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*The UNESCO CHAIR WENDI Resilience Brief 2021* is a collection of brief reports by Kyoto University UNESCO Chair WENDI graduated students, who have worked on their independent studies or fieldworks under a compulsory elective subject: 1) “Social Innovation and Resilience” or/and 2) “Practices for Creating Resilience” provided by Course for Creating for Resilient Societies (CRS) in UNESCO Chair on Water, Energy and Disaster Management for Sustainable Development (WENDI), Kyoto University, during 2020-2021. The authors also contributed to the session “How can Resilience Approach address SDGs?” in *International Forum: Accelerating SDGs Implementation Through SDGs Innovators* which was held on 21<sup>st</sup> January, 2021, to share their activities and drive collaborative dialogues for actions with invited participants from different backgrounds. We hope this report will contribute to building collaborative knowledge on creating resilient societies. We will keep working on the theme of Creating Resilient Societies with relevant vigorous activities and research.

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## To increase resilience of Japanese marginal village communities: a case study of Senjo village in Saijo City, Ehime Prefecture

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### 1. Introduction

In recent years, an increasing number of rural localities have disappeared in Japan, provoking beyond the extinction of local population, the unnoticed loss of countless historical materials and intangible cultural assets. The causes can be found in successive waves of rural-to-urban migration (Masuda, 2011), the collapse of mountain-based industries in the post war era and the adverse effects of an aging society. This phenomenon, with 91.62% of the country population living in cities, 70% of it being concentrated on only 3% of the land<sup>6</sup>, is particularly affecting mountainous villages, victims of their geographical isolation.

Prior to extinction, such settlements are defined as marginal villages (Ohno, 2005), characterized by half of their population being age over 65 years old. In this situation, the village community, aged and diminished, is struggling to fulfil its traditional functions and ensure the continuation of its social organization, economic activities, residence, transmission of culture and management of the village infrastructures and local environment.

In a disaster prone country like Japan, where the occurrence and intensity of natural disasters like typhoons and floods is expected to increase over the coming years because of climate change, populations of marginal villages appear to be particularly vulnerable to their geographical and social marginality. Far from the archipelago's

megalopolises, such settlements are however lacking the attention they deserve.

### 2. Senjo village

Senjo village belongs to the municipality of Saijo in the prefecture of Ehime on the island of Shikoku. Saijo City is the result of four municipal merges (1919, 1950, 1985, 2004) that continuously dragged rural population to its city center, concentrating services and economic opportunities on the coastal and flat lands to the detriment of mountainous areas although they represent 70% of the municipal land.

Located about 15 kilometers south of the urban center of Saijo, Senjo presents a unique man-made landscape of 2500 terrace paddy fields built in the 16<sup>th</sup> century on a gentle slope facing west. This rare example of *satoyama* environment strongly bounds the livelihood,



Figure 1. View of Senjo terraces in 2015.

cultural and religious practices of its community to agriculture.

The end of mining and forest activities in the 1960's, in opposition to Saijo booming coastal industries and largescale farming rapidly depopulated the village and resulted in the closing of all services and shops. Of the thousand inhabitants, only seventeen are now remaining, the youngest of which being in his 50's. As a consequence, the village lost most of its political power and decision making capacity, historical landmarks are disappearing together with local festivals and the ancestral agricultural landscape of the terraces is fading under growing vegetation. No plan has been developed by the municipal government to hinder this trend and most of Saijo urban citizen remain unaware of the village very existence.

### **3. My research and field activity**

During my fifteen field trips to the village between May 2019 and December 2020, including a period of three months in which I lived in the village, the general lack of interest of the municipality for Senjo pushed me to try to contribute to the village in any possible way. The vulnerability of its community to natural disasters appeared to me as evident and thus I tried to understand and assess the risks that villagers are facing and identify key information on the village vulnerability that can be transmitted and useful for the local government of Saijo City in the event of a disaster. In addition, I also wanted to propose approach to increase the resilience of the community itself. To do so, my research was based on field observations, the interview of 15 villagers, 26 previous villagers and 3 municipal officers and the use of GIS tools.

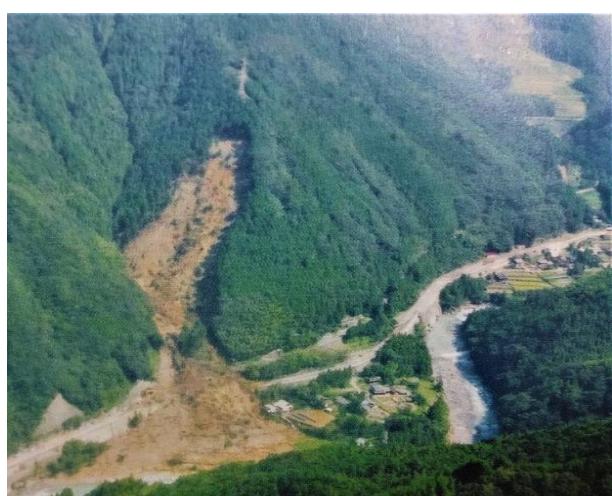
### **4. Understand the vulnerability**

In 2004 an unprecedeted series of typhoon flooded Saijo and provoked a landslide on the village main road that locked down its inhabitants for 10 days. A Division of Crisis

Management was created in response by the municipality to mitigate such disasters in the future. Successful programs have been implemented in collaboration with the United Nations Office for Disaster Risk Reduction and the Japanese International Cooperation Agency but such initiatives remain limited to urban areas. Interviews of municipal officers revealed that no particular protocol or guideline have been developed for marginal villages like Senjo in the event of a disaster, the responsibility being left to the local leader, 79 years old, to secure all of the villagers by himself.

According to the National Research Institute for Earth Science and Disaster Resilience, the village location is categorized as the highest level of probability (26 to 100%) for possible earthquake risks in the coming thirty years<sup>5</sup>. Additionally, landslide hazard also appears to be important and poses a direct threat to both a village community house, which functions as a traditional shelter, and Senjo main road, only access to the village.

Officers of Saijo City Division of Crisis Management stated that material like sediment disaster hazard maps have been distributed to all the municipality inhabitants to increase their awareness on natural disaster risk, but none of Senjo villagers declared to have ever seen such kinds of maps.



*Figure 2. Landslide on Senjo's main road in 2004.*

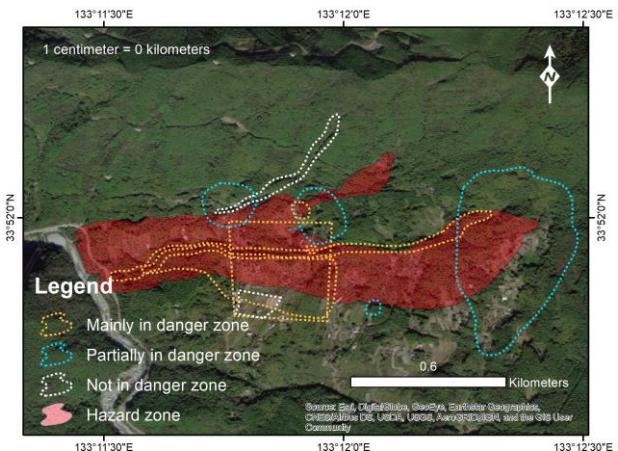
## 4 . Identify key information

### a. Current condition of the housing

To support my research in the village for the three months I lived there I used a lot of secondary data like topographic maps from the local government. To my surprise most of the maps were outdated or presented mistakes by displaying numerous houses that do no longer exist. Although the understanding of housing condition is of primary importance in the aftermath of a disaster for emergency services to search and rescue the right locations with no delay, the reality can also be confusing for the municipality as several houses that are no longer inhabited are still registered as mailing addresses. This blurs the comprehension on the real number of inhabitants in the village from an administrative point of view.

Through observations and interviews, I could reliably assess that of 78 houses and storages displayed on available maps, 7 were in ruins, 26 abandoned, 33 used occasionally in the day time by previous villagers and only are still 12 inhabited. In addition, referring to Saito City Sediment Disaster Hazard Map, of the 12 inhabited houses, 9 are located in an area prone to major landslide risk.

**b. Awareness towards disaster risks** I interviewed villagers to assess how they understand the risks they face. As none of them was familiar with municipal information materials indicating the location of hazardous zones in the village, I asked villagers individually to designated areas they believed to be dangerous. As a result, 5 appeared to be correct, 4 were partially correct and 2 were wrong while 3 stated that they didn't know, 1 declared that the whole village was safe while another said oppositely that nowhere was.



*Figure 3. Comparison of villager's risk identification with municipal hazard evaluation.*

Based on the interview, it is recognized that while a small majority of villagers have a certain understanding of the areas at risk, for example none considered to seek shelter in the village community house, located in a dangerous area, in case of an emergency as an option. Yet, the awareness of each of them could significantly be improved if their individual knowledge was shared and the dedicated materials effectively reached them.

### c. Villagers vulnerability

Furthermore, the overall assessment on the vulnerability of each of the village households was made to identify the most vulnerable villagers. This was achieved by the combination of various factors such as: the number of people per households, the location of the house, capacity to identify hazardous areas in the village, available ways of mobility (car or on foot), physical condition, social capital and reliance on others in the case of an emergency. Unfortunately, three households couldn't be included in this assessment as they refused any kind of social interaction. This attitude of social isolation is also expressed towards the rest of the village community, leaving these three households cut from the local social network and thus particularly vulnerable. This lack of cooperation within the community limits its

resources and capacity to respond to disasters. even with the rest of the village community which itself poses a serious threat to these isolated households but also to the village capacity to effectively respond to disasters as a group through its social organization (Li et all, 2019).

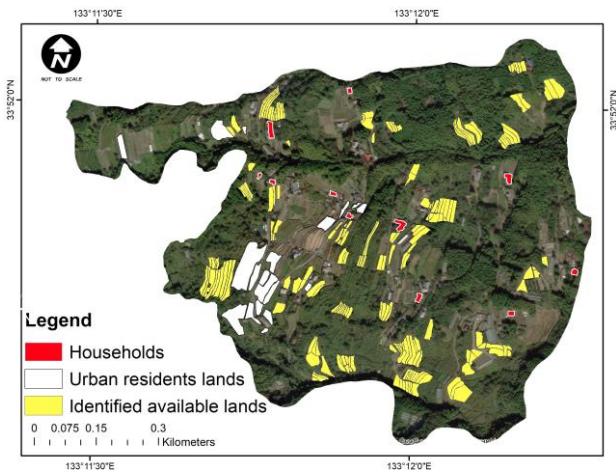
Besides these three households, among the twelve successfully investigated ones four were considered to be particularly vulnerable and requiring a special attention from local government dedicated services. With little surprise, all of these vulnerable households appear to be inhabited by widows living on their own - women having a higher life expectancy in Saijo municipality than men (87.9 against 80.8 as 2015) - with a low social capital, no car, a bad physical condition and relying on relatives that already migrated to urban areas in the event of an emergency.

## 5. Possible approach to resilience

How can resilience be increased in Senjo village? Numerous researches in Japan have emphasized the importance of a strong social capital to support aging communities based on the collaboration between both urban and rural residents (Shaw et all., 2012). Linked to urban areas on a regional scale, the missing labor can be provided once again from outsiders to protect and sustain villagers lives, environment and traditional assets.

However, in the case of Senjo, few urban residents are already coming to the village to cultivate a small number of terraces. Furthermore, their interactions with the villagers are very low in both qualities of the relationships and size of the network.

As a potential clue to increase these interactions, I identified with landowners willing to lend their lands 209 terraces over 5 hectares that could be cultivated by outsiders to join such agricultural activities.



*Figure 4. Identified available lands*

Located on average 42 meters to villagers' households these lands could also contribute to the restoration of the village ancestral scenery and restore the pride that villagers attached to it. Positively, 100% of the villagers I interviewed recognized the benefit of such approach. A majority of them, 66% of interviewed residents, believe that it could improve the social life and support the local annual festival of the village craving for manpower.

To achieve a significant resilience able to sustain Senjo's last villagers in this critical final stage, resources from both inside and outside the village need to be mobilized by a multiplicity of actors as the village suffered too long of its prolonged isolation. Urban residents have the capacity to directly support villagers but their initiatives and efforts should be backed by the municipality of Saijo who must consider and emphasize the safety of all its citizen regardless of their rural or urban affiliation. As the condition of the upstream mountainous environment directly affects the coastal cities on the downstream, an effective revitalization of Senjo village would not only benefit to the villagers but also to the residents of dense urban areas who should remember the natural connectivity of mountains, humans and oceans.

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## Collaborative Approach for Commons in Sustainable Society:

### Case of Sugarcane Bagasse Concrete in Okinawa

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## 1 Sugarcane Bagasse Concrete in Okinawa

### 1.1 Introduction

The infrastructure in a region usually depends on the availability of natural resources like sand and gravel. However, exhaustive mining leads to vegetation decrease, loss of water retaining strata, lowering of the groundwater table, and disturbance in the existing ecosystem. Several regions adopted mining restrictions that reduced suitable aggregates' availability at shorter haul distances for these reasons. Consequently, the transportation of aggregates from longer distances to construction sites increased their cost, leading to an increase in the total cost of construction [1].

The use of local aggregates for concrete is desirable not only to reduce costs but also to reduce environmental impact since longer transportation distances emit more CO<sub>2</sub>. However, resources limitation does not allow several regions to produce their own aggregates or suffer a shortage of options. Also, for islands with small land areas, it is imperative to conduct eco-friendly production activities from the viewpoints of waste reduction, resource-saving, and prevention of global warming.

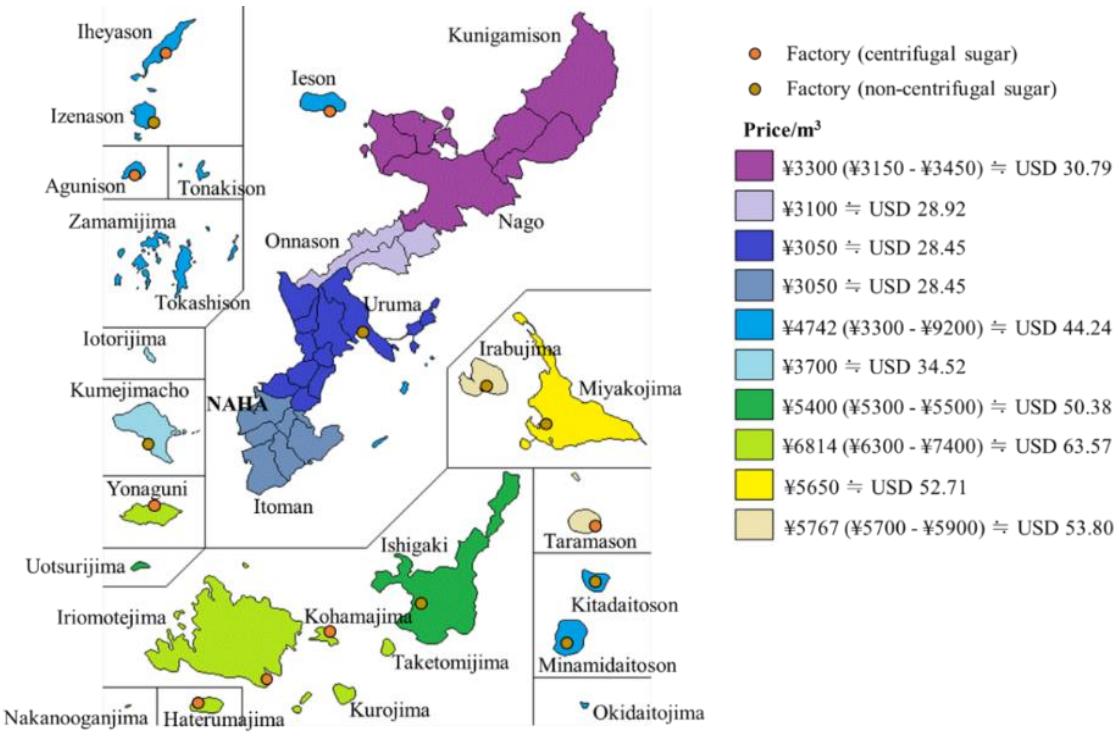
Okinawa Prefecture is one of the 47 prefectures in Japan and is located in the

southwest of Japan. Since Okinawa Prefecture consists of a series of small islands, the concrete aggregates are generally crushed stone and sea sand; once there is a lack of adequate river basins to obtain ordinary river aggregates [2]. The aggregates' mining/collection is concentrated on the main island of Okinawa, where the capital city Naha is located. Therefore, the aggregates are transported from the main island of Okinawa to smaller islands by vessels. **Figure 1** illustrates the prices per m<sup>3</sup> of the fine aggregates, which are available online or published monthly in a magazine [3] [4], and the location of sugar factories in Okinawa Prefecture [5].

### 1.2 Sugarcane Residues

The bagasse ash is rich in silica and has a potential for pozzolanic reactivity and filler effect in concrete and mortar mixtures [6]. For this reason, in order to improve the quality of the burned residues collected from the boiler, a re-burning treatment process is applied [7] [8]. However, the re-burning treatment may be an unsustainable process due to the additional CO<sub>2</sub> emissions.

In some studies, it was observed that the addition of polypropylene and steel fibers improves the mechanical properties of concrete [9] [10] [11]. It is known that plain concrete



**Figure 1. Price of the fine aggregates and location of sugar factories in Okinawa [24]**

under tension exhibits brittle failure with initial cracking when there is no reinforcement [12]. However, the use of fibers in concrete as non-conventional mass reinforcement has been proved a promising alternative since it primarily enhances the inherent deficiencies of concrete, such as the weak tensile strength and the limited deformation capacity in the presence of cracking [13]. This happens because cracking and, eventually, tensile failure of fiber-reinforced concrete requires a debonding and pulling of the randomly distributed fibers in the concrete [9] [14].

Considering the results of the above mentioned previous studies, the bagasse fiber in cement composites may also improve concrete's mechanical properties. Previous studies reported that natural fiber-reinforced cement composites have a high potential for replacing standard fiber materials due to their high performance in mechanical properties and low cost [15] [16] [17] [18]. Therefore, the use of sugarcane residues in their original form - that is, in the form the residues are generated out of mills or boilers – may be a way to make both the civil engineering industry and the sugar/alcohol industry more sustainable [19].

### 1.3 Sugarcane Bagasse Concrete

In a previous study [19], sugarcane residues were classified into three different categories by the process of sieving: bagasse fiber, bagasse sand, and bagasse ash. These residues were utilized to prepare mortar specimens and to investigate the mechanical properties of mortars. The study revealed that mortar added with 2% of bagasse fiber showed a higher percentage of water retention than the mortar specimens without fiber due to the high amount of bagasse fiber. However, the fibers used in this research were those that passed through a 4.76 mm sieve and remained in a 2 mm sieve, leaving bagasse bigger than 4.76 mm to be cut or used in another way.

### 1.4 Sugarcane Bagasse Concrete to Address Challenge in Sustainable Society

Recently, the Urban Heat Islands (UHI) has become a critical challenge in a sustainable society. The large proportion of artificial surfaces, such as concrete, absorbs and store more heat than natural vegetation, increasing the temperature in urban areas [20]. Several measures have been developed over time to

mitigate UHI. These measures include the design of cool pavements by increasing the albedo of surfaces and making them more reflective, permeable, porous, and water retentive [21], and more.

Since the sugarcane bagasse fiber is known for its high-water retention and water absorption characteristics, it is possible to take these advantages and use the bagasse fiber bigger than 4.76 mm as concrete aggregates for the production of sidewalk blocks, since they do not need to have high strength.

Furthermore, local sugarcane residues as aggregates for concrete, especially for islands with small land areas like Okinawa, are desirable for a sustainable society since they can reduce environmental load and decrease transportation CO<sub>2</sub> emissions. Besides, the development of more construction material options is critical since a country's policies may repeatedly change. Japan's government announced that it aims to reduce coal-fired power generation by about 90% by 2030 [22]. This can dramatically reduce fly ash production in all of Japan, and consequently, it may impact the use of fly ash as aggregates.

## 2 A Follow-up Project

### 2.1 Overview

Based on the above previous research, a follow-up project including community work and workshop was conducted with aims to:

1. let local people know the importance of using sugarcane residues for building a sustainable society,
2. transfer knowledge about the potential use of sugarcane residues as aggregate in concrete,
3. let local people realize various problems and consider countermeasures against UHI, and
4. discuss among the local government, institutions, companies, etc., a sustainable way to continue the production of interlocking blocks with sugarcane residues and apply them in local communities.

This project started by contacting the local government, companies, academic experts, local farmers, and citizens to invite them to collaborate with this project.

This project's aim was explained to the collaborators and volunteers, giving them a basic knowledge of the background of the sugarcane bagasse concrete. Also, the possible contributions to the environment, civil construction industry, sugar/ethanol industry, and farmers and government by using sugarcane residues were explained as well.

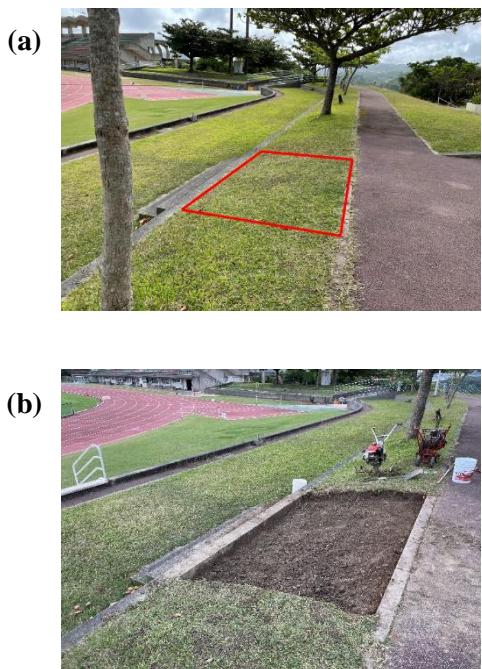
Following the overall explanation, preparation for the project's execution was begun by laying interlocking concrete blocks in a park together to the local community. The details, such as determining the location where the paver blocks were placed, dates, and the mix proportions of the blocks, were decided together with the collaborators. The mix proportions of the block are described in **2.2. Concrete Mixture** of reference [23].

Right after the execution of the work, evaluations about this project were made. It includes interviews and surveys about what the collaborators and volunteers thought about the interlocking concrete blocks with sugarcane residues and about this project in general.

Finally, all the processes, interviews, and surveys made in this study were summarized and presented in a workshop.

### 2.2 Community work

The interlocking concrete blocks with sugarcane residues were laid in a park on November 12th, in Nishihara Town, Okinawa Prefecture, at the Nishihara Athletic Park, shown in **Figure 2 (a)**. This location's choice was motivated due to the park's users slip on the wet grass since the location inclines approximately 30 degrees. After deciding where to lay the blocks, the work of digging the ground has begun. An area of 6.0 m<sup>2</sup> was dug approximately 8 cm deep, as shown in **Figure 2 (b)**. The blocks' preparations the same as described in **2.3 Preparation of blocks** of reference [23].



**Figure 2. Construction site**

A total of 15 volunteers were involved in this work.

### 2.3 Workshop

A workshop was held on December 7th in Nishihara Town, Okinawa Prefecture, at the University of the Ryukyus, Researcher Exchange Facility, from 13:00 until 16:30.

The workshop's objective is straightforward: to overcome barriers among stakeholders and different sustainable issues, including environmental, technological, and economic issues. This will be achieved by combining and advancing existing technologies for sustainable processing of sugarcane residue as construction aggregate, generating revenue.

Specifically, this workshop addressed the 3Rs (reduce, reuse, and recycle) ideals, sugar/alcohol and construction industry problems, and countermeasures that can be applied to achieve sustainable development in both industries. Furthermore, the workshop presented case studies and experiences from Okinawa Citizens' Recycling Movement of 3Rs projects; transferred knowledge about the potential use of sugarcane residues as aggregate in concrete; received feedback from users and Okinawa Prefectural government and local level



**Figure 3. Construction site after laying interlocking concrete blocks**

authorities; exchanged views and good practices among participants, and identified possibilities and challenges for moving towards the implementation of sugarcane residues as concrete aggregate.

## 3 Achievements

### 3.1 Community work

The output of this project is shown in **Figure 3**. In order to evaluate the slip resistance for pedestrians, the test described on JIPEA-TM-6 was applied. According to the "Manual for Interlocking Blocks Pavement Design and Construction" published by Japan Interlocking Blocks Pavement Engineering Association (JIPEA), the sliding resistance value (BPN value) has to be greater or equal to 40 BPN for pedestrian roads. The average BPN value acquired from this work was 61.7 BPN which indicates a fair value compared to the standard.

### 3.2 Workshop

**Figure 4** shows a snapshot of the workshop. The total participants were 37, including people from the government, private companies including civil construction companies and sugar companies, academics, and local citizens. Overall, the goal of the workshop was achieved: it was possible to raise awareness about the sugarcane residues and local resources; collaborators came up with new ideas for the use of sugarcane residues; also, how to make this business model sustainable was discussed among collaborators.



**Figure 4. Participants of the workshop**

#### **4 Collaborative Approach for Commons: Toward Sustainable and Resilient Society**

Sugarcane residue can contribute to a sustainable society in that it can be used as a construction material for its worldwide accessibility and because of its renewability. Besides, by using sugarcane residue as construction materials, conventional resources such as sand can be saved. This will result in the avoidance of landscape destruction. Moreover, the reduction of greenhouse gas emissions is another promising factor [24].

To face hurricanes, earthquakes, extreme heat, and flooding posed by climate change, less warm urban areas will do a far better job at maintaining habitable temperatures in the event of an extended power outage. As such, the buildings using sugarcane residue will emit far less carbon dioxide, which contributes to climate change, during normal operations.

It is to note, in addition to the previous research that identified the high-water retention and reduced surface temperature as a countermeasure for UHI when natural bagasse fibers are incorporated in concrete blocks for pavements [23], strategies to increase the resilience and adaptive capacity to use local materials and products should be taken into account. This is especially because the lack of precedents of the use of sugarcane residue concrete makes its implementation difficult. By introducing the knowledge and information to different stakeholders, it will be possible to increase resilience and facilitate the adaptation of sugarcane residue as construction material, even without precedents.

In conclusion, producing concrete secondary products, such as blocks with added sugarcane residues, and registering these products as local brands can be a step forward toward creating a resilient society. Besides in combining this approach with local business, an innovative business model can be formed to produce a sustainable and resilient product with locally available materials, the creation of local brands, urban heat island mitigation, and environmental load reduction. To achieve this, it should involve the whole local community with "commons" that can cover overarching public interests, stakeholders and generations; in the case of Okinawa Prefecture: sugarcane.

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## Resilience-Based Public Policy to Address the Toxic Smog in Lahore, Pakistan

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### 1 INTRODUCTION

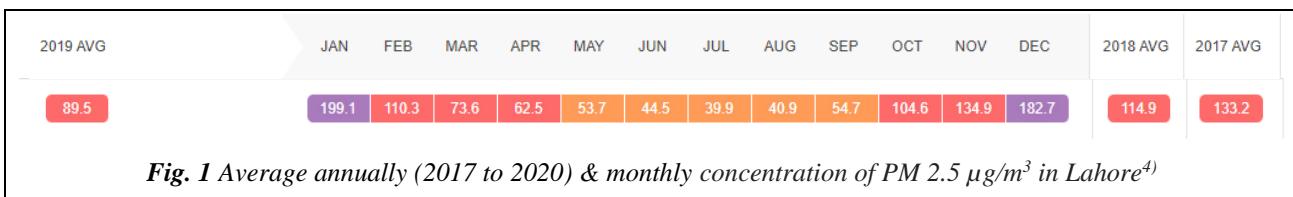
This paper attempts to address the rising threat of toxic smog in Pakistan's megacity and develop by introducing a resilience-based smog policy framework that can be adopted to tackle the rising threat of toxic smog in Lahore. Through this process, the existing policy gaps will also be identified, and some strategies and approaches to reduce the toxic smog will be provided in this paper.

Smog is a type of environmental pollution, generally deemed a combination of smoke and fog in the atmosphere<sup>1)</sup>. It may also be defined as a mixture of several gases, including dust, sand, smoke, pollen, and water vapors in the environment<sup>1)</sup>. Smog is a yellowish or dark hazy air that causes breathing problems, suffocation, upper and lower respiratory distress, cold, flu, and inflammation of lung tissues that lead to chest pain, cough, eye irritation, and poor visibility environment<sup>2)</sup>. It is produced by sunlight intervention with nitrogen oxide and particulate matter, pollutants emitted from various sources release into the atmosphere such as fuel burning, industrial smoke, and vehicle emissions, react with

the sun in the atmosphere and produce smog<sup>3)</sup>. It is poisonous to humans and animals and adversely affects plants and nature as a whole. Besides, to inhibit plant growth, ground-level ozone in the smog also damages crops and vegetables and wheat, rice, tomato, and cotton substance to infection when they are exposed<sup>3)</sup>.

### 2 TOXIC SMOG MENACE IN LAHORE

Smog is one of the most severe environmental issues in Pakistan. The most developed and urbanized city of Pakistan, called Lahore, faces toxic smog for the last few years (see the detail in section 3). From October to February, devastating smog has been experienced every winter in Lahore (see fig.1), which causes several health issues and serious road mishaps that lead to many injuries and deaths in the city<sup>3,4)</sup>. Fig 1 shows the average annual concentration of PM 2.5  $\mu\text{g}/\text{m}^3$  in Lahore during 2017, 2018, and 2019. It also shows the average monthly concentration of PM 2.5  $\mu\text{g}/\text{m}^3$  in Lahore during 2020. Lahore has been ranked no. 1 in the top 10 most polluted cities globally on 21<sup>st</sup> December 2020 by IQAir (see fig. 2).



Major city	US AQI
1 Lahore, Pakistan	286
2 Dhaka, Bangladesh	265
3 Kathmandu, Nepal	227
4 Kolkata, India	219
5 Sarajevo, Bosnia Herzegovina	193
6 Delhi, India	187
7 Wuhan, China	180
8 Mumbai, India	176
9 Chengdu, China	170
10 Chongqing, China	159

Fig. 2 Top 10 cities with bad air quality on 21<sup>st</sup> Dec, 2020<sup>4)</sup>

Table 1 PM 2.5 legend with limit values <sup>4)</sup>	
<b>WHO target</b>	0-10 $\mu\text{g}/\text{m}^3$
<b>Good</b>	10-12 $\mu\text{g}/\text{m}^3$
<b>Moderate</b>	12.1-35.4 $\mu\text{g}/\text{m}^3$
<b>Unhealthy for sensitive groups</b>	35.5-55.4 $\mu\text{g}/\text{m}^3$
<b>Unhealthy</b>	55.5-150.4 $\mu\text{g}/\text{m}^3$
<b>Very unhealthy</b>	150.5-250.4 $\mu\text{g}/\text{m}^3$
<b>Hazardous</b>	>250.4 $\mu\text{g}/\text{m}^3$

Table 1 shows the PM 2.5 legend with the limit values. On 21<sup>st</sup> December 2020, Lahore has crossed the limit of hazardous level and ranked as no. 1 in the top most polluted cities globally. Recently, Lahore residents have experienced a dense blanket of smog that, in addition to the other problems, caused low visibility, respiratory and eye distress<sup>5,6)</sup>. Whereas burning eyes, severe breathing, sneezing, wheezing, and cough were the most significant signs and symptoms in Lahore<sup>5,6)</sup>.

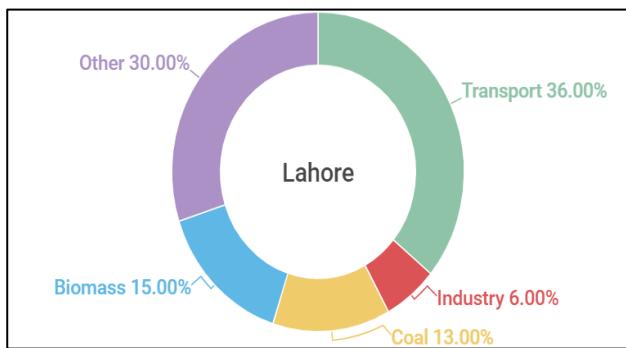
### 3 RATIONALE OF SMOG IN LAHORE

In recent years, smog has worsened due to the increasing environmental pollution, secondary to establishing large numbers of mills, brick kilns, heavy traffic, remarkable construction, deforestation, and reduced biodiversity due to urbanization. Fig. 3 shows the sector-wise contribution to pollution in Lahore whereas, fig. 4 shows the smog condition in Lahore in December 2020. However, the main reason for smog in New Delhi was the farmer's burning of cultivated waste. Since Lahore is very close to the Indian borders, this might be an additional reason to smog more thickly in Lahore.

In addition to this, the motorcycles and rickshaws equipped with two-stroke engines in Lahore are the most inefficient vehicles as they release Carbon Monoxide (CO), Nitrogen Oxides (NOx), Hydrocarbons (HC), and Particulate Matter (PM) in the air<sup>7)</sup>. One of the most hazardous pollution for human health is Particulate Matter because, according to WHO, around 9% of global fatalities from lung cancer, 5% of fatalities from cardiopulmonary illness, and approximately 1% of fatalities from respiratory diseases are caused by Particulate Matter.

Furthermore, population growth (increasing population means increasing people's needs and demands leading to pollution), increased industries and factories in the urban center (toxic smoke from factories), usage of heavy transport, high temperature or sunny climate, reduced biodiversity, burning of coal or combustion of fuels like petroleum, wood, coal, etc., improper waste management system, heavy construction dust (rapid construction works severely impede the ecosystem, reducing biodiversity), crops waste burning in the farms, coal-

fired power plants and urbanization are the main reasons for increased air pollution in Lahore.



**Fig. 3** Sector-wise contribution to pollution in Lahore

Sources: [FAO/United Nations, 2018](#)



**Fig. 4** Condition of smog in Lahore in December 2020

#### 4 SMOG POLICY OF PUNJAB

Pakistan has four Provinces, two states, and one federal territory. The provinces are divided into divisions, and then divisions are further divided into different districts. Lahore is a district that comes under the province of Punjab. The government of Punjab has developed a policy on controlling smog in 2017<sup>8)</sup>. The main responsibility for implementing Punjab smog controlling policy rests upon Environment Protection, Home, Local Government, Agriculture, Industries, Education, Primary and Secondary Health, Inspector General Police, Information Departments, Environmental Protection Agency and their field agencies<sup>8)</sup>.

Under this policy, the Environmental Protection Department will closely monitor rice stubble-burning activities in Punjab, whereas the Home Department shall impose a complete ban on open burning of rice stubble, solid wastes, and other hazardous materials. This ban shall be enforced by the respective Deputy Commissioners and District Police Officers. Similar instructions shall be forwarded to their field offices by the Local Government and Agriculture Department<sup>8)</sup>.

In the event of a forecast or actual smog event, Environmental Protection Department will issue advisory to each department concerned based on the Air Quality Index (AQI) for PM2.5 and other parameters<sup>8)</sup>. Primary and Secondary Health Care Departments shall issue a health advisory and ensure that it is disseminated widely through paper, electronic, and social media. Additional Inspector General of Traffic shall issue advisory on the use of roads, particularly highlighting the forecasted or prevailing visibility levels and their likely impact of safe use of roads<sup>8)</sup>.

The Department of Agriculture shall prepare and implement the plan(s) for the disposal of crop residues in an environmentally friendly manner. Environmental Protection Agency shall not grant environmental approval to any housing society unless it provides a comprehensive system for managing solid waste collection and disposal. Local Government and Housing & Urban Development Departments shall ensure the development of master land-use plans through their respective subordinate offices<sup>8)</sup>.

In addition to the above responsibilities, several other initiatives have been taken to tackle the smog's threat, but the problems are severely increasing with every day passing. Although the government has

formulated a smog policy in some ways and is taking several initiatives to reduce the smog, there are many challenges in the existing policy.

One of the main challenges is the lack of policy formulation and implementation process in addressing the smog problem at the local level. Since the Government of Punjab has made policy at the provincial level, implementing that policy at the district level is challenging. Only the major government departments in Punjab, such as Environmental Protection Department, Health Department, Transport Department, Industries Department, Planning and Development Department and Local Government Department, etc., are playing their roles in implementing the policy, whereas many other stakeholders such as businesses, educational institutions, NGOs, and local people or political leaders are not taking part in the implementation of the smog policy in each district. Knowledge from different groups of scientists and local community perspectives has not been incorporated into the policy formation and implementation process.

The above challenge has led to the lack of collaboration among the government departments, businesses, industries, NGOs, and educational institutions, which puts the government in difficulty implementing the provincial smog policy.

Furthermore, it is to note there is no regular monitoring, assessment, and evaluation of each department's contribution and role in addressing smog.

Given the above, in sum, only the government departments have been involved in the policy formulation and implementation process. There is a need to include businesses, academia, research institutions, NGOs, and other stakeholders in the policy formulation and implementation process. The

smog policy should be formulated and implemented at the local/community level for each city, and then it should be connected with the provincial and regional level policy. Since Indian Punjab (New Delhi) and Pakistani Punjab (Lahore) are both facing severe smog (see fig. 5), the regional level policy should also be formulated. The policy should be revised regularly, and duties should be assigned to different stakeholders for smog reduction. Through the process, community-based activities such as social seminars and public education can also help in promoting behavioral changes in local people.

Especially, awareness campaigns at the local level, by collaborating with all government departments, NGOs, and other stakeholders, including local people, should be raised to encourage people to take actions at the individual level for smog reduction.



*Fig. 5 Smog in Indian Punjab and Pakistani Punjab*

Based on the gaps in the existing policy and the challenges faced by governments to combat the issue of smog, a resilience-based smog policy framework is proposed in the next section.

## **5 RESILIENCE-BASED SMOG POLICY FRAMEWORK**

A framework of resilience-based public policy based on systems approach and system linkages was developed by Shimizu and Clark (2019). They defined “operational” resilience, which is a key in the resilience-based public policy, as “the enabling capacity to create environments or systems that remain functionally intact when impacted by unexpected events.” This is accomplished by recognizing situational changes and understanding the whole systems linkages from a short, medium, and long-term perspective<sup>9</sup>.

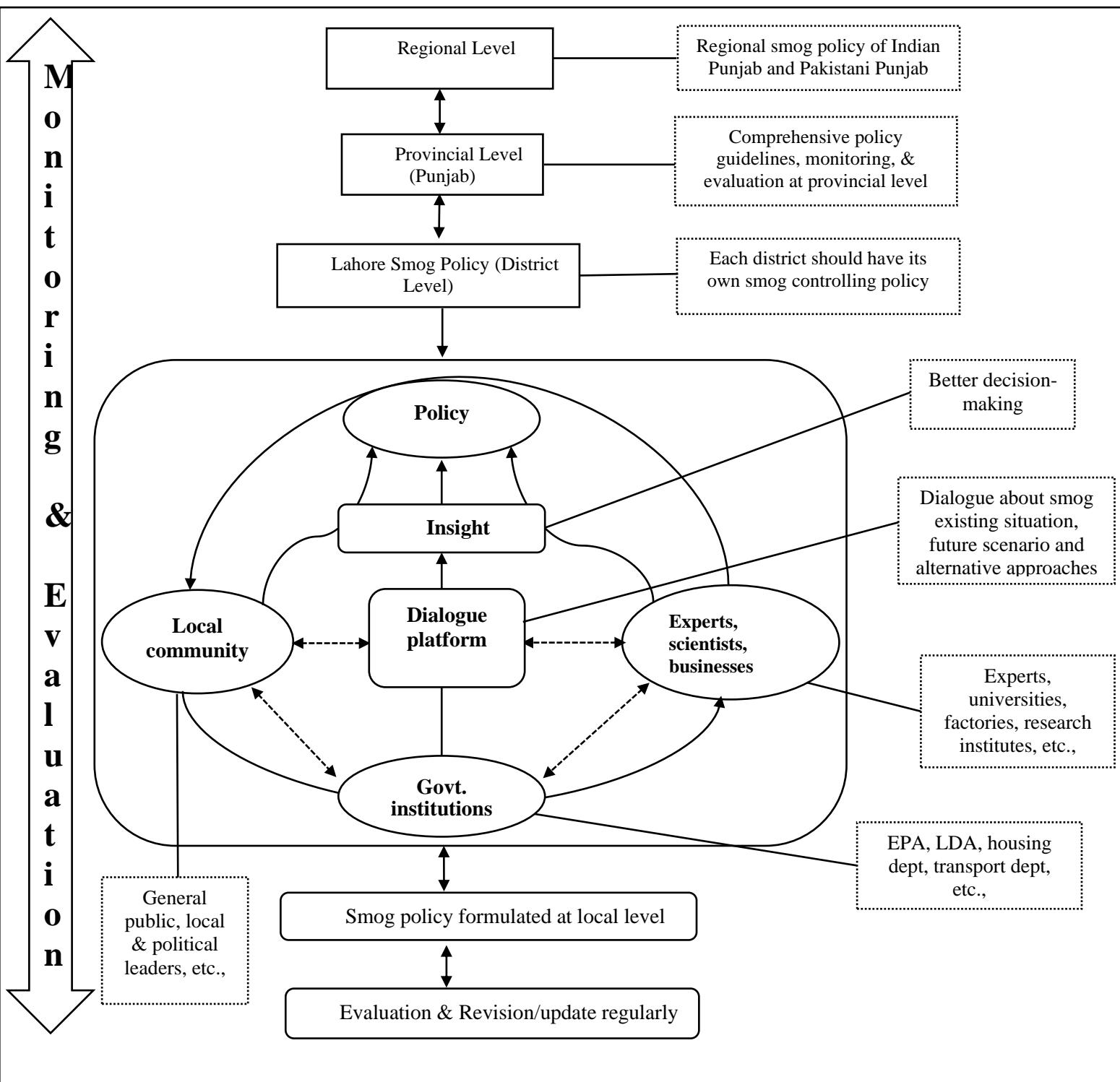
Moreover, building resilience based on the framework of resilience-based public policy requires interdisciplinary research and understanding of the importance of collaboration with local actors to understand what information is required and how it can be implemented in order to design solutions that benefit all aspects of society. If Lahore is to be successful in its fight against smog and poor air quality, it will need an evidence-based policy approach rather than perform a set of superficial tasks like issuing notices to a few individuals.

By applying the framework of resilience-based public policy to the smog challenge, a resilience-based smog policy framework is proposed in Fig.6, considering the integrated views of possible risks, impacts, and uncertainty among policy communities. The proposed policy framework aims at facilitating to develop a smog policy at the local level for each city and connects the local level policy with the provincial and regional level smog policy. It includes short, medium, and long-term perspectives for residents, communities, and multi-stakeholders

across sectors by taking into account the linkages of human, natural, and social systems, and incorporates knowledge from different groups of scientists and local community perspectives into the policy formation process. The monitoring and evaluation of the policy formation, policy revisions, and assessment at each level will be taken into account in the proposed resilience-based smog policy framework.

After the policy formulation at the local level, the next step will be the implementation phase in which all the concerned departments, including industries and factories, will take initiatives to reduce smog and organize training workshops, and raise awareness campaigns. Social media and TV should raise awareness for the general public and educate them to take necessary steps at the individual level to reduce smog. Regular monitoring of the industries, factories, and other major contributors to smog pollution should be carried out. The resilience-based policy framework, which incorporates different sectors and the general public through dialogue platform, is presented in Fig.6.

**Fig.6: Resilience-Based Policy Framework for Smog Reduction in Lahore**



## 6 OUTCOMES OF RESILIENCE-BASED PUBLIC POLICY

Applying the resilience-based public policy to the smog challenge enabled integrating knowledge from

different groups of scientists, environmental experts, local government institutions, and local leaders and communities' perspectives through a dialogue platform. The dialogue platform will promote foresight dialogues among multi-stakeholders from

different channels, which will be linked with better responsiveness of different stakeholders such as government institutions, environmental experts, businesses, and local communities. The platform will allow the multi-stakeholders and all concerned departments to discuss the existing smog situation, future scenarios, and possible alternative approaches to tackle smog. The outputs and outcomes from the foresight dialogue platform will lead to “insights” for smog policy. The foresight dialogue and insight will lead to better decision-making and decisions, and finally, all of these will lead to better implementation of the smog policy at the local level.

## 7 SMOG PREVENTION MEASURES

Long-term smog prevention is essential. The plantation is crucial to control air pollution. Cutting of trees must be prohibited in the cities. It is necessary to reduce the use of gas-powered engines, oily paints, and insecticides to a minimum level. There must be a ban on two-stroke motors using mobile petrol oil. Factories should be pulled out from urban centers. After treatment, household and industrial waste should be properly disposed of. People should use

public transport and avoid using private cars for daily commute purposes.

For this challenge, government assistance is vital for dealing with smog-related issues. The government should provide farmers, the necessary modern crop waste management mechanism. For the timely program's implementation, a strong political will is necessary to prevent crop residues' burning. A consolidated air quality monitoring policy should be formulated immediately by the government. Environmental Protection Agency (EPA) should increase their own local air surveillance capabilities and capacity, focusing on industrial units.

Meanwhile, the government should not tolerate any infringement by any contributor to existing environmental legislation. The government should also focus and take one step forward in conducting studies on environmental impact assessment, risk assessment, and implementation of strategic impact assessments for the construction of megaprojects. In collaboration with businesses, industries, factories, education sectors, and NGOs, the government should organize capacity-building training and awareness campaigns to reduce smog.

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## Applying Insights drawn from Yakushima School to University Community Efforts with SDGs

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**Masters 2<sup>nd</sup> Year**

### 1. Introduction

Nature is a great place to learn about the life, science, engineering, art and other disciplines. Anyone who has spent some amount of time in nature, among mountains, forests, trees etc., knows that nature actually resonates deep within us. Nature does not only serve as a medium for understanding ourselves, but for connecting with society and understanding the broader social and environmental ecosystem in the world around us.

However, researchers and scientists have now been calling for substantial societal changes from our individual and collective livelihood perspective to reduce human-activities related impacts on nature. Nevertheless even after much action sought for conservation has been taken, natural environment continues to decline particularly due to our current high consumption rate. Human and social systems depend directly on the output of natural system; hence, this decline will affect us, just as it does with other extinct species.

The UNESCO Yakushima SDGs School (called Yakushima SDGs School hereinafter), held as a part of Kyoto University's UNESCO Chair initiative and sponsored by the Ministry of

Education, Culture, Sports, Science and Technology (MEXT), aimed at narrative learning from nature to apply insights to our life based on the understanding that our whole natural system encompasses all other sub-systems which stand-alone yet are inter-connected and inter-dependent.

The author participated in the Yakushima SDGs School. Based on the learnings, the author provide insights drawn from the school and apply the insights to other fields in this paper.

Basically, the holistic approach used in Yakushima SDGs School to visualize and grasp the natural/social/human systems in order to understand esoteric challenges in sustainable society by linking Yakushima and Kyoto with collaborative group works is critical in the nature-based learning process. This kind of program will help to achieve individual transformation, societal transformation, with social and technological advancement as targeted in United Nation's Education for Sustainable Development (ESD) framework.<sup>1</sup>

### 2. Yakushima Island and Yakushima SDGs School

Yakushima, also known as "The Alps of the Ocean" is a small island located in the southern

<sup>1</sup> <https://www.oneplanetnetwork.org/initiative/education-sustainable-development-towards-achieving-sustainable-development-goals-esd>

part of Japan. It is a subtropical island, falls under the Kyushu area and part of Kagoshima Prefecture.



Figure 1: Map of Yakushima

It was awarded the status of UNESCO World Natural Heritage Site (1993) and Biosphere Reservoir (1980)<sup>2</sup> due to its rich biodiversity (with over 1,900 varieties of plants and over 80 of them are indigenous to Yakushima) and local ecosystem as the only case of double designation. Yakushima is blessed with diverse natural geographic conditions as a beautiful blend of trees, forests, ocean and human society. It is covered by widespread cedar forests that contain some of Japan's oldest living trees. Trees more than 1000 years old are affectionately called Yakusugi (a combination of Yakushima and Sugi, the Japanese word for cedar), the most ancient of which are over 7000 years old.

With this background, the SDGs Yakushima School provided opportunities for university students to interact and acquire knowledge through fieldwork, knowledge co-production based workshops on resilience approach from system linkages and system capacities prospect, with emphasis on grasping linkages among SDGs by looking at nature, human and social systems in a continuum.<sup>3</sup> There are several lectures on Yakushima with respect to cultivating overarching thinking and collaborative system

design so the students can engage in co-innovation and implementation of SDGs, ultimately for a better future, well-being, and more resilient society.

Yakushima SDGs School also signifies the research work<sup>4</sup> that nature-based learning promotes creativity, critical thinking, problem-solving, social interactions and academic readiness in numerous ways, including impacting cognitive development, health and well-being. It also helps as increased enthusiasm, engagement with learning process and knowledge co-production activities.

### 3. Key Insights

The Yakushima SDGs School encouraged students to connect insights drawn through the Yakushima SDGs School to how to approach SDGs with students' community efforts by broadening students' vision 'beyond the boundaries' and acceptance of the outside world by "lowering walls" within and around us. The author has picked up three main key learnings as take-away for this paper:

- Human, Society and Nature Linkage
- Locals and Visitors Knowledge Exchange
- Lower the walls & Look beyond boundaries

#### **Human, Society and Nature Linkages**

The model in Figure 2, from "Nexus of Resilience and Public Policy in a Modern Risk Society" (Shimizu and Clark, 2019), was used as an underlying concept for Yakushima SDGs School represents correlation, linkages and interconnections in human, social, and natural systems. It illustrates that community resilience

<sup>2</sup> Biosphere reserves are sites established by countries and recognized under UNESCO's Man and the Biosphere (MAB) program to promote sustainable development based on local community efforts and sound science.

<sup>3</sup> <https://resilience-initiative.com/special-initiative/>

<sup>4</sup> <https://www.childrenandnature.org/resource-hub/resources/>

can be sustained only through linkages with outside systems by incorporating components of resilience between community and local or national systems through public policy (resilience-based public policy).

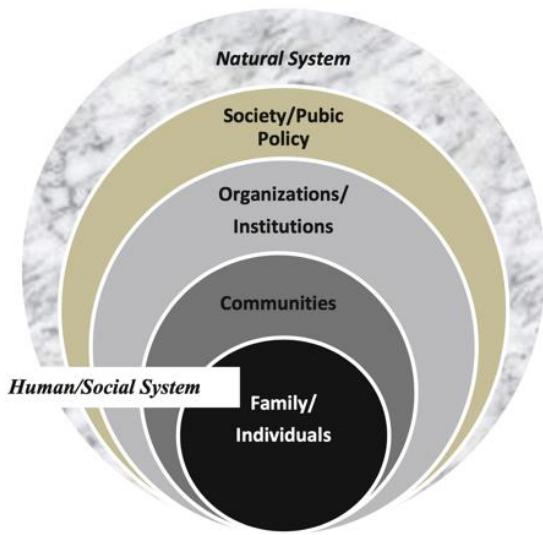


Figure 2: Resilience in human, social, and natural systems and their relationships (Shimizu and Clark, 2019)

The residents of Yakushima have long been able to conserve the natural ecosystem of their island against exogenous (deforestation due to illegal logging, pollution etc.) and endogenous (different natural disasters etc.) risks, remain self-sustained, and resilient against extreme weather conditions for centuries. This incited a tendency to view their resilience as a local or community-related matter; however, in the context of a modern risk society, the size, complexity, uncertainty and the impact of cascading risks are sometimes beyond the capacities of local community handle. (Shimizu and Clark, 2019) Few to name are natural disasters such as tsunami risk, population shrinking, and effect of migration of young people to bigger cities to seek educational and career related opportunities. These risk factors pose a question to sustain their

resilience and cannot be handled by Yakushima residents alone.

Therefore, it is essential to apply a resilience approach with systems thinking and understand the complex inter-linkages among different systems to overcome the gaps, risk mitigation, and create more opportunities pertaining to resilience enhancement of the communities in order to avoid vulnerability to modern risk society challenges. These inter-linkages are also crucial to enable any individual and societal transformation that leads to the effective implementation of SDGs.

We need to understand that we are connected to many systems coupled with the influence of our circumstances; we belong to a system that is part of another chain of systems. Everything comes in a continuum in this top-down as well as bottom-up influential process. We cannot eliminate or skip one dimension for something else to attain a sustainable business and living system. Addressing each system separately or focusing on just one may negatively impact the outcomes of sustainable society. For example, it is very important for any manufacturer to realize the whole product life-cycle starting from scratch till the end, i.e. design to the disposal. Product design teams can inter-link and expand their design-thinking process to the downstream stages to build product design with better capabilities for easy recycling in order to tackle the massive global waste problem and avoid huge landfills, etc.

### **Local and Visitors Knowledge Co-production**

Yakushima Island has been facing increased tourism <sup>5</sup> after being declared with the valuable status of both World Natural Heritage Site and

<sup>5</sup> Over-tourism in Japan has led the locals to coin a new phrase: *kankō kōgai*, or tourism pollution.

Biosphere Reservoir Site and its unique fauna and flora are the main attraction.

Although there have been efforts put in to preserve nature and ecology in its essential form, this increased tourism is causing some concealed problems such as waste pollution, tourists trespassing the private places or farmlands, trampling the corps to take photos, or defacing trees by etching their names on the trunk and other challenges associated with over-tourism.

Therefore, it is again very important to focus on interlinking connections between locals as well as visitors / tourists in order to develop sustainable tourism or eco-tourism through joint efforts to achieve more sustainable communities.

From the hospitality viewpoint, emergence of sustainable tourism as an indispensable tourism culture occurs when the interactions between locals as hosts and tourists as guests take place in the process of exchange of services, creativities, capabilities and incapabilities to fulfil the essence of hospitality, e.g. Omotenashi. They learn from each other to respect and observe the delicacies of the place, people, and practices (tradition) in order to maintain sustainability.<sup>6</sup> Consequently, referred to Figure 2 again, local people as individuals or families are part of the whole set of community and society. Optimally successful results cannot be achieved without taking locals and visitors under considerations required from policy making and implementation perspective. Hence by understanding the linkages that tourism may have an impact on the evolution of local culture by means of absorption of visitor's culture, and it may be an origin or result of sustainability

practices, we have to be open up to learn from each other and their living. (Brendan, 2016)

### **Lower the Walls and Looking Beyond the Boundaries**

What makes Yakushima particularly unique is that within this small island it has a subtropical to cool-temperature climate, biosphere reservoir diversity and three naturally representative environments: mountains, forests and the sea. We shall connect these aspects in order to understand the whole system by lowering the walls and boundaries as a mountain, forest or sea. Hence, lowering the walls and looking beyond boundaries was another most important insight that we learned during the program.

United Nation's SDGs targets are also about adopting same holistic approach as solution to look in to details, with and beyond boundaries, and understanding problems in the local and global context. It is also essential to realize the "leaving no one behind" agenda for any population, place, island, etc. System linkages thinking and resilience approach perspective, as described in previous pages, based on same narrative and calls for adapting the new skills, knowledge co-production and co-innovation by looking beyond the boundaries, no matter visible or invisible such as cultural, geographic etc.

One interesting example of this notion is actually the emerging field of interdisciplinary studies<sup>7</sup> and research programs. Particularly the UNESCO Chair on Water, Energy and Disaster Management for Sustainable Development, Kyoto University (WENDI) that offers a novel and interdisciplinary Higher Education and Research

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<sup>6</sup> An East Asian/Japanese View on Human and its Implications to Hospitalities (Lecture by Prof. Y. Deguchi, GSL-KyotoU)

<sup>7</sup> Interdisciplinary studies involves the combination of two or more academic disciplines into one activity.

for Sustainable Development (HESD) Programme, WENDI aims at contributing to achieving the SDGs as well as establishing resilient societies through collaborative education, research and several other activities like Yakushima SDGs School.

#### **4. Applying the Insights to University Community Efforts**

In today's world, the large-scale challenges and complex problems such as climate change, water scarcity, poverty, inequality, and many others cannot be addressed by just individual or community resilience. It is now more essential than ever before to link the global to national to domestic to local and community systems as an impact co-creation and co-innovation by means of knowledge co-production for sustainable solution.

Hence, the need for recognizing the importance of nature and fieldwork-based learning and implementation of outcomes as practical to give-back-to-society is important. There has been immense literature (Daniel T. L. Shek Robert M. Hollister, 2017 etc.) on the importance of role universities can play by going beyond the core functions of teaching, research, and service and voluntarily act beyond legal requirements to promote the public good and environmental sustainability. Yakushima SDGs School program has influenced the author like other students to take responsibility as a university community member and participate in impactful activities to applying insights learned in the program.

#### **Takashima Shiritsu Kutsukinishi Elementary School in Kutsukionyudani, Takashima**

In February 2021, the author (with family) got an opportunity to visit Kutsukionyudani, a very

remote and hidden valley, surrounded by mountains, forest and thick snow in winter, near Takashima city for three days.



Night view of the valley: Snow, mountain, forests, sea of stars

The local community consists of few people practicing an environmentally-friendly life-style in most the possible sustainable way. It is a small village with many scattered abandoned houses. The most impressive thing for me was the fully-equipped and beautiful elementary school, where the author got the opportunity to teach the kids.



School building: Outside view



School entrance: Inside view

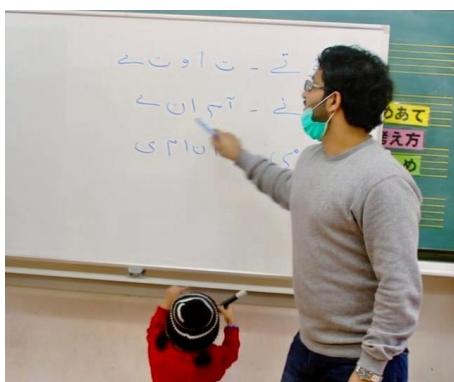
The interesting thing was only three kids live in the area. Most of the native locals have migrated to big cities. There are two full-time teachers and one principal who are taking care to run the school. Due to the long-distance, it cannot

be merged with another school, Takashima Shiritsu Kutsukihigashi Elementary School.



Inside classroom: During the presentation

All three students were very ambitious, bright, and confident, even though they get very little chances to interact with people from outside but they asked interesting questions. I got the opportunity to teach them about few topics related to positive thinking, communication, and learning from others and other cultures including few greetings from Urdu, Hindi and Punjabi language.



During lecture: Culture & Languages (my toddler also joined me in the class with three students)

According to the principal, as long as there are school children in this area, it will continue to function as a school. Once they are done with elementary school and move-on, there remains the question of what to do for school children who come to this area after that.



Inside classroom: Activity time

## 5. Conclusion

Belonging to academia and the university student community put a bigger responsibility to play our part in order to achieve an “all-inclusive” society. We have to look around and beyond the invisible boundaries of language, culture, distance, and environment by lowering the walls. Working in such communities will also enlighten us in return via grasping linkages among SDGs by looking at nature, human and social systems in a continuum.

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## Case Study of Cardboard Compost as a resilience practice toward sustainable waste management

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### 1. Overview

Waste management has been one of the most urgent issue to enable sustainable city in Kyoto. To date, surrounded by lands, Kyoto city has left considerable footprints on environment not only by emitting enormous CO<sub>2</sub> in the process of incineration of waste, but also by burying those ashes and incombustible wastes in the Otowa Dam, the landfill site located in Daigo, Fushimi-ku, far apart from resident area. The dam is supposed to reach its limitation in 50 years. Besides, there are no sites where the alternative dam can be constructed all over Kyoto city. This fact indicates the extreme necessity of waste reduction.

Meanwhile, the statistic shows that nearly 40% of waste from living sector is occupied with kitchen waste<sup>1</sup>, which could be reduced to compost. In fact, many communities and organizations have adapted compost activities as a solution to waste management. Momoyama-cho, Fushimi-ku, Kyoto City also has the

Momoyama Citizen Committee for Promotion of Eco-friendly Activities (hereinafter referred to as Momoyama committee) that engages in cardboard compost. Established in 2015, it has worked on raising social awareness of environmental protection. Cardbord compost is one of the most important activities in Momoyama committee because it is possible to continue it easily at each household with relatively small cost. Moreover, community people can experience circular ecosystem by watching kitchen waste disappeared because of microbe activities.

On the other hand, the Momoyama committee faces some challenges in diffusing compost activities. One of the most difficult hurdles is involving young generation who currently have jobs. Those generation are mostly too occupied with their work and housekeeping to continue cardboard activities.

### 2. Research Objective, Questions

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<sup>1</sup> Kyoto City, 'Current situation and challenges of waste from living sector', available at:

<https://www.city.kyoto.lg.jp/kankyo/cmsfiles/contents/000248/248968/R01katei.pdf>

How the compost activities in Momoyama committee can be enhanced to contribute to lesser waste in Kyoto City? To address the major question, this study pursued two following questions: i) What are the current challenges for the cardboard compost activities practiced by Momoyama committee? ii) How those challenges can be overcome through the resilience framework?

### 3. Methodologies

As for the research question i), interviews to five stakeholders were conducted. Next, for the research question ii), certain suggestions based on the revealed challenges were proposed to the Momoyama committee at the monthly meeting in December 2020. Then the participants were requested to make the comments on those suggestions.

Throughout the above-mentioned pursuit, a problem-solving oriented resilience framework based on systems approach and resilience thinking

provided by Shimizu (2015) or Shimizu and Clark (2019) were applied. In specific, each step of “Ten steps program design set upon collaborative knowledge creation-based resilience” framework (hereinafter referred to as “10 step’s framework”, Table 1) was examined in the interview results.

### 4. Response to Research Question 1

When we see the compost activities by Momoyama committee from the perspective of the resilience framework mentioned above, we find that the activities are supported by at least four stakeholders: 1) activists, 2) soil providers, 3) soil acceptors, and 4) information managers. Also, four key resilience factors were revealed through the application of 10 steps’ framework: established linkage among four stakeholders, generous acceptance of diverse styles of participation, frequent communication to share the problems and actors’ inner confidence or beliefs in their activities.

No.	Steps	Application
1	set the targets	Resilience against waste management aiming for natural resource circulation
2	Systems’ Approach	activists (S)- resource providers/accepters (Sb.) -Info station (Hub)- local community (Env.)
3	communication, function, process	Regular meeting, role distributions ( <b>feedback &amp; timelines</b> )
4	participation of multi stakeholders	Mainly retirees ( <b>young generations, working peoples</b> )
5	holistic approach	Mainly experience sharing ( <b>external check, total revision</b> )
6	resource and decision	Established linkages among stakeholders ( <b>limited &amp; settled</b> )
7	analyses and evaluation	<b>Mostly missing</b> (only minor changes based on experiences)
8	collaborative knowledge creation system	<b>Undeveloped</b>
9	absorption, adaptation, innovation	<b>Undeveloped</b>
10	linkages between systems	Established <b>but yet reviewed for updating</b>

Table 2: 10 step’s framework (by author, based on Shimizu, 2015)

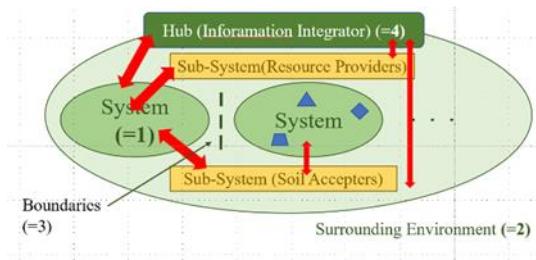


Figure 1: structure of compost activities by Momoyama committee (by author)

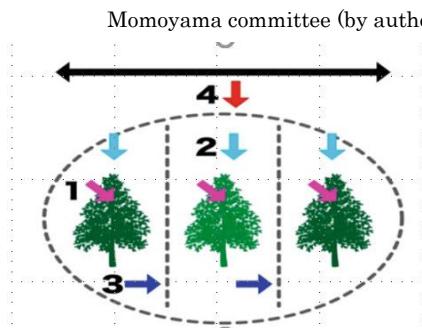


Figure 2: systems' approach (Shimizu & Clark, 2019)

As Figure 1 shows, these factors can be located in similar ways to the figure of systems' approach (Figure 2, Shimizu & Clark, 2019). This implies the fact that this compost activities have already installed some basic factors related with systems approach or resilience framework

However, three challenges were also found: dissemination, capacities for acceptance and resource assurance. It is true that the members acknowledged all these challenges, but they seem to lack in motivation or intention to improve or expand their activities, by recognizing composite activities as something similar to hobbies.

## 5. Response to Research Question 2

This author made suggestions based on three challenges. First, for dissemination, she proposed to make

compost activities as communication tools among families. Second, for capacities for acceptance, cultivating additional sectors such as rental farms, and schools was proposed. Third, for resource assurance, cultivating additional sector and applying for additional subsidies were suggested.

In response, the chair of Momoyama committee partly accepted her ideas that will be practiced in near future. Those prospected outputs will be analyzed and evaluated for the purpose of further development. Also, for the dismissed ideas, discussion will be made at the committee to revise it in feasible manner. Such learning process will be repeated in a broader timeframe to achieve gradual improvement of whole systems.

## 6. Discussion

While current approach of Momoyama committee has a basic factor related with resilience framework, the community activity function has a major challenge from broader views: From the perspective of collaborative knowledge creation system which is related to a broader view of the resilience framework, the current Momoyama compost activities is located almost at the first floor in the triangle, meaning that resources such as data, information, experiences, expertise, ideas have yet properly systematized (Figure 3, Shimizu & Clark, 2019). Therefore their activity is not yet operational from problem-solving

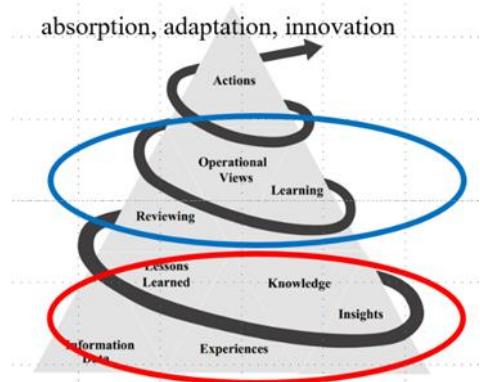


Figure 3: Collaborative Knowledge Creation System (Shimizu & Clark, 2019)

perspectives, and vulnerable to environmental change. In the next decades their activities won't be fully sustained because they currently lack in young generations.

From another point of view, the above lack of collaborative knowledge creation system may imply that they may prefer to be limited to existing approach to keep their genuine objective or manner. But this tendency simultaneously hinders their further development in terms of operational resilience.

## 7. Conclusion

This case study revealed four key resilience-related factors observed in the cardboard activities conducted by Momoyama committee, which are linkage, diverse styles, problem sharing, and each actor's confidence. On the other hand, it clarified that it needs further systemization in order to obtain operational resilience. Moreover, these

shortcomings can be used as indicators to measure resilience in other local activities.

In the process of this study, an American farmer who operates an organic farm in a tiny countryside kindly accepted the author's visit. He is also a compost activist with passion to grow his business as a sustainable practice, which was yet insufficient in current Momoyama committee. He confessed that one of his biggest motivation is sense of comfortability by living with little footprint on environment, or sense of obligation to keep in harmony with nature. These two senses are also shared with Momoyama committee, but there lies something different in terms of ability of practice. Whether the difference is because of culture, generation, or anything else may be another research question. Additionally, Two issues for the future research can be raised: First, further conduct of related research is definitely needed. Second, to disseminate obtained insights over Momoyama regions will be another touchstone of these key factors.

## References

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