually used it. The largest obstacle for promoting Ha:mo is the fact that majority of Toyota citizens have cars in part because many work for TMC. This is a difficult issue to address. This study indicates that increasing the number of Ha:mo stations would not be a solution because few respondents reported that they did not use Ha:mo for the long distance between their homes and nearest stations. Regarding the heat island effect, barely 10% of respondents took measures, though 60% of respondents (including those who act on it) knew of the heat island effect. The biggest reason why they knew of it but do not act on it is that they do not know what they can do. The city government should inform citizens of measures that they can take such as greening (e.g., placing planters, planting trees, and watering). Similarly, the biggest reason why citizens knew of but have not visited Ecoful Town is that they do not know what is there or what they can do there. The city government should inform citizens of the activities in Ecoful Town, such as driving an NGC, receiving eco-points, or eating at the restaurant Hogaraka.

The top three reasons why citizens knew of but do not live in the smart house are: they live in an apartment or mansion, they have recently purchased a house, and the smart house is expensive. Like the case of Ha:mo that the majority of citizens have their own cars, it is infeasible to force those who have their own houses or who are renting apartments/mansions to purchase smart houses. It would be more reasonable for the city government, as suggested by previous studies, to include some renovations for energy saving and energy generating systems, such as installment of solar panels, as similar to smart houses. Many respondents find the registration process of eco-family cards troublesome or they simply do not know the registration process. While informing citizens of the registration process, the city government should facilitate the registration process. Citizens should be able to receive eco-family cards at City Hall or any affiliated store after filling out a simple form because many citizens arguably do not find or do not seek information about the eco-family card.

6. Limitations of Research

One of the limitations of this study is the confusing structure of the questionnaire. We asked respondents whether they knew an eco-item or not as well as whether they acted on it or not in the same question. For instance, we asked respondents whether they know of Ha:mo or not and use it or not, and then asked them why they do not use it while knowing of it. For future research, we should first simply ask whether they act on an eco-items and then ask why they do or do not act on them. Another possible limitation is that the questionnaire survey was conducted around Toyota City station: the sample may not represent the general population. However, 90% of Toyota citizens live in the city center where the station is located, and thus the sample arguably does represent the general population of Toyota City. Finally, the sample for this study may not represent the population of

Toyota City. While the gender distribution is very similar to that of Toyota City (53.1% males and 46.9% females in the sample versus 52.3% males and 47.7% females in the population), the age distribution, in particular, that of under 19 and over 50 are different, arguably because infants and the elderly may not go out as often as the other aged individuals.

7. Conclusion

This study suggested that the majority of respondents act or do not act on eco-items for economic reasons. For instance, buying an NGC or a smart house is costly. Encouraging citizens to live in the smart house is particularly difficult because many already have houses. Likewise, encouraging citizens to use Ha:mio is difficult because many already have cars. However, the eco-policy themes of the heat island effect and Ecoful Town are relatively easy to deal with. Perhaps the city government should first focus on addressing the issues of Ecoful Town and the heat island effect, and then move on to a comprehensive strategy for addressing others, including ways that citizens can contribute to the themes without purchasing entire smart houses or completely changing method of transportation.

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