

Toyota as an Environmental Model City: Is Its Eco-policy Recognized?

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Abstract

In 2009, Toyota City was selected by the Japanese government as an environmental model city in pursuit of a low carbon society. The city has been working on promoting its eco-policy and raising its citizens' awareness toward the establishment of an eco-city. For instance, Ecoful Town, a pavilion that demonstrates how Toyota City tackles challenges and elaborates on strategies toward a low-carbon society, has been established. Free papers with information on the city's eco-policy are distributed during civic events and mailed to 70% of the city's populace. The city has also created a Facebook account and provides a concept book for children to explain its eco-policy. However, the effectiveness of its eco-policy has not been studied yet. Through survey questionnaires with 229 individuals in Toyota City, this paper examines how much the city's eco-policy is recognized by its citizens. The collected data is analyzed in three different categories: personal information (i.e., age, sex, where they live), general information about public awareness of Toyota City's eco-policy (i.e., what citizens know or do not know about the city's general eco-policy), and more specific information about public awareness of Toyota City's eco-policy (i.e., what citizens know or do not know about the city's specific eco-policies on transportation, forests, the urban center, industry, and public welfare and livelihood). The findings show that less than 40% of Toyota City's citizens are aware of the city's eco-policy. This paper suggests that a target of 65-70% total citizen awareness of eco-policy initiatives be set to help guide public awareness campaigns.

Keywords: eco-city, urban planning, sustainable development, environmental policy

1. Introduction

Toyota is a mid-sized city with a population of 423,000 located in the same area as Toyota Motor Corporation (TOYOTA)'s headquarters. The city was formerly called Koromo but changed its name to Toyota in 1959 in honor of the car company. In collaboration with TOYOTA and many other companies such as Chubu Electric Power Company, Toshiba, Mitsubishi, and Toho Gas, the city has been addressing environmental issues. In the mid-1990s, for example, the city enacted action plans for environmental protection. These plans were further developed in the beginning of the 2000s. In 2009, Toyota was designated as one of the environmental model cities by Japan's Ministry of Environment (Toyota City, 2009). Environmental model cities intend to reduce greenhouse gas emissions toward the realization of a low-carbon society. Toyota City aims to reduce carbon emissions by 30% (possibly 50%) by 2030 and 50% (possibly 70%) by 2050 compared to the CO₂ level of 1990. The city's slogan is "a hybrid city Toyota", invoking the vision of an ecologically and economically advanced city with a synergy of people, environment, and technology. In order to promote its eco-policy and to raise eco-awareness of citizens, Ecoful Town has been established: a pavilion that demonstrates how Toyota City tackles challenges and elaborates on strategies toward a low-carbon society in order for people, environment, and technology to coexist comfortably. In addition to Ecoful Town, free papers with information on the city's eco-policy are distributed during civic events and mailed to 70% of the city's populace. The city has also created a Facebook account and provides a concept book for children to explain its eco-policy. Toyota City has been making efforts to promote its eco-policy and to put it into practice. However, it is uncertain how successful the city's eco-policy has been in terms of raising citizens' awareness. This is a common challenge faced by many environmental sustainability initiatives. While the involvement of citizens are essential in making "the necessary changes in governance to move cities in a more sustainable path" (United Nations University, 2012, p. 33) because the drastic reduction of CO₂ requires citizens to make a dramatic change in their lives (Masuhara, 2010), a broad public awareness of eco-policies has been missing (Kemp, Rotmans, & Loorbach, 2007). As Williams

(2010, p. 129) describes, despite “some impressive practical initiatives, a very contradictory, or at least fragmented, picture arises of change ‘on the ground’”. This paper reports a study which explored how much Toyota City eco-policy is recognized by its citizens.

2. Toyota City Eco-policy

Toyota City’s eco-policy aims at making the city an eco-city. Eco-city is defined as a city where input of resources and output of waste are economized (Register, 2002). The World Bank’s definition of eco-city is twofold: an economically and ecologically sustainable city. The World Bank calls such a city an Eco² city (World Bank, 2010). In this regard, Toyota City’s eco-policy is comprehensive and consists of five themes with both economic and ecological elements essential for a low carbon society: *kotsu* (transportation), *shinrin* (forest), *toshin* (urban center), *sangyo* (industry), and *minsei* (public welfare and livelihood) (Toyota City, 2014a).

2.1 Transportation

In line with TOYOTA’s environmental initiative (Toyota, 2013c), Toyota City has promoted an environmentally friendly public transportation system called the Intelligent Transportation System (ITS). ITS entails information and communication technology to improve the use of vehicles, roads, traffic lights and other type of infrastructure (Ezell, 2010). In the context of Toyota City, the on-demand responsive bus, which runs only when reserved or called, is an example of a transportation indicative toward sustainability. Another is the placement of electric battery charging stations established within every 10km² is another. Introduction of next-generation vehicles such as electric vehicles (EV) and plug-in hybrid vehicles (PHV) is one of the pillars in developing eco-friendly car life. Comus, for example, is a small EV that does not emit CO₂ and does not pollute the air. The car can be recharged from a house outlet and can run for up to 50km in distance when the battery is fully recharged. A PHV usually use electricity to run and switches to gas only when necessary. TOYOTA’s Prius is a prime example.

2.2 Forests

According to Toyota City (2013a), about 70% of the city consists of forests. In order to preserve forests in decent conditions, the city engages in activities such as periodic thinning as well as the promotion of regional lumber and forest environmental education. Periodic thinning, or *kanbatsu*, removes trees from the condensed woods to make room for other trees to grow (Punches, 2004) and makes it possible to maximize CO₂ absorption and sustain a quality timber supply (Lowell et al., 2012). TOYOTA has spent millions of dollars for thinning and organizing forest environments (Nikkei Ecology, 2001). In the case of Toyota City, however, the thinning of forests has had difficulty in providing an economically and environmentally sustainable supply of lumber due to the cost and the devastation of the Japanese forestry industry as a result of having lost its economic advantage against foreign lumber: Japanese lumber is worse in quality and higher in price (Nikkei Ecology, 2001). Other uses of thinned trees are also being explored.

2.3 The Urban Center

As Kleerekoper (2012) states, temperatures in urban areas are higher than those in rural areas due to the heat-island phenomena, which may cause increased air pollution and the deterioration of quality soil. Creating urban green spaces is important in enhancing the quality of the urban environment (Karuppanan et al., 2014). Toyota City has been greening at least 10% (where 60% of the land property is occupied by buildings) and preferably 20% (where 80% of the land property is occupied by buildings) of its urban center in order to work against heat-island effect through rooftop wall greening, environmentally-friendly parking, and water-retentive pavement.

2.4 Industry

Toyota City promotes transition to sustainable plants. Sustainable plants are factories or districts with systems for creating, storing, and economizing energy. According to TOYOTA (2013a), sustainable plant activities lead to environmental performance and increase the use of renewable energy in harmony with natural surroundings. In order to develop sustainable plants in Japan, for example, TOYOTA addresses the issues of: 1) reducing CO₂ emissions by increasing solar and wind power energy and other renewable energy sources such as biomass and geothermal, 2) contributing to society and protecting the environment by inspiring members to take action and encouraging and engaging the local community to preserve and promote the local ecosystem, 3) realizing excellent environmental performance by introducing and improving advanced technology, and 4) making the Tsutsumi factory where Prius are manufactured a sustainable plant model (TOYOTA, 2013b). Nonetheless, many small and medium size companies are unable to develop sustainable plants as their resources are limited.

Toyota City financially supports small and medium size companies working toward establishing sustainable plants for effective CO₂ reduction.

2.5 Public Welfare and Livelihood

Toyota City promotes the Smart House, which automatically controls and monitors energy production and consumption at home (Gross, 1998). Robles and Kim (2010, p. 37) define the Smart Home as “the integration of technology and services through home networking for a better quality of living”. The Smart House principally generates energy by solar panels built on the roof and can store the energy in a home storage battery or even on board the batteries equipped in EVs. An EV battery can store up to a few days of electric energy for home usage (Automotive Technology, 2011). They can also sell extra energy to City Hall or Electric Power Companies.

Home Energy Management System (HEMS) utilizes information technologies to control energy use at home. HEMS shows how much, when, where, and for what energy is generated, stored, and consumed (Nikkei Journal, 2013). That is, as Kuzlu et al. (2012, p. 1704) explain, HEMS “provides a homeowner the ability to automatically perform smart load controls based on utility signals, customer’s preference and load priority”.

In order to make its eco-policy more popular and practiced by its citizens, Toyota City has introduced the Eco Family Card system. By obtaining the Eco Family Cards, citizens can receive Eco Points exchangeable for certain products or gift certificates. When one purchases an ecological product with the Eco Family Card at a greenly affiliated store, he or she can receive points. If one with an Eco Family Card recycles something at a designated place, he or she can receive points as well. If one accumulates a certain amount of points, he or she can exchange the points for certain goods such as stationery, bus tickets, or gift certificates.

3. Methodology

In this research, surveys were conducted with individuals in Toyota City in November 2012. The survey questionnaires were distributed on the street and in the shopping mall near Toyota City Station, a commercial area in the city center. 229 individuals were randomly surveyed. The survey questions were classified into the following three categories: personal, general, and specific. The specific questions pertain specifically to Toyota City’s five eco-policy themes (i.e., transportation, forests, the urban center, industry, and public welfare and livelihood). The questionnaires first requested personal information (i.e., age, sex and home city) and then asked participants about their awareness of Toyota City’s eco-policy: whether they knew the fact that Toyota City was selected by the government as an environmental model city and whether they knew about Ecoful Town. The questionnaires then asked items related to more specific themes. Concerning transportation, participants were asked whether they were considering purchasing next generation cars such as EVs or PHVs and whether they knew about ITS and/or on-demand responsive buses, a commonly cited example of ITS. With respect to forests, participants were asked whether they knew about *kanbatsu* (periodic thinning) and its effectiveness for reducing CO₂. As for public welfare and livelihood, participants were asked whether they knew about the Smart House, HEMS, and Eco Family Cards. Regarding industry, participants were asked whether they knew that small and medium size companies make efforts to create and develop sustainable plants. Participants were also asked obstacles for purchasing next generation vehicles and ideas about how to utilize the harvested trees from periodic thinning. These questions were elaborated through consultations with the personnel from the Toyota City Hall.

The collected data were analyzed as follows. First, data on personal information (i.e., age, sex, home city) was described. Next, data on general information about public awareness of Toyota City’s eco-policy (i.e., what citizens know or do not know about the city’s general eco-policy) was examined. Finally, data on more specific information about public awareness of Toyota City’s eco-policy (i.e., what citizens know or do not know about the city’s specific eco-policy: transportation, forests, the urban center, industry, and public welfare and livelihood) was analyzed.

4. Results

Below are the tables that demonstrate the survey results.

Table 1. Personal information: age, sex and cities where they live

Age	Toyota City Participants	Other Cities Participants
<19	57 (34.6%)	12 (19.4%)
20-29	23 (13.9%)	16 (25.8%)
30-39	23 (13.9%)	10 (16.1%)
40-49	17 (10.3%)	10 (16.1%)
>50	45 (27.3%)	14 (22.6%)
Unspecified	2	0
Sex		
Male	75 (55.6%)	24 (55.8%)
Female	60 (44.4%)	19 (44.2%)
Unspecified	32	19
Total Respondents	167	62

Table 2. General information about public awareness of Toyota City's eco-policy

	Toyota City	Other Nearby Cities
<i>Do you know Toyota was selected as an environmental model city?</i>		
Yes	64 (39.0%)	20 (32.3%)
No	100 (61.0%)	42 (67.7%)
Unanswered	3	0
<i>Do you know about Ecoful Town?</i>		
Yes	48 (31.4%)	9 (15.5%)
No	105 (68.6%)	49 (84.5%)
Unanswered	14	4

Regarding the issue of citizens' awareness of Toyota City's eco-policy, 39.6% of the participants reported that they knew that Toyota City was selected by the Japanese government as an environmental model city. This figure is 7.4% higher than the awareness of participants from other nearby cities. While the gender of the participants does not seem to affect the result (i.e., there is no significant difference between males' and females' knowledge of Toyota City's eco-policy as demonstrated by a chi-squared test equaling $.08 > .05$), their age seems to matter: as their age increases, they are more likely to know about Toyota City's eco-policy. For instance, while only 15.8% of the participants less than 20 years old knew that Toyota City has been designated as an environmental model city, 43.5% of the participants aged 20-39 and 56.5% of the participants aged 40 or above knew it. 31.8% of Toyota City citizens reported that they knew about Ecoful Town as opposed to 15.5% of the participants from other cities. However, only two Toyota citizens and one participant from other cities had actually been there.

As to the issue of transportation, 40.4% were thinking of purchasing next generation vehicles such as EVs or PHVs. This is 4% lower than participants from other cities. As to obstacles to buy next generation vehicles, 19 participants reported that the cost of these cars may be too high for them to consider purchasing them. For 11 participants, charging the car battery is a concern. Four participants mentioned insecurity and a lack of variety in design as weaknesses of next generation vehicles. While 40.1% of the participants recognized ITS, only 15% knew about on-demand responsive buses. With respect to battery-charging stations, 23.5% knew that battery-charging stations had already been placed every 10 km² in the urban center. Given that quite a few participants reported that they would not consider purchasing next generation cars because they were worried about charging car batteries, the spread of this information might encourage them to reconsider.

Table 3. Specific information about public awareness of Toyota City's eco-policy

Transportation	<i>Toyota City</i>	<i>Other Cities</i>
<i>Are you considering buying a next generation vehicle?</i>		
Yes	65 (40.4%)	26 (44.1%)
No	96 (59.6%)	33 (55.9%)
Unanswered	6	3
<i>Do you know about ITS?</i>		
Yes	67 (40.1%)	17 (27.4%)
No	100 (59.9%)	45 (72.6%)
<i>Do you know the battery charging stations are allocated every 10 km²?</i>		
Yes	39 (23.5%)	12 (19.7%)
No	127 (76.5%)	49 (80.3%)
Unanswered	1	1
Forest	<i>Toyota City</i>	<i>Other Cities</i>
<i>Do you know kanbatsu and its effectiveness for CO₂ reduction?</i>		
Yes	81 (50.0%)	34 (54.8%)
No	81 (50.0%)	28 (45.2%)
Unanswered	5	0
Urban center	<i>Toyota City</i>	<i>Other Cities</i>
<i>Do you know about the heat island phenomena?</i>		
Yes	71 (42.5%)	32 (51.6%)
No	96 (57.5%)	30 (48.4%)
Industry	<i>Toyota City</i>	<i>Other Cities</i>
<i>Do you know that small / medium size companies are working on sustainable plants?</i>		
Yes	67 (41.1%)	21 (35.6%)
No	96 (58.9%)	38 (64.4%)
Unanswered	4	3
Public welfare and livelihood	<i>Toyota City</i>	<i>Other Cities</i>
<i>Do you know about the Smart House?</i>		
Yes	87 (52.1%)	31 (50.0%)
No	80 (47.9%)	31 (50.0%)
<i>Do you know about the HEMS?</i>		
Yes	22 (13.2%)	11 (17.7%)
No	145 (86.8%)	51 (82.3%)
<i>Do you know about the Eco Card?</i>		
Yes	113 (67.7%)	33 (53.2%)
No	54 (32.3%)	29 (46.8%)

Concerning forests, 50% of Toyota citizens knew about *kanbatsu* (periodic thinning) and its effectiveness for reducing CO₂ while 54.5% of the participants from other cities knew the information. With regard to the use of the thinning trees, six participants suggested that they be used for construction materials and furniture respectively. Five participants suggested making chopsticks. Four participants suggested using them as fuels and

carbons. Two participants suggested making children's toys and benches. The issue of high transportation cost of delivering thinning trees, however, remains unaddressed.

Regarding the urban center, 42.5% of the participants knew about the heat island phenomena. With reference to industry, 41.1% reported that they knew that issues related to sustainable plants were addressed by small and medium companies located in Toyota City. Regarding public welfare and livelihood, 52.1% of the participants knew about the Smart House. 13.2% reported that they knew of HEMS. It may be important to note that 67.7% of Toyota citizens knew or used Eco Family Cards. This figure is much higher than 39.6%, the percentage of the Toyota citizens that knew that Toyota was designated by the Japanese government as an environmental model city.

5. Discussion

How are the above-stated figures interpreted? Despite its efforts, Toyota City's eco-policy is still not well recognized by its citizens (and others). Less than 40% of the respondents knew that the city was designated as an environmental model city. Particularly few participants under 20 years old knew about it. While 40.4% of the Toyota citizens thought about buying next generation cars, 41.9% of the participants from other cities considered this purchase. The same trend goes for knowledge about thinning and its effectiveness for CO₂ reduction: half of Toyota citizens knew about it while 54.5% of the participants from other cities did. Although 40.1% of Toyota citizens recognized ITS, only 15% knew about on-demand responsive buses. Although 52.1% of Toyota citizens knew about the Smart House, 86.8% did not know about HEMS, one of the main characteristics of the Smart House.

It is noteworthy, however, that the majority of Toyota citizens regardless of their age have the Eco Family Card, which can serve as a catalyst to further promote and implement eco-policy. One of the probable reasons why the eco-card has gained popularity is that it was initiated and promoted during the 2005 World Exposition that attracted over 22 million visitors (Japan Association for the Promotion of Creative Events). One strategy to promote Toyota City's eco-policy using the eco-card could be, for example, that the Eco Family Card holders be emailed information on Toyota's eco-policy periodically. Another strategy could be to integrate the information on Toyota's eco-policy or Ecoful Town into TOYOTA's advertisements. As Bennett et al. (2008, p. 38) state, "a message delivered through an alliance with a well-known corporation may achieve far greater penetration than otherwise would have been the case". As already stated, TOYOTA has been collaborating with Toyota City toward sustainable development as part of its corporate social responsibility (Toyota, 2013c). Yet, its contributions may not be as visible as they should be. Through cause-related marketing, the public-private partnerships between Toyota City and TOYOTA for social benefits, could play a key role in establishing an ecologically and economically sustainable city. In every strategy to promote an eco-policy, involvement of teenagers is also a matter of urgency. If Toyota City can have green affiliation with stores where teenagers often go (e.g., fast food shops, karaoke boxes), both teenagers and these stores might be better informed of Toyota City's eco-policy. Given that over two-thirds of Toyota citizens have the Eco Family Card, an item relevant to the city's eco-policy, this paper suggests that a target of 65-70% total citizen awareness of eco-policy initiatives be set to help guide public awareness campaigns.

This research is preliminary and thus requires further research. For future studies, longitudinal value-added research is expected to be conducted in order to examine the increase or decrease of Toyota citizens' awareness of the city's eco-policy and relevant issues. Since there are no benchmark figures for public awareness prior to 2009 when the city was named an environmental model city, it is difficult to determine whether its eco-policy has already increased awareness. Longitudinal research will address this issue. Furthermore, comparative studies with other domestic or international cities promoting eco-policies within and outside Japan such as Yokohama and Curitiba can be useful for a broader analysis. Also, some questions may be added to the survey employed in this research. Questions regarding fuel cell vehicles (FCV) and hydrogen-gas station, multi-mobile station, *chisan-chisyo* (local production for local consumption), and Ha:mo are such examples. Ha:mo is a new urban transport support system with NAVI (an information system that supports low-carbon, seamless mobility) and RIDE (a car sharing system that uses compact electric vehicles for urban short-distance transportation) (Toyota, 2013c). In addition to surveys, in-depth and action-oriented interviews may be desired to be conducted to further analyze and develop participants' ideas around Toyota City's eco-policy.

While Toyota City's eco-policy supported by Toyota Motor Corporation can serve as a role model for other environmental cities, its effectiveness had not been analyzed. This paper has revealed that Toyota City's eco-policy is still not fully recognized by its citizens and suggests that a target of 65-70% total citizen awareness of eco-policy initiatives be set to help guide public awareness campaigns with the Eco Point Card. This

preliminary research provides a benchmark figure for future studies to examine whether Toyota citizens' awareness of the city's eco-policy will have been improved.

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