A STUDY ON THE TRANSITION AND PROGRESS OF BUILDING ENVIRONMENTAL PERFORMANCE AND HUMAN PERCEPTION IN THE ARCHITECTURAL COMMUNITY IN JAPAN

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Summary

Since the 1990's, environmental issues have been key issues. The general public and the architectural community are increasingly becoming concerned with these issues year after year, so a major movement of environmental strategies and developments has been conducted in the architectural community in Japan. An awareness and perception of environmental issues are expected to change in both the architectural community and the general public. But it is uncertain which direction we are moving in and how much progress we have achieved so far. It would be useful if there is a monitoring and guiding system that would guide the direction and progress of environmental strategies in the building sector. It is also important to identify the characteristics of the movement, what is being improved, and the key drivers of improvement.

The purpose of this study is to determine the progress of building performance based on real data, key aspects of the movement, the opinions of key actors in the architectural community, and to provide primary information that supports decision making for future direction and strategies to the architectural community in Japan.

It is expected that this pilot study will be a basis to develop a periodic monitoring and assessment system that shows the transition, progress, and direction of environmental activities and human perceptions in the architectural community in the world to compare the differences in cultural and technological conditions in each region and country.

1. Introduction and Methods

Several surveys have been conducted about real data and human perceptions on environmental issues in the architectural community in Japan. The questionnaire surveys were conducted twice in the architectural community in Japan to measure the change in human perception during a five year interval. The first survey was conducted in 2000 and the second survey was conducted five years later in 2004, using the same questionnaire items. Respondents of these surveys were Japanese local governments, building design and engineering firms, and construction companies. About 150 people responded to the questionnaires.
Some of questionnaires contained current issues and future estimates in order to know future expectations on environmental and building issues.

2.Real data survey

2.1 The trends of specific events and energy consumption

2.1.1 General events and buildings

Fig.1 shows the transition of major events, policies and laws, current expressions, and key words that relate to environment and buildings in Japan from 1970 to the present day. It can be divided into four specific periods based on the social situation as follows:

1955 to 1973: General trend: rapid economical growth period
Building: pollution issues, smog, wind harm, sunlight shading
Large and high-rise buildings were designed and constructed. Most of them were designed to be mechanically controlled buildings.

1974 to 1988: General trend: period of stable growth,
Building: limitation of resources and chasing improvement efficiency
Energy is one of the critical issues for building design

1989 to 1994: General trend: bubble economy and the collapse of the economy
Building: chasing technological limitation, realization of global environmental issues

1995- today: Collapse of the reliance on technological and social systems,
practice, implementation of environmental strategies

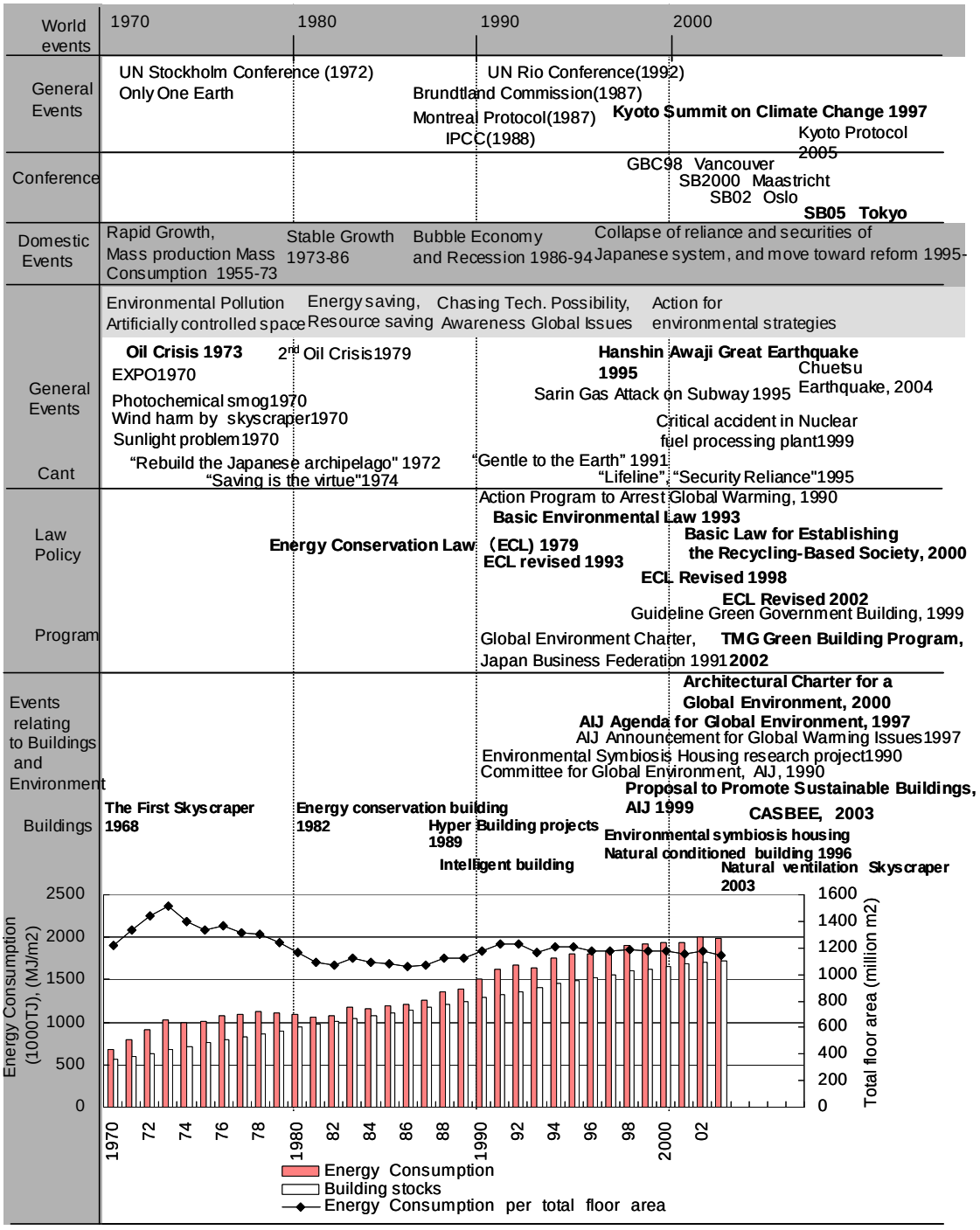
It is difficult to draw a clear connection between the social situation and building design. However, some buildings indicate that social events influenced the building concept and design, such as energy conservation building around the period of the oil crisis, hyper building projects around the period of the bubble economy, and natural conditioning buildings after Kyoto summit.

2.1.2 Environmental strategies of the Government and Arch. Community

Since the late 1990s, a series of specific events have occurred in both policy and architectural strategies. Some important laws were launched by the government, and an agenda, proposal, and charter relating to the environment and buildings were established by the architectural community. There is a clear transition in both society and the architectural community toward environmental concern.

However, it is still not known whether environmental performance has improved along with strategies.

A more subjective analysis is needed in order to show the social transition and suggest a rough overall trend.



Energy and building stock data source: EDMC 2005

Fig.1. Trends of specific events relating to buildings and environment, and energy consumption

2.1.3 Stock and energy consumptions

Fig. 1 also shows the transition of building stocks and operating energy consumption of non-residential buildings, and energy consumption per total floor area. The peak of the energy consumptions was around 1973, and after the oil crisis it began to decrease year by year until it stabilized in the present day.

On the other hand, the trend of energy consumption of buildings as a whole has been increasing year by year and still continues today.

There are several reason for this situation. Building stocks and building floor area per person have been increasing and building operating times of each building have been becoming longer and longer. These trends suggest that there is a gap between the strategies of energy conservation in buildings and the real situation in society.

A survey of many kinds of environmental data was required, and energy consumption and building stock data were selected to understand the progress in reality. Data availability was also considered. Other data related to environmental issues is difficult to collect or to use to survey the current situation.

3. Human Perception Survey

3.1 Methods and questionnaires

The questionnaire survey was conducted to know the human perception on building environmental issues within the architectural community in Japan. The respondents were people in local government, design firms, construction companies, utility companies, etc. It was distributed to 250 people, and answers were obtained from a total of 149 people. This questionnaire survey prepared several sets of questions that related to the current situation and the near future in order to measure the change and transition. There was also contained another set of questions that were part of questionnaire survey conducted in 2000 in order to measure a change and transition during the five year period from 2000 to 2004.

The questionnaire survey covered several questions shown in Table 5. This survey is expected to be conducted five years and ten years from now using the same question items. Some of questions asked are about the present and future situation and it is expected that the same type of survey will be conducted five or ten years from now. When it is be conducted and results are obtained, it will be possible to compare the differences of human perception between present and future.

Table2 Questionnaire items and respondents

	Question	Respondents	
Overall	Priority of Issues Influential events	Local government	42
Buildings	Building name Negative factor to enhance Green buildings Trend of Energy consumption	Design Firm	41
Design process	Effective tools Environmental design strategies Importance of design strategies Information source	Construction Company	27
Environmental Assessment tools	Awareness of assessment tools Purpose of assessment Environmental criteria weighting Cost and time for assessment Assessment tool user	Sub-construction Company	25
Env. strategies	Effective strategies: Law, policy and program Research and development	Utility Company	8
		Others	6

3.2 Overall issues

3.2.1 Influence Events

Table 3 shows the ranking of most influential events. “Kyoto summit on Climate Change” is ranked first by respondents of all ages. “Health issues” and some laws relating to environment are ranked second. Others vary based on the ages of the respondents.

Table 3. Most influential events based on ages of respondents

Ranking	20s	30s	40s	50s
1	Kyoto Summit on Climate Change	Kyoto Summit on Climate Change	Kyoto Summit on Climate Change	Kyoto Summit on Climate Change
2	Health issues	Energy Law revised	Health issues	Construction waste and recycle Law
3	Brundtland Commission	Health issues	Earthquake	Health issues UN Rio Conference

3.2.2 Priority of issues

Fig. 4 shows the priority of issues. “Environmental loads” and “Resource consumption” will become more important in the near future, compared to “Economics,” which is considered most important today.

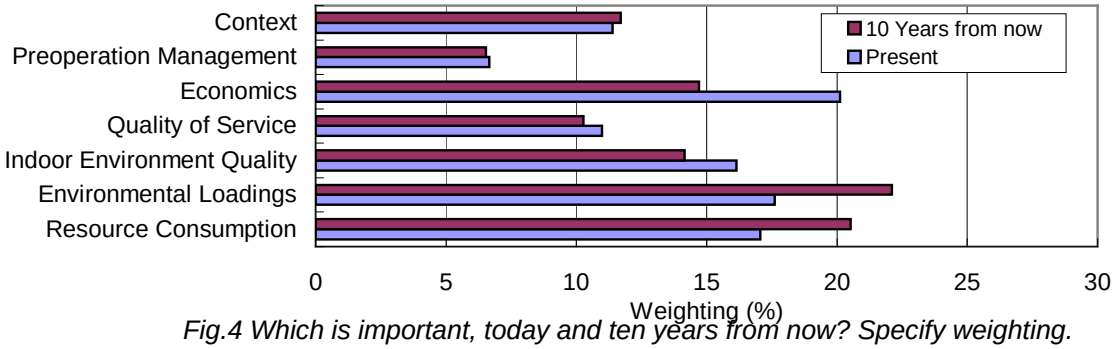


Fig.4 Which is important, today and ten years from now? Specify weighting.

3.2.3 Information Source

Fig. 5 shows the popular information source. Professional books and magazines are a popular information source today but many people assess that the Internet will be the most popular source ten years from now.

3.3 Buildings

3.3.1 Building name (Fig. 6)

“Sustainable Buildings” is one of the one of the best-known names for environmental buildings, but “Environmental Symbiosis Buildings” and “Ecological Buildings” are also popular among the Arch. Community in Japan. Some of respondents support “Autonomous Buildings” for future buildings.

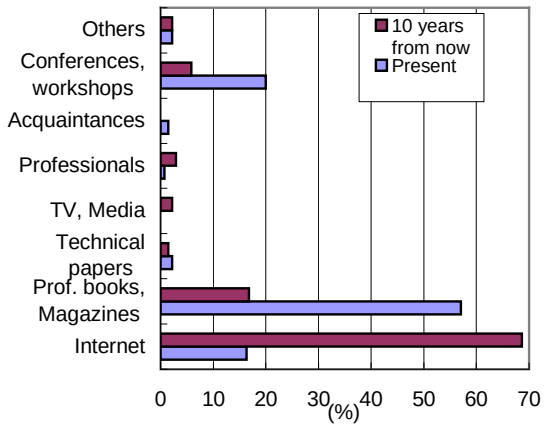


Fig. 5 What type of information source is effective today and ten years from now?

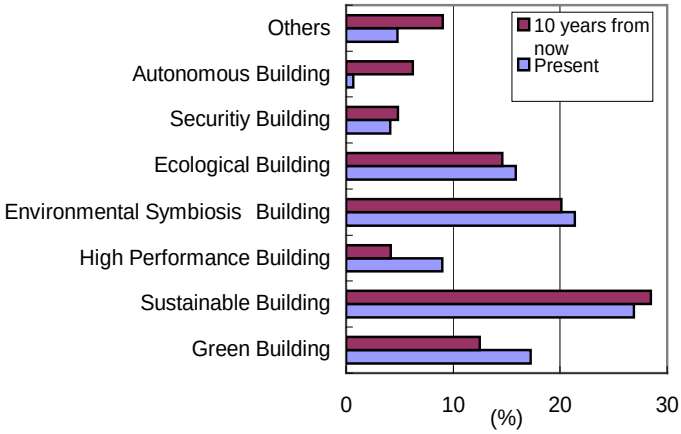


Fig.6 What type of name is appropriate for cutting edge buildings, today and ten years from now?

3.3.2 Energy Consumption trends

Fig. 7 shows the perception of energy consumption trends by the respondents. Many people think the trend of energy consumption since 1990 until today has increased. Half of the respondents estimate the energy consumption will be decreasing and stabilize ten years from now.

10% of respondents think the trend of energy consumption has decreased, and it shows a gap between reality and human perception of energy consumption.

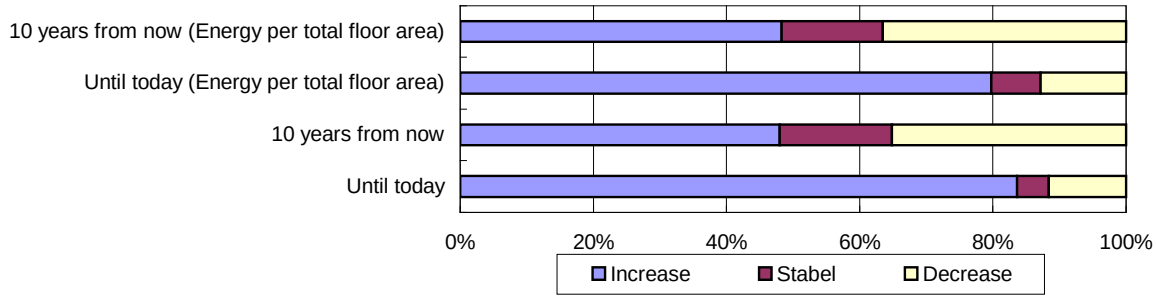


Fig. 7 Energy consumption of buildings has been increasing or decreasing so far, and will it be increased or decreased ten years from now?

3.4 Design Process

3.4.1 Negative factors

Fig. 8 shows the negative factors in achieving green and sustainable buildings. Increasing initial cost is considered to be a key negative factor to achieving green and sustainable buildings in the present and ten years from now.

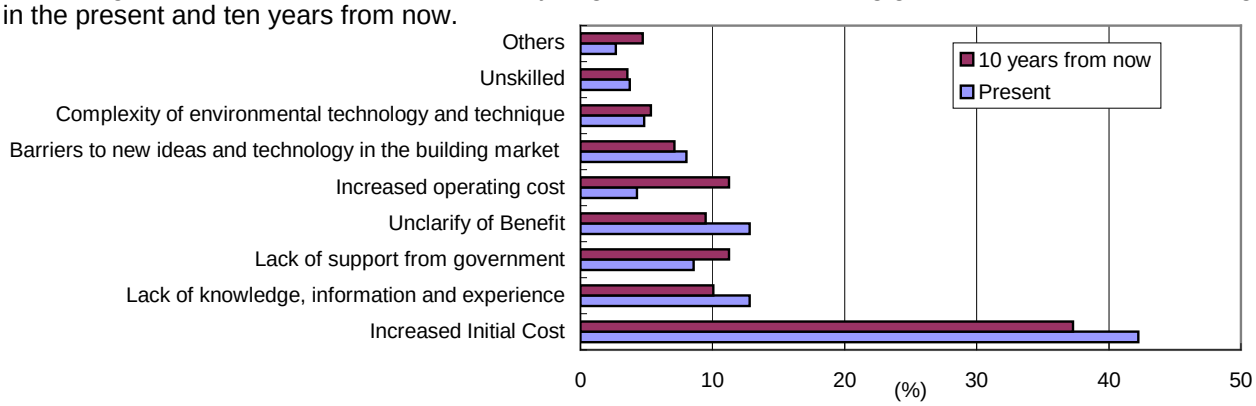


Fig.8 What is a negative factor achieving green, sustainable buildings, today and 10 years from now?

3.4.2 Effective tools for environmental design

Fig. 9 shows the effective tools to supporting environmental design. Energy simulators are thought to be the most effective tools today and environmental assessment tools are supposed to be the most effective as near future tools.

3.4.3 Popularity of environmental design

Fig.10 shows popularity of the environmental design strategies. It shows the difference between 2000 and 2004. Recycled material usage was popular in 2000 and reducing waste strategies became popular in 2004. Sun-shading and day-lighting design strategies make up only a small portion but it is shown that there is an expectation of greater use in the future.

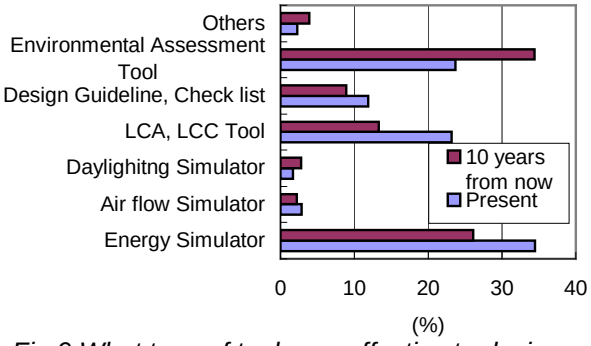


Fig.9 What type of tools are effective to design green buildings today and ten years from now?

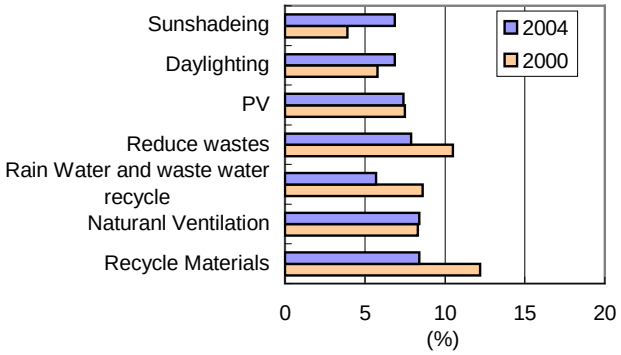


Fig. 10 What type of environmental design are you interested in?

3.5 Environment Assessment

3.5.1 Awareness of assessment tools and purpose of environmental assessment

Fig. 11 and Fig. 12 show the transition of awareness of assessment tools and the purpose of assessment between 2000 and 2004. Around 30 to 40% of respondents knew BREEAM and GBTool in 2000, and more than 50% of respondents knew CASBEE in 2004.

Many of the respondents think the main purpose of environmental assessment is “reducing environmental loads” both in 2000 and 2004, and its ratio increases a lot compare to other purposes.

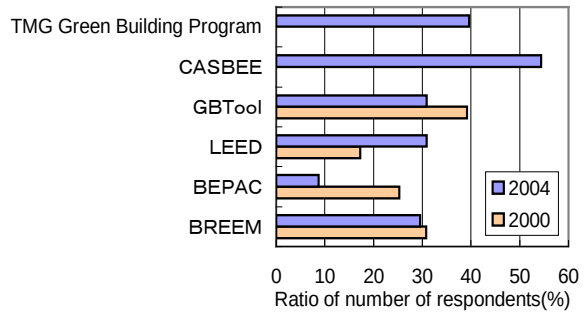


Fig.11 Awareness of environmental assessment tools?

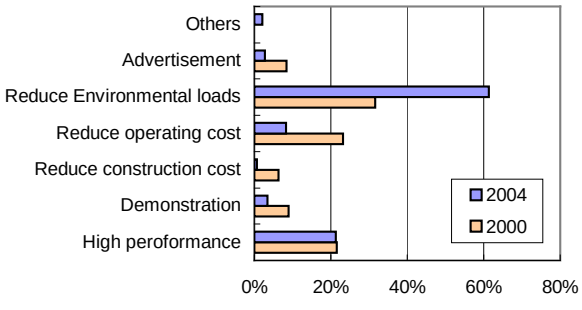


Fig.12 Purpose of environmental assessment?

3.5.2 Environmental criteria weighting

Fig. 13 shows the transition weighting value about resource consumption, environmental loads, and indoor environment. The differences of weighting value between 2000 and 2004, and ten years from now are small changes.

The assessment criteria relating to “energy,” “GHG,” “thermal comfort” are weighted higher than other criteria.

3.6 Environmental strategies

3.6.1 Law, Policy, and R&D

Fig. 14 and Fig. 15 show the effective environmental strategies and R&D.

Regulation and taxes are considered effective policies and many people support the R&D related to energy. Energy managements systems, especially, are expected to increase in the near future.

4. Results

The real data survey and analysis results show some progress and changes between the 1990’s and 2004.The data suggests that the environmental performance of leading edge buildings has achieved some progress, and several advanced technologies and green design strategies have been applied year by year. However, there is a gap between the strategies and reality of energy performance progress that affects the sustainability of society, as energy consumption of buildings stock increases year by year and its trends still continues.

The questionnaire survey results show that the priority of environmental issues and green design strategies have changed between 2000 and 2004. It is supposed that the reason for these changes is that information about environmental issues, experiences of green design strategies, and environmental assessment tools affected key actors in architectural community in Japan.

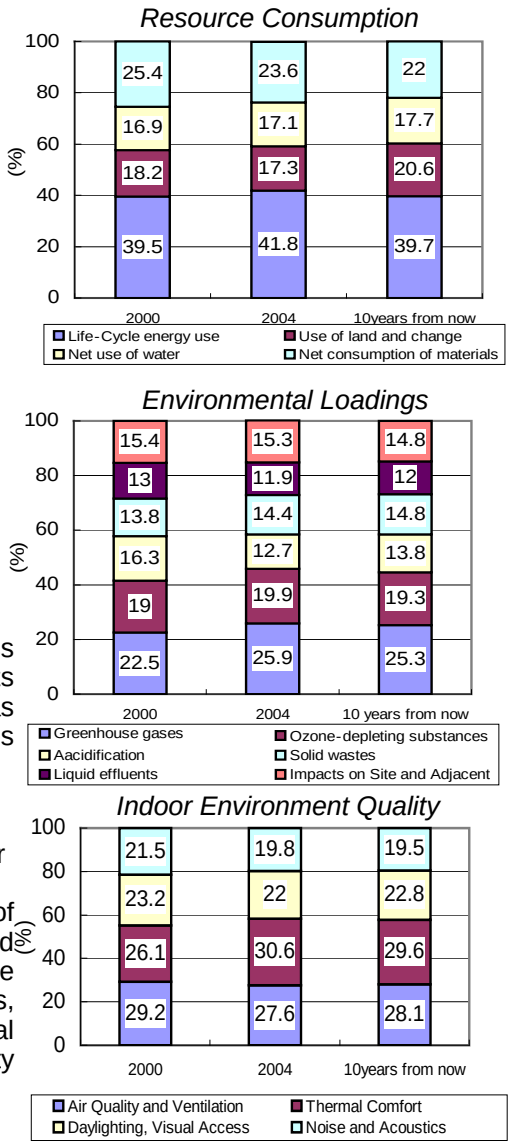


Fig.13 Transition of weighting value of assessment criteria

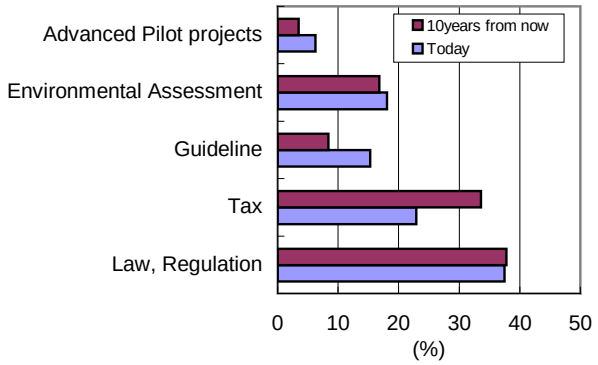


Fig.14 What are the most effective strategies to achieving sustainable buildings?

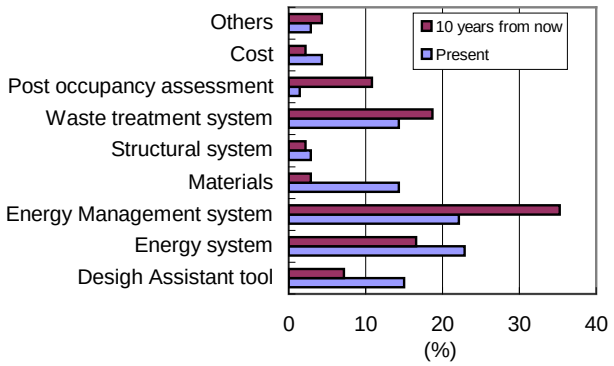


Fig.15 What kind of R&D should be focused on?

5. Conclusion and future research

The architectural community has a large responsibility to society through the designing and construction of buildings. It is important to assess the progress and the direction of strategies of the architectural community in order to achieve a sustainable society.

This paper describes an idea and demonstrates a framework to assess the progress and movement in the architectural community. The results suggest that it is possible to assess the movement and progress of environmental strategies by surveying several indicators, events, energy consumption and environmental performance of buildings, and human perception through a questionnaire survey.

It is expected that this framework will be revised and modified into an appropriate one to support the environmental strategies of the architectural community both locally and internationally.

This study is the pilot survey and we are planning to continue conducting this series of surveys both locally and internationally, and present them to the public periodically.

It would be useful if we could conduct the surveys in different countries and regions, and compare technological and cultural aspects to understand what is needed to realize different approaches and solutions while considering each area's climatic and historical backgrounds.

Table 4 and 5 show a framework and time schedule for future survey. Future works will be expected to describe the results in Fig. 20 as technological and cultural change and progress, along with the gap between reality and human perception about environmental issues relating to buildings, and these figures will suggest progress and direction. To map technological change and cultural change, several representative indicators and questionnaire items will be selected to explain the situation appropriately.

Table 4 Time frame of future research

		Past	Present	Future
Reality	Real Data Building design Building performance	2000	2004	2008 2013 20XX
Perception	Human perception Questionnaire survey	Measure	Measure Open to public Feedback	Measure Open to public Feedback Measure Open to public Feedback

Table 5. Survey frameworks for future research

	Overall	Technological Change	Social and Cultural change
Reality Data surveys	1) Global issues progress 2) Building community progress	1) Building system progress 2) Energy consumption 3) Building stocks 4) Advance technologies 5) Performance score of cutting edge buildings 4) Design process and tools 5) Affect of assessment tools	1) Weighting on Tech vs Tradition 2) Weighting on Environment, Economy and Social 3) Green movement events 4) Building names 5) Green Design strategies 6) Cost premium 7) Engines and drivers of Change
Perception Questionnaire surveys			

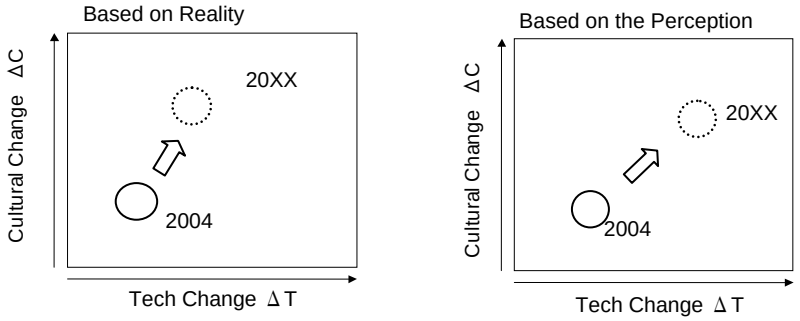


Fig. 20 A diagram of the transition of progress and direction based on reality and perception data

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