REVITALIZING LOCAL COMMUNITIES THROUGH REGIONAL CURRENCIES USING GIS: A CASE STUDY IN KASAMA AND KESENNUMA IN JAPAN

Mayumi Dan*, Kayo Okabe**

*Tokiwa University, Japan, mdan@tokiwa.ac.jp
**LatLng Corporation, Japan, kayo.okabe@latlng.jp

ABSTRACT

In Japan as well as in many developed countries, population is decreasing and ageing is progressing simultaneously. Under these circumstances, it is vital for the younger generation to get to know more about the area where they live and work in, so that they can take part in reactivating their areas. Toward this reactivation, regional currency can play an important role in attracting the younger generation to learn how to revitalize their communities. In realizing this goal, GIS (Geographic Information Systems) has great potential as an educational tool for analyzing the geographic facets of the regional currency circulating in the region, and for making reactivation plans for the region. This paper first describes the present situation of regional currencies in Kasama and Kesennuma in Japan. Second, the paper demonstrates a GIS application to improve the accessibility to the terminals in Kasama, at which people exchange points to coupons. Third, the paper provides an educational material for exercising the most basic GIS operations for beginners, that is, how to acquire location data and how to represent the resulting location data on a map using Google My Maps.

KEY WORDS

ACKNOWLEDGEMENTS

1. INTRODUCTION

Japan has a long history of regional currency, which worked as an important lubricant of economic activities of local corporations and institutions until the 19th century. For example, *Hansatsu* was issued by a number of local governing bodies in the Edo era 1603-1868 (Nohmura 2016). According to Hayashi (2012), in the 2000s, many types of regional currencies were created, which amounted to a few hundreds, and issued by non-profit organizations, private corporations, chambers of commerce, local governments, and councils. Nishibe (2013) clarifies that the aims of regional currencies are firstly to activate local economies, and secondly to revitalize local communities by way of regional exchanges of economic value and communication within local areas. Contrary to the expectation of people in local communities, most of these regional currencies have faded away over the years.

Quite recently, however, the second aim i.e., revitalization of local communities by way of regional currency, is attracting attention once more in Japan as one of the possible triggers to create and vitalize communities in local areas near big cities as well as in disaster recovering areas. In this situation, it is vital for the young generation to get to know more about the area where they live and work in, so that they take part in reactivating their areas. Toward this reactivation, as pointed by Nishibe (2013), regional currency plays an important role and it is hoped that young people learn how to revitalize their communities by way of regional currency. To realize this hope, GIS provides a good educational tool for surveying the current situation of regional currency in local communities and for making revitalization plans.

This paper consists of five sections including this introductory section. The following second section describes the current situation of regional currencies called KapoCa, Crewship and Reneria, in three local communities in Kasama and Kesennuma. In the third section, the paper demonstrates a GIS application for the improvement of accessibility to the terminals in Kasama where people exchange their regional currency points to coupons to use. In the fourth section, educational material for exercising the most basic GIS operations for beginners is provided. The paper closes with concluding remarks in the last section.

2. THREE REGIONAL CURRENCIES: KAPOCA, CREWSHIP AND RENERIA

2.1 KapoCa of Kasama City

Regional currencies are issued and used in various types and in diverse areas throughout the world. Timebanking UK, which celebrated its 20th anniversary in September 2018, is one of the most successful examples. Fureai Kippu of Japan also attracted great attention internationally in the 1990s, but its activities have somewhat faded away, partially due to changes in society (Hayashi 2012). There are few regional currencies that are surviving the undergoing worldwide societal changes over the years, and we can note that regional currencies are vulnerable to institutional changes of the society, making differences in stableness and continuity.

Like Timebanking and Fureai Kippu, KapoCa of Kasama City aspires to encourage vibrant activities of human resources of the residents of Kasama City in Ibaraki Prefecture.

From an overview of regional currencies in Ibaraki Prefecture, which are listed in Table 1, we chose KapoCa of Kasama City. Starting from the website and related documents, we made an appointment to interview the issuer and administrator. Citizens Activities Department of Kasama City is in charge of KapoCa and the manager provided us with informative presentation with reference materials. As shown in Table 2, KapoCa incorporates a point system; points are issued to local volunteer groups and activity groups in Kasama City, and points can be used in certain shops and exchanged to services the city provides, such as a rental mini-bus.

Table 1. Regional Currencies of Ibaraki Prefecture – City and Name of Currency

	City	Name of Currency	Issuer
1	Mito	Wa (Ring)	NPO Yawaragi since 2002
2	Mito	-	NPO Idaten
3	Tsuchiura	Kirara	NPO Community Building Bus Tsuchiura since 2005
4	Ishioka Yago	Satonowa	Satonowa Office since September 2016
5	Ryugasaki	Com	NPO Ibaraki Minami Seikatsusha Net since 2003
6	Hitachi Ohta	Green	Green Furusato Promotion Institute since 2004
7	Kasama	KapoCa	Citizen's Activities Department, Kasama City since 2011
8	Tsukuba	Gamar	Industry and Tourism Department, Tsukuba City since 2002
9	Tsukuba	Kusa no Neco2 Chip	Community Building Town Meeting
10	Tsukuba	-	Tsukuba Wellness Research, Tsukuba City since 2005
11	Tsukuba	Maisu	Hojo Community Building Promotion since 2009
12	Yawahara	Wara	Nishinodai Eco Money Institute since 2005

Source: List of All Regional Currencies http://cc-pr.net/list/ （2019/05/07）

The city of Kasama has 240.40 square kilometers in area, and is located in the west of Mito City, capital of Ibaraki Prefecture which is on the south side of Fukushima Prefecture (Figure 1). Kasama City has a population of 74,673 as of April 2019, which has decreased by 6.7% in 10 years, from 80,066 of April 2009. The area is known for producing quality chestnuts *kuri* and pottery called *Kasama-yaki*.

Figure 1. Map of Ibaraki Prefecture

With the progress of ageing and depopulation, Kasama City introduced this point system in order to find human resources and have them participate in local activities to solve local tasks. The primary aim of KapoCa was to secure and develop human resources in the area, with the leadership of the local authority, supported by the government.

With a test period of one year, the point card system was first implemented with paper point cards, and was then transferred to IC (Integrated Circuit) cards, followed by the creation of the KapoCa portal site. In April 2015, the system started to work with Kapo Coupon which can be exchanged to 14 different kinds of goods. Tablet terminals are now placed in 18 locations within Kasama City to indicate the menu for exchanging points to coupons. Figure 2 shows how KapoCa works as a mutual assistance system to activate the local economy.

In short, KapoCa is a regional exchange system introduced by the Kasama City, to activate citizens' activities, unearth human resources, and assist citizens' regional activities continuously, with the aim of building a community of collaboration. As a wide variety of activities are operated in many fields and operating bodies, 1 point is provided to one activity at a time, to make the system simple. For example, activities include holding square-step dance events, cleaning up at festivals on disaster prevention, holding courses on speaking style, etc. As an exception, 5 points are provided to speakers giving seminars. Health-related activities are attracting about half of the total participation, with 30 percent in volunteer groups delivering meals, and 20 percent in environmental activities.

*Figure 2. Image of KapoCa System Source: Kasama City website*

Image of the Local Point System

◆ **At Start of the System**

Activities Volunteering → 参加 → City → points → Citizen to Citizen → points → Presents, Assistance

+ Information Technology

Volunteering exchanged to Assistance

◆ **Future of the System**

Activities Volunteering Cooperation + Purchase of Goods and Services → 参加 → City → points → Citizen to Citizen → points → Presents Assistance

通貨 → Shop → points → Points to Purchase → points → Coupons

Local Comprehensive Card

By purchasing, you contribute to community.

Mutual Assistance System to activate the Local Economy

https://www.city.kasama.lg.jp/kapoca/sys_about/index.html (2019/03/12) translated by author

2.2   Reneria and Crewship of Kesennuma

One of the objectives of regional currency is to revitalize the local communities in areas recovering from disasters. To examine such a case, we looked into Reneria and Crewship currencies in Kesennuma City in Miyagi Prefecture. Kesennuma is located at the far north coast, south of Iwate Prefecture, with the area of 332.44 square kilometers (Figure 3). Kesennuma was heavily damaged by the tsunami caused by the Great East Japan Earthquake of 2011[1], which resulted in over 1,400 deaths/missing persons and over 15,000 houses destroyed. Population of Kesennuma City has been decreasing rapidly from its peak of 75,298 in 2009, to 64,352 of March 2018[2]. The decrease of population is 14.5 per cent in 9 years, far severer than that of Kasama City.

Figure 3. Map of Miyagi Prefecture
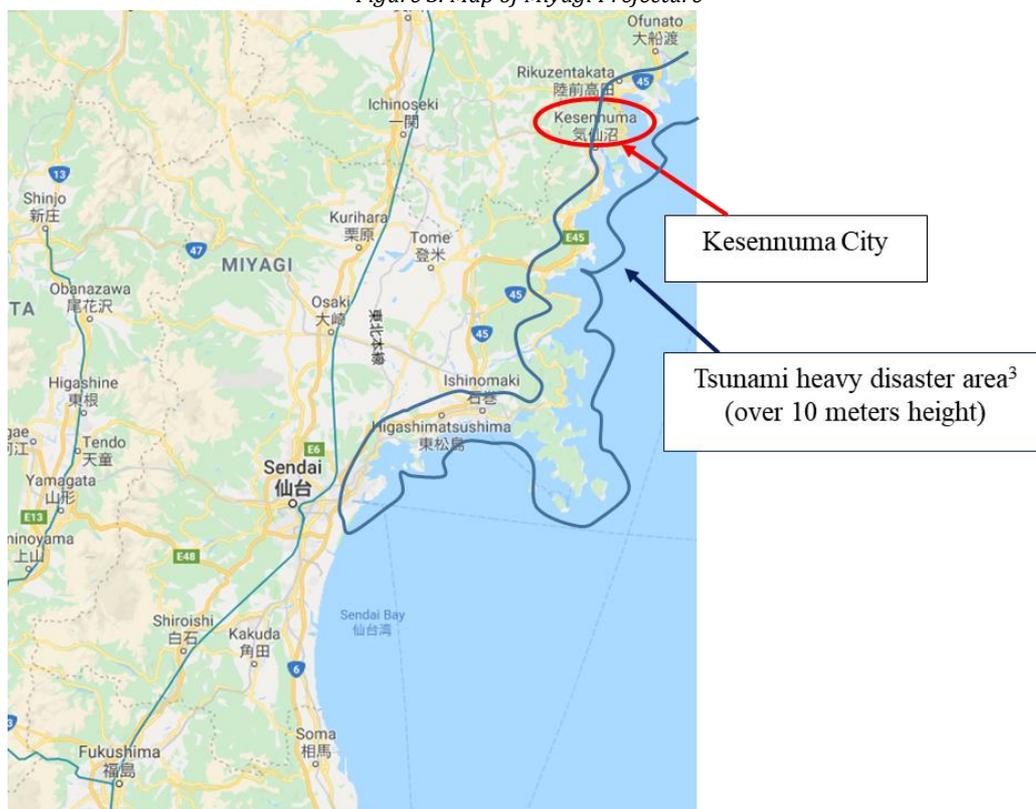
Kesennuma is one of the areas in desperate need of community revitalization for the residents and activation of local economies. Both Reneria and Crewship are regional currencies that were introduced after the tsunami destruction to assist the revival of the region. They both can be used to buy goods in stores, however, the concepts behind them differ largely.

In contrast to Crewship which aims to attract incoming tourists from outside the region, Reneria has the primary purpose of incorporating nature to the exchange system. It seeks to sustain the natural environment by circulating resources from ocean and mountains to food, starting with woody biomass operation. The name of Reneria comes from 'Re' meaning regeneration, 'ene' meaning energy, and 'ria' is a coined word from the Rias coast, designed by Hiroyasu Yamauchi of Slow-Food Kesennuma (Figure 4).

Figure 4. Note of Reneria
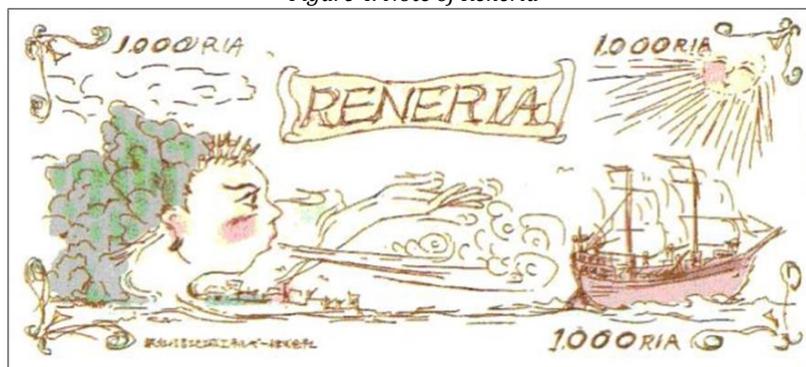
Source: Website of Kesennuma Regional Energy Development Corporation (Kesennuma Chiiki Energy Kaihatsu)
http://chiiki-energy.co.jp/business/reneri

From the reconstruction after the tsunami of 2011, the initiator of the currency, Masaki Takahashi[3], considered that energy should be diversified to protect the region in disasters, and that it would be sustainable if energy were to be generated within the region. As Kesennuma has forest resources around the area, the idea of issuing a regional currency as an exchange to wood chips came up. Kesennuma is a Slow-food City and with the cooperation of the Slow-food Association, 50 percent of the consideration to the wood chips produced in the area for biomass energy generation is paid by Reneria to the owners of the forest lands (Figure 5).

Reneria is issued by Kesennnuma Regional Energy Development Co., Ltd. (Kesennuma Chiiki Energy Kaihatsu), with a validity of six months, and 1 note of 1000 Reneria can be used for 1000 yen in affiliated establishments in Kesennuma. If used within the validity period, it can be used multiple times, by writing the name of the store or the individual on the back of the note.

Figure 5. Circulation of Energy to Food Source: Website of Kesennuma Regional Energy Development Corporation (Kesennuma Chiiki Energy Kaihatsu) http://chiiki-energy.co.jp/business/reneria (2019/03/12) translated by author

On the other hand, Crewship issues Crew Cards to the residents and visitors of the city, whom Kesennuma refers to as "passengers." It is a point system administrated by Kesennuma Tourism & Convention Association[4] and can be used in the establishments in Kesennuma and related Internet shopping sites. The Crew Card was primarily created as a step of regional management through tourism, based on the concept of the DMO (Destination, Marketing Management, and Organization combined) system to collaborate client needs and management point of view.

In the Second Comprehensive Plan of Kesennuma City, it is the primary aim to increase purchases and consumption within the city, enlarging the financial circulation in the area, to construct an earning system under the "Local First" policy for strengthening the local economy. The actual target of the city is to raise the regional economic circulation rate[5] from 33.7 percent in 2013 to the pre-earthquake level of 80 percent by 2020. Under this target, Crewship aims to construct a stable client database for marketing to promote sales of local merchandise.

2.3   Comparison of the three regional currencies

To summarize the different aims of the three currencies: the primary aim of Kasama City's KapoCa is to support citizens' activities; Reneria of Kesennuma was introduced after the tsunami destruction, to make a circulation from energy to food for the sustainability of the region, and Crewship strives to activate the local economy through tourism.

We compare the three on eight major factors which are 1) area; 2) issuer/administrator; 3) aim; 4) number of members; 5) start date; 6) number of establishments; 7) validity; and 8) possibility of exchange, as listed in Table 2.

Table 2. Regional Currencies Researched

	KapoCa	Reneria	Crewship
Area	Kasama City, Ibaraki Prefecture	Kesennuma City, Miyagi Prefecture	Kesennuma City, Miyagi Prefecture
Issuer / Administrator	Citizens Activities Dept., Kasama city / Social welfare council	Kesennuma Regional Energy Development Co. Ltd. / Kesennuma Shokai	Kesennuma Tourism Promotion Organization / Simons Co. Ltd.
Aim	Mutual support	Sustainable society	Earning from DMO tourism with local management
Members	3,520 citizens (Sep. 2018)	Mountain owners, citizens Members undisclosed	17,068 volunteers, tourists and citizens
Started	April 2013	April 2012	April 2017
Number of Establishments	22 (facilities & stores)	Over 140 stores	73 stores & 1500 internet stores
Validity	2 years	6 months	December of each year
Exchange	1 activity = 1 point Not exchangeable to cash	1000 rea = 1000 yen	1 point = 100 yen

Source: Information from each regional currency obtained through interviews.

Each regional currency has its own characteristics that contribute to community-building, with its original form and philosophy as shown in Table 2. Among the three, we chose to further investigate KapoCa of Kasama City to continue our discussion of revitalizing the community using regional currency.

3. RELOCATION OF KAPOCA TERMINALS IN KASAMA TO IMPROVE ACCESSIBILITY

As mentioned in the introduction, GIS is useful for analyzing geographic facets of local communities and for making a revitalization plan based on the analysis. This section shows an example of such a use of GIS. Stated explicitly, this section proposes a relocation plan for improving accessibility to point-coupon exchange tablet equipments called "KapoCa Terminal" in Kasama. This relocation has potential to increase the number of KapoCa users, and consequently supports to revitalize Kasama City by increasing the usage of the regional currency.

To solve this relocation problem, because people access to terminals on a road network, the shortest path distance on a road network is assumed, in place of Euclid path distance on a plane. Fortunately,

GIS-based toolbox for spatial analysis on a road network, called SANET, is freely available for research purposes.

### 3.1   The current location of KapoCa terminals in Kasama

KapoCa terminal is a computer tablet equipment by which points are exchanged to coupons by selecting an option from the menu. In 2018, eighteen terminals were located in Kasama, and their addresses are tabulated in Table 3. Three of them are located in the Kasama city hall building. Therefore, Table 3 has sixteen different addresses to terminals at which people visit and exchange points to coupons in their daily life.

Table 3. Address list of KapoCa Terminals in Kasama

No.	端末設置場所 Building name	住所 Address
1	本所　市民活動課 City hall	笠間市中央三丁目2番1号
2	本所　健康増進課 City hall	笠間市中央三丁目2番1号
3	本所　高齢福祉課 City Hall	笠間市中央三丁目2番1号
4	支所　笠間地域課 Kasama local center	笠間市石井717番地
5	支所　岩間地域課 Iwama local center	笠間市下郷5140番地
6	社協　友部支所 Tomobe local center	笠間市美原三丁目2番11号
7	社協　笠間支所 Kasama center	笠間市石井717番地
8	福祉センターいわま Iwama center	笠間市泉159番地
9	友部保健センター Tomobe health center	笠間市美原三丁目2番11号
10	笠間保健センター Kasama health center	笠間市笠間230番地
11	岩間保健センター Iwama health center	笠間市下郷5139番地1
12	市立病院 Municipal hospital	笠間市中央一丁目2番24号
13	消防本部　警防課 Main fire department	笠間市箱田2564番地
14	友部消防署 Tomobe fire department	笠間市中央三丁目3番1号
15	岩間消防署 Iwama fire department	笠間市市野谷1542番地18
16	笠間図書館 Kasama library	笠間市石井2023番地1
17	友部図書館 Tomobe library	笠間市平町2084番地
18	岩間図書館 Iwama library	笠間市下郷5140番地

Column of address

As the road distance to the nearest terminal becomes closer to user's house, the user is likely to be more interested in KapoCa and wishes to get more points. Currently, the locations of terminals are limited to public facilities such as the city hall, fire departments, libraries, community centers and public health centers as shown in Figure 6.

Figure 6. Current locations of KapoCa terminals
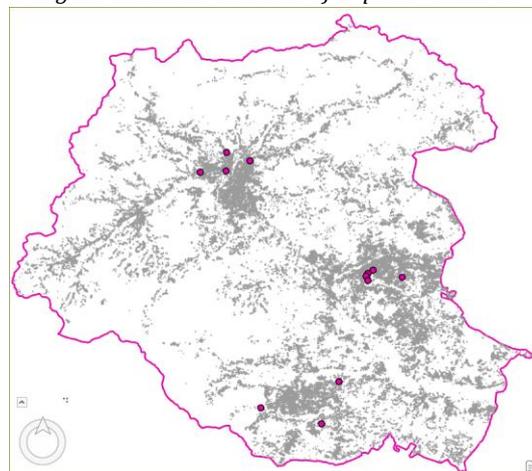
This limitation produces inconvenient access to KapoCa Terminals for the residents of Kasama. Therefore, our aim is to find the effective locations for KapoCa Terminals that would reduce the travel distance of people from their houses to their nearest terminals. This type of location problem is often discussed in operation researches (OR) known as the location optimization or relocation problem. This section tries to solve the relocation problem using GIS.

3.2   Distribution of people in Kasama City

To solve the above relocation problem, the first step is to know the distribution of buildings (the origins of people to their destinations, i.e., KapoCa Terminals) in Kasama. One might consider GIS census data, but the spatial unit of the census data available in Japan is a grid cell whose smallest size is 125 meters. Within a 125 m cell, there are over a hundred houses on average in Japan. Therefore, to measure the accessibly from one's house to the nearest terminal, building data are more precise than the grid-cell population data.

GIS Basic Map Data

Geospatial Information Authority of Japan provides GIS Basic Map Data covering all Japan. The data are downloadable from the website: https://www.gsi.go.jp/ENGLISH/index.html.

Figure 7. Home page of GSI
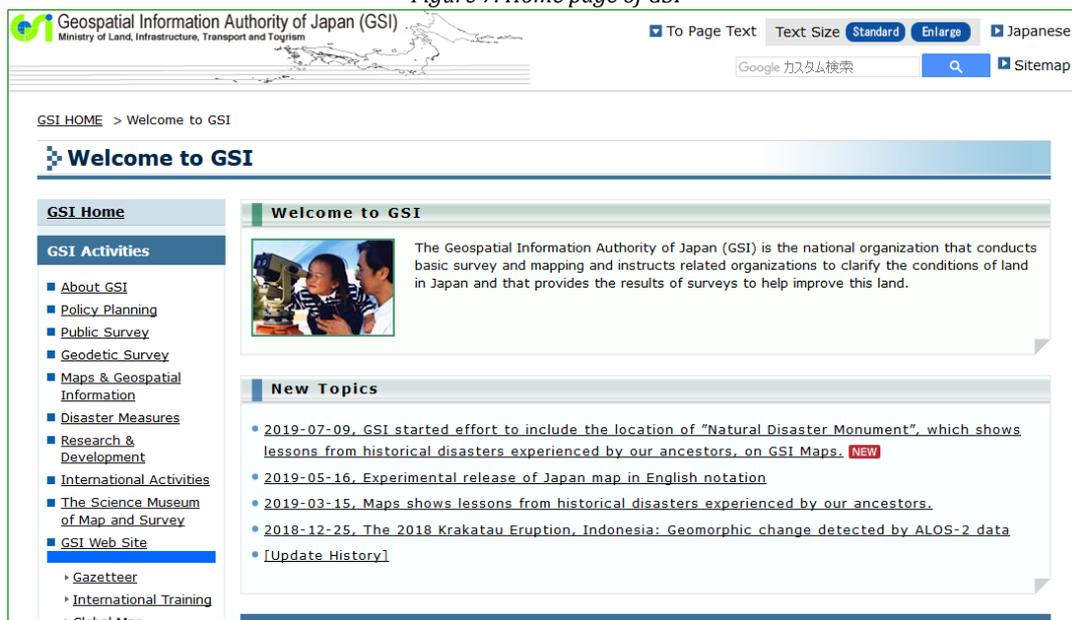
Having successfully downloaded a zipped GIS Base Map Data file of a target area, the next step is to convert this GML format file to shape files using a conversion tool with GIS software. The converted data consist of seventeen shape files (Figure 8), one of which is the building polygon data.

Figure 8. Seventeen shape files of GIS Base Map Information of GSI
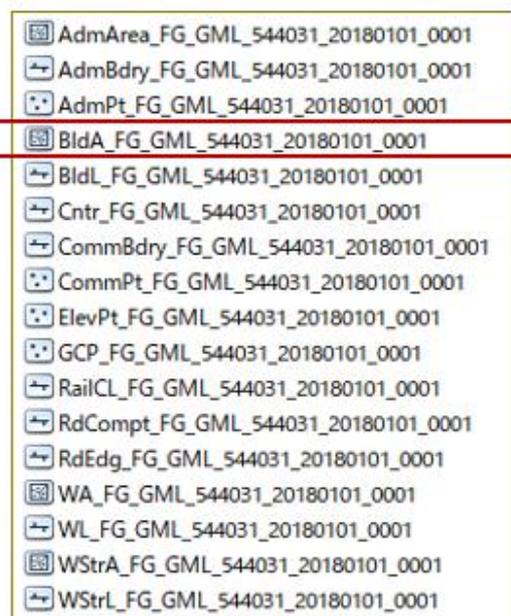
Acquisition of building data in Kasama

Figure 9 shows the distribution of buildings in Kasama City displayed on the map window of the GIS software; ArcGIS.

Figure 9. Buildings in Kasama City displayed on the map window of ArcGIS
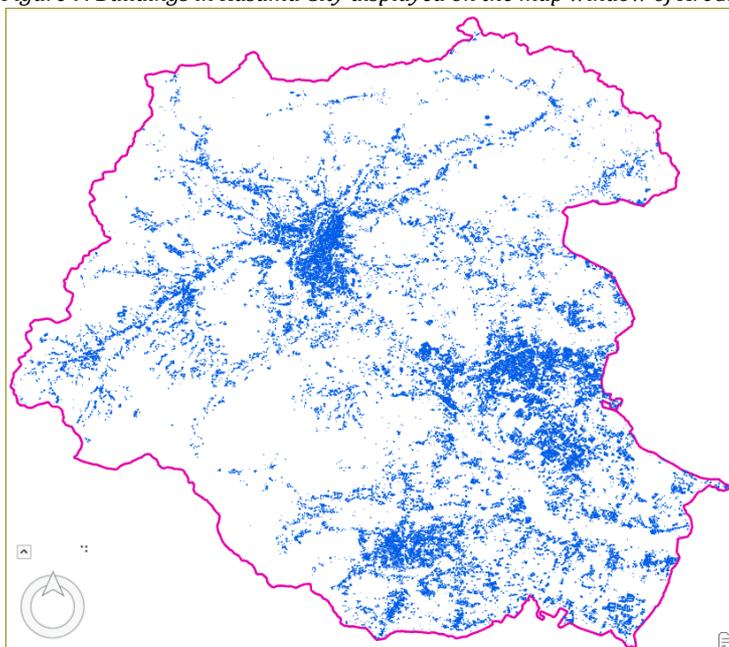
As you enlarge the map in Figure 9, detailed shapes of houses become noticeable as polygons shown in Figure 10. There are 77,070 polygons in Kasama City.

Figure 10. Polygons of houses in an area in Kasama
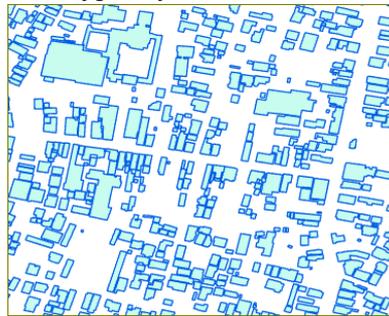
Generation of centers of house polygons

To obtain the density of houses over Kasama City, we represent a house polygon by its gravity center. The gravity center of a house is obtained from a tool in the geometry toolbox of the software. The result is shown in Figure 11.

Figure 11. Polygons of houses with their centers (left) and the distribution of the centers (right)
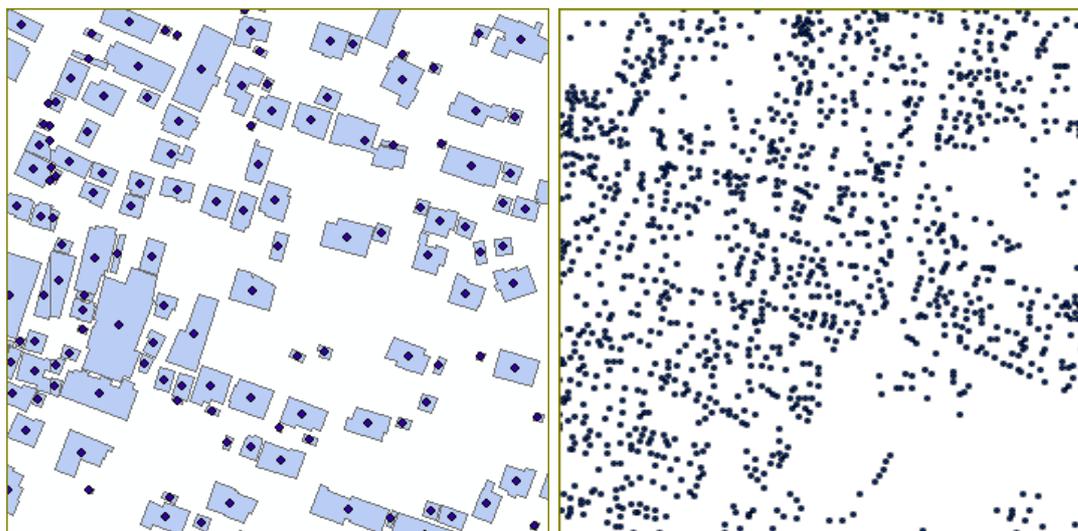
3.3   Kernel density estimation and the visualization of the resulting density in 3D

The next step is to estimate the density of houses by the Kernel density method. The result may be represented by contour lines in a 2 dimensional space shown in Figure 12 (high density areas are indicated by dark orange in color, whereas low density areas in white), or it may be represented by a solid model in a 3 dimensional space shown in Figure 13. These figures are obtained using a tool in ArcGIS Toolbox and with ArcScene application.

Figure 12. Density of houses in Kasama estimated by the Kernel density estimation method
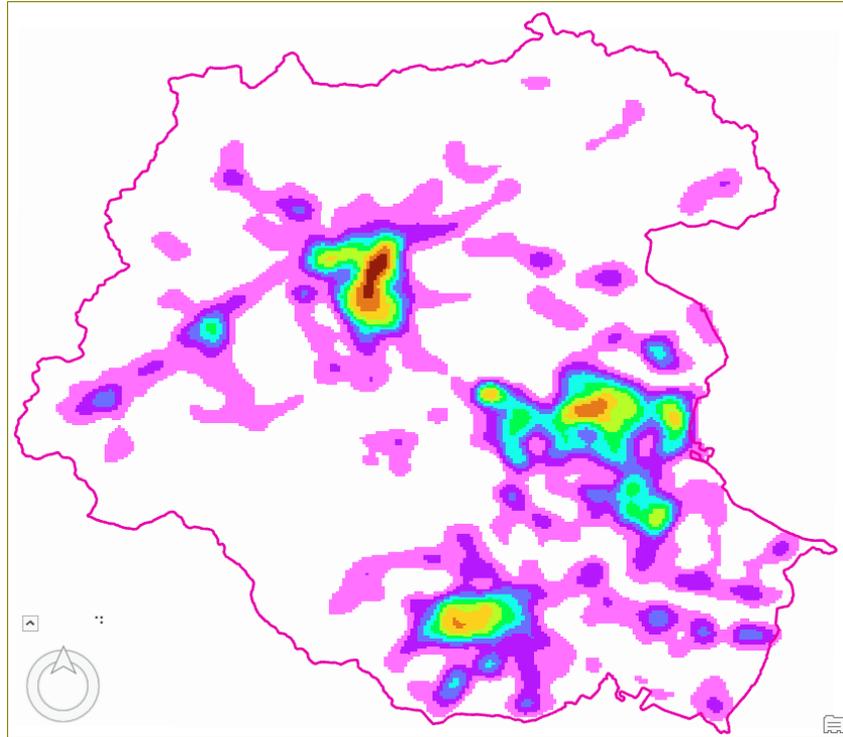
Figure 13. Density of houses in Kasama illustrated in a 3 dimensional space
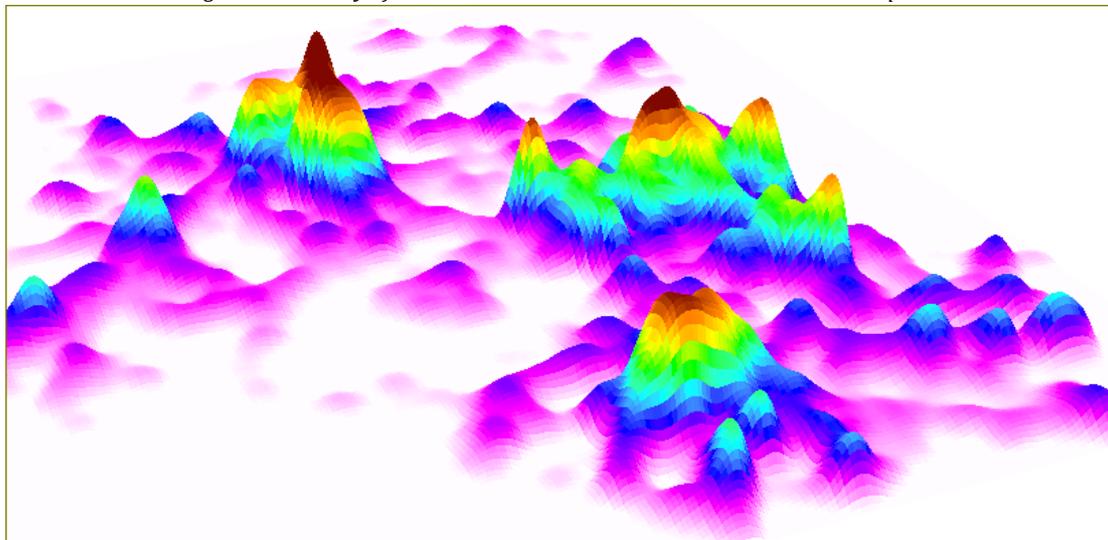
Figures 12 and 13 indicate sixteen distinct peaks which are indicated by the black circles in Figure 14.

Figure 14. Sixteen alternative location of terminals
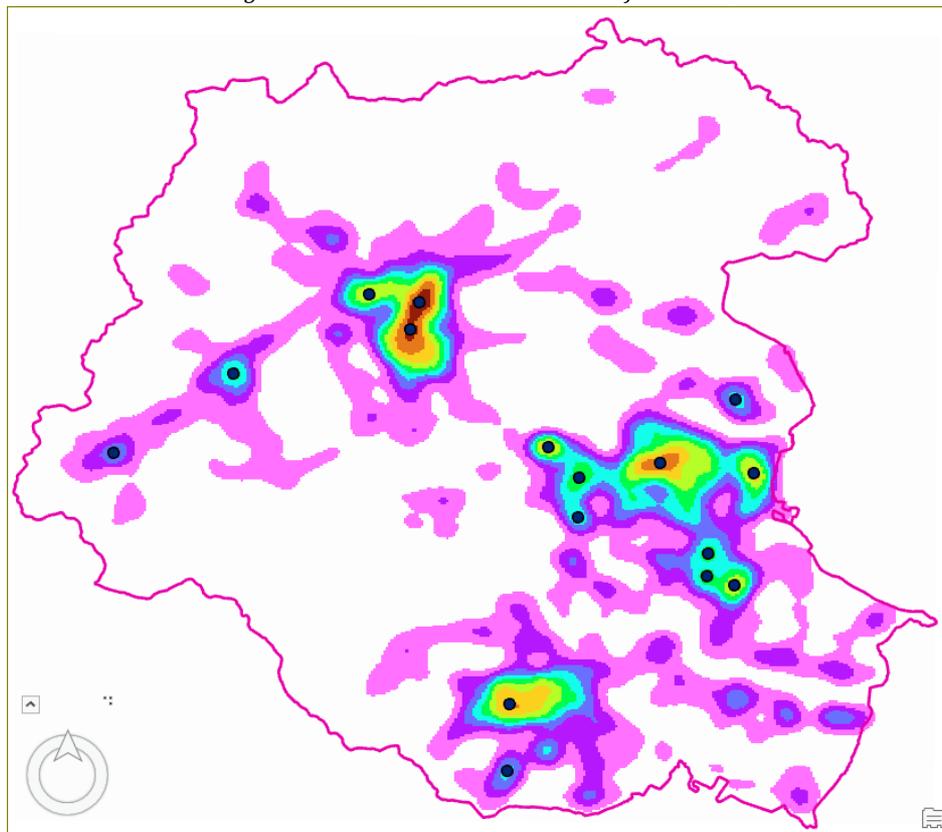
The areas around the peaks (distinctively high density points) are the places where the density of population is high. Comparison between Figure 14 with Figure 6 suggests that the current location of KapoCa Terminals can be reconsidered. If KapoCa Terminals are placed on the peaks, residents' accessibility would increase. Therefore, one of the appropriate location strategies would be to relocate the sixteen existing KapoCa terminals to the peaks indicated by the black circles in Figure 14.

3.4   Service areas of KapoCa terminals estimated by the network Voronoi diagram

Given the sixteen alternative locations of KapoCa Terminals shown in Figure 14, the next step is to estimate the service area of each KapoCa Terminal under the assumption that people choose the nearest terminal from their houses with respect to road distance (not Euclid distance). The subareas of sixteen KapoCa Terminals are computed by the network Voronoi diagram on a road network.

Road network

To compute the service area under the assumption that people visit the nearest terminal through a road network requires road network data consisting of nodes and links with their topology. Such road network data in Japan are available from the Sumitomo Electric Company (Sumiden). Figure 15 shows the road network in Kasama provided by Sumiden. As is seen in an enlarged network in Figure 16, the data consist of a link (the blue line segment) with its end nodes.

Figure 15. Sumiden road network and sixteen locations of terminals
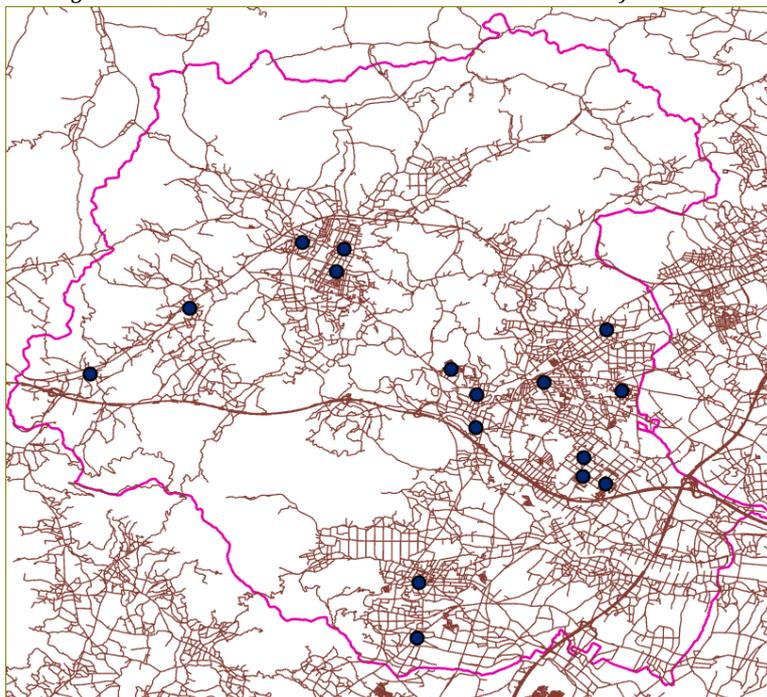

Figure 16. Nodes and links consisting of a road network
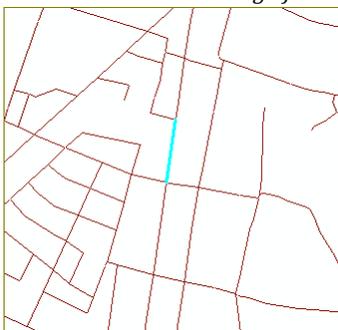
Construction of the network Voronoi diagram representing service areas of terminals

The next step is to construct the network Voronoi diagram of the sixteen KapoCa Terminals using a tool in SANET[7] (a software package for analyzing events that occur on or alongside of a network), which is freely available for university researchers from the following site:

http://sanet.csis.u-tokyo.ac.jp/

Figure 17. Home page of SANET
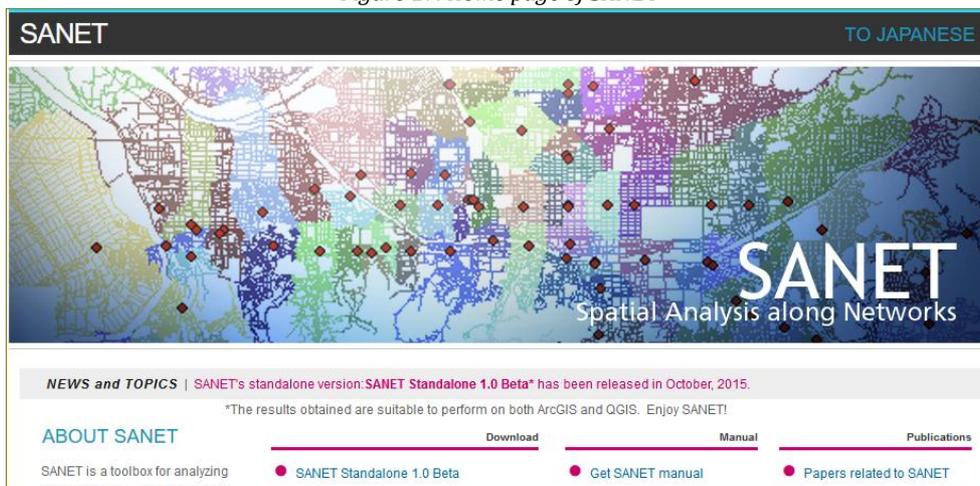
The software package of the network Voronoi diagram in SANET produces two shape files: the file of line segments (links) and that of points (nodes of the links). Figure 18 shows the network Voronoi diagram in Kasama City obtained from the AcsID attribute in the line segment shape file.

Figure 18. Service areas of KapoCa Terminals in Kasama City estimated by the network Voronoi diagram
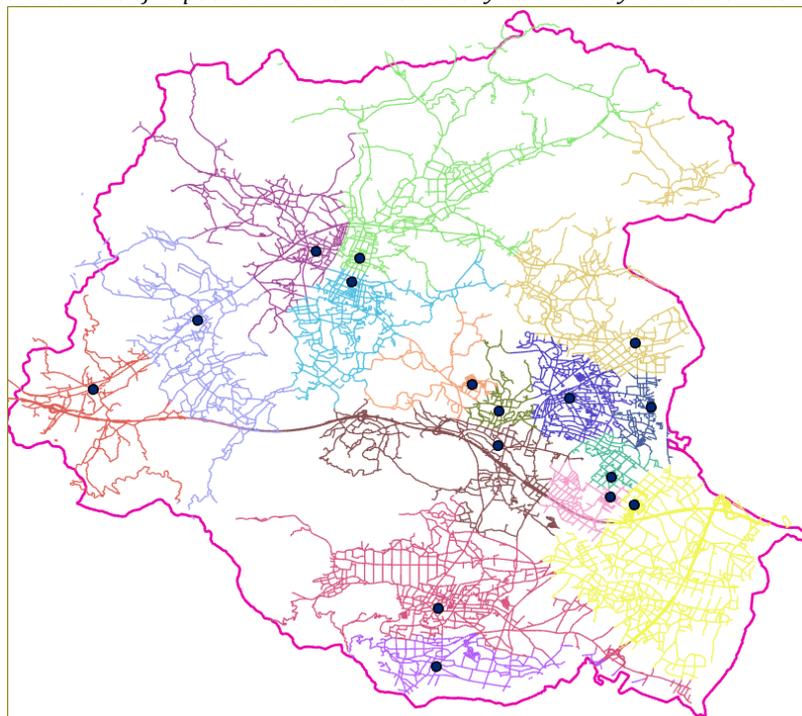
In Figure 18, the sixteen service areas of KapoCa Terminals are indicated by different colors of the road segments. The accessibility to KapoCa Terminals is improved. It is expected that these alternative locations will revitalize local communities to a certain extent.

4. EDUCATIONAL MATERIALS: INTRODUCTORY EXERCISES OF THE MOST BASIC GIS OPERATIONS

In order to revitalize a region, it is vital for us to understand the geographical circumstances of socio-economic activities, housing, facilities, infrastructures and environments across the region. For this purpose, GIS is a good tool for acquiring, managing and analyzing the above geographical information; it is also a good tool for planning as shown in Section 3 and for communicating the resulting analyses and plans with residents of the region. Nowadays, GIS is becoming a common tool for the younger generation. In fact, a new course curriculum of "comprehensive geography" is planned to be a compulsory subject in high schools in Japan from 2022, and GIS will be taught in this subject. Regional currency would be one of the most attractive and useful materials for this GIS education.

Motivated by the introduction of GIS to high school classes, this section provides an educational material for exercising the most basic GIS operations for beginners, that is, how to acquire location data, and how to visualize the acquired location data on a map.

The exercise is explained step by step with an actual example of KapoCa Terminals in Kasama. Section 4.1 instructs how to obtain the location data of KapoCa Terminals, and Section 4.2 explains how to create the map of KapoCa Terminals with Google My Maps.

4.1 Acquisition of latitude and longitude data from address[8]

There are two ways to acquire latitude and longitude data, i.e., one from address and one from Google Maps, which are explained in the following two sub-sections.

Acquisition of latitude and longitude data using a geocoding system

GIS data are a set of data consisting of location data and attribute data. When the location data are given by a list of addresses of facilities (or more broadly entities), an address is converted to its latitude and longitude by a geocoding system.

Geocoding services are usually received from the website either of governments, institutions or universities. In Japan, for example, the Address Matching System (geocoding system) managed by the Center for Spatial Information Science (CSIS) at the University of Tokyo is available free of charge. Using this geocoding system, for instance, the addresses of stores that accept regional currency, that of KapoCa Terminals, that of houses of regional currency users are converted into latitude and longitude data.

The addresses of KapoCa Terminals in Kasama are listed in Table 3. In the following, the procedure for converting these address data to latitude and longitude data is described step by step.

Step1. Visit the website of the Center for Spatial Information Science (CSIS) at the University of Tokyo. http://www.csis.u-tokyo.ac.jp/

Figure 19. Website of CSIS

Step2.   Click 'Service' and select 'CSV Address Matching Service'

Figure 20. List of Services
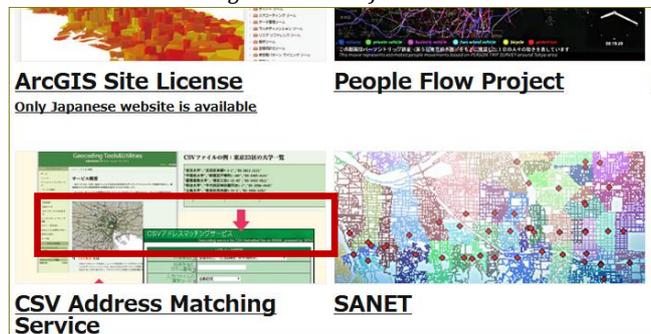
Step3.   'Geocoding Tools & Utilities' page appears showing the menu on the left side frame
    in Japanese.

Figure 21. Geocoding Tools & Utilities

If your file is an Excel file, save the file as a csv file. Click on 'Address Matching Service' indicated by the square frame in Figure 8. Then Figure 22 will appear.

Figure 22. Address Matching Service Page
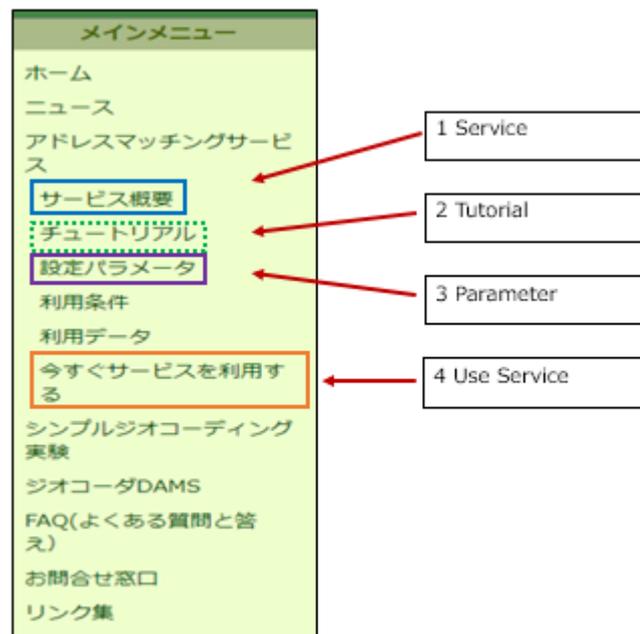
By clicking the dotted frame (2 Tutorial) in Figure 22, you can download a tutorial that explains the geocoding system and csv format. In the tutorial, you will find how to set and prepare a *.csv file along with instructions for sending your file to the system and getting the converted file back from the system.

     Step4.   To start using the service

Click "want to use the tool right now" indicated by the largest frame (4 Use Service) in Figure 22 and move to the next page to start the service.

Figure 23. Parameter setting

Since the addresses of terminals are listed in column three in the KapoCa data file (see Table 3), input 3 in "column number of address" indicated by the top large frame. Next, select the file in your PC to submit. After selecting your file, click the bottom frame to submit. Instantly, the transferred file with

geocoded data added will be back in the download folder of your PC. Open the file, and you will find the file as in Table 4.

Table 4. File Returned from the Address Matching System

No.	端末設置場所 Building name	住所 Address	X	Y
1	本所　市民活動課 City hall	笠間市中央三丁目2番1号	140.30739	36.34223
2	本所　健康増進課 City hall	笠間市中央三丁目2番1号	140.30739	36.34223
3	本所　高齢福祉課 City Hall	笠間市中央三丁目2番1号	140.30739	36.34223
4	支所　笠間地域課 Kasama local center	笠間市石井717番地	140.24062	36.38284
5	支所　岩間地域課 Iwama local center	笠間市下郷5140番地	140.29578	36.29886
6	社協　友部支所 Tomobe local center	笠間市美原三丁目2番11号	140.321	36.34059
7	社協　笠間支所 Kasama center	笠間市石井717番地	140.24062	36.38284
8	福祉センターいわま Iwama center	笠間市泉159番地	140.26457	36.28811
9	友部保健センター Tomobe health center	笠間市美原三丁目2番11号	140.321	36.34059
10	笠間保健センター Kasama health center	笠間市笠間230番地	140.26028	36.38743
11	岩間保健センター Iwama health center	笠間市下郷5139番地1	140.29578	36.29879
12	市立病院 Municipal hospital	笠間市中央一丁目2番24号	140.30933	36.34347
13	消防本部　警防課 Main fire department	笠間市箱田2564番地	140.25098	36.3908
14	友部消防署 Tomobe fire department	笠間市中央三丁目3番1号	140.30647	36.34115
15	岩間消防署 Iwama fire department	笠間市市野谷1542番地18	140.28874	36.2818
16	笠間図書館 Kasama library	笠間市石井2023番地1	140.25075	36.38331
17	友部図書館 Tomobe library	笠間市平町2084番地	140.3074	36.33942
18	岩間図書館 Iwama library	笠間市下郷5140番地	140.29578	36.29886

In the converted file you have downloaded, you will find five new columns which are added by the Address Matching System. Among them, the Column X is for longitude data X and Y for latitude Y of the geographic locations of KapoCa Terminals.

Acquire latitude-longitude data on the Google Maps

When you are not able to access any geocoding systems easily, there is an alternative convenient way of getting latitude and longitude data. If your computer is connected to the Internet, you can find a set of latitude and longitude data on Google Maps. In the following, the procedure is explained in steps with an example of Kasama Inari Shrine.

Step1.　Access Google Maps

Find Kasama Inari Shrine on the Google Maps indicated with a red marker.

Figure 24. Kasama Inari Shrine

Step2.   Right click the red marker and let a pull-down menu show up.

Figure 25. Pull-down Menu of Kasama Inari Shrine
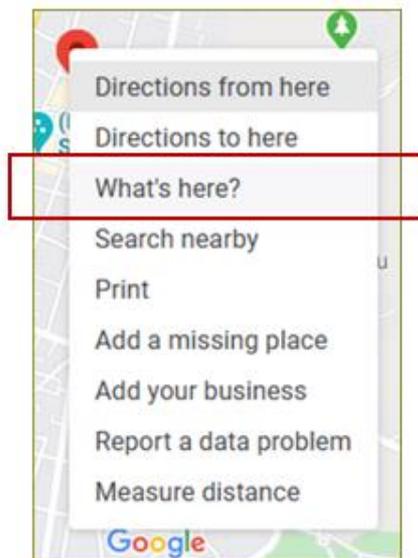
Step3.   By clicking "What's here?," you will find a set of latitude and longitude data of KasamInari Shrine shown at the bottom of the map as in Figure 26.

Figure 26. Latitude and longitude data

Step4.   In the same way, you can, for example, make a list of location data of shops in Kasama City that accept coupons.
Step5.   Save the location data you have collected in a *.csv file with your text editor for mapping.

4.2   Creating 'Regional Currency Map' with Google My Maps

Having obtained longitude-latitude data, this subsection shows the procedure for making 'KapoCa Map' with Google My Maps.

Step1.   Access Google My Maps.

https://www.google.co.jp/intl/en/maps/about/mymaps/

Step2.   Click "GET STARTED."

Figure 27. Google My Maps
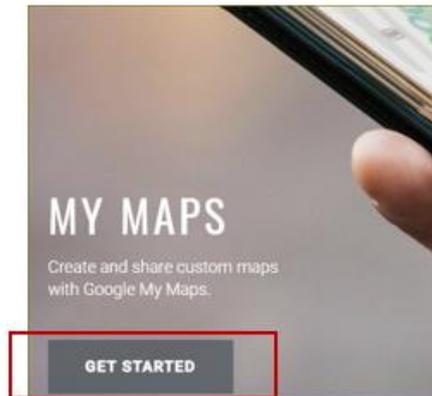
Step3.   Click "+ CREATE A NEW MAP" shown in Figure 28. Then Figure 29 will appear.

Figure 28. Create a new map
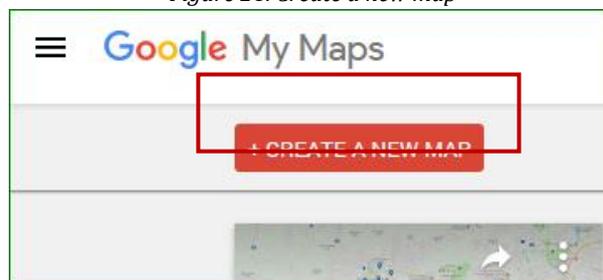
Figure 29. Untitled map
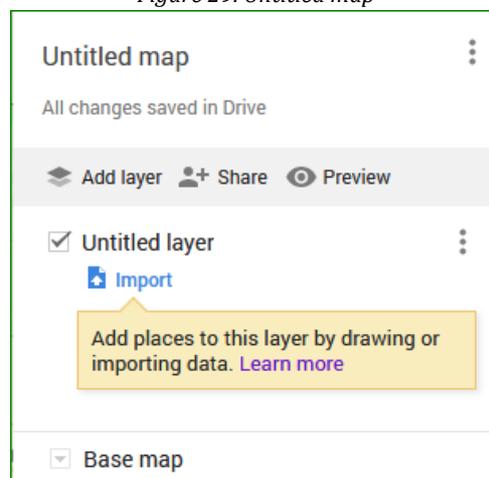
Step4.   Click 'import' in Figure30 to proceed to importing the data of KapoCa Terminals which you have collected.

Figure 30. Import a set of data

Below is the location data of KapoCa Terminals in *.csv file to import.

Figure 31. CSV file of location data of KapoCa terminals

Drag and drop above KapoCa Terminal csv file from your PC onto the frame shown in Figure 32.

Figure 32. Choose a file to import and upload

Once you have finished dragging and dropping your file, you are asked to tell which column indicates the location of a place.

Step5.   Choose the column of longitude and latitude respectively in your file. Namely, X axis for longitude and Y axis for latitude.

Figure 33. Columns to choose

Figure 34. X for Longitude column

Figure 35. Y for Latitude column

Step6.   Press "Continue" to upload the data to create a map.

Figure 36. Terminal Location

Having picked a column to use as the title for the placemarks, click the "Finish" button and uploading begins. Wait until the markers for the terminals are indicated on your My Maps as shown in Figure 36. If done correctly, your KapoCa Map regional currency map is successfully created.

Figure 37. KapoCa Map of terminal locations with markers
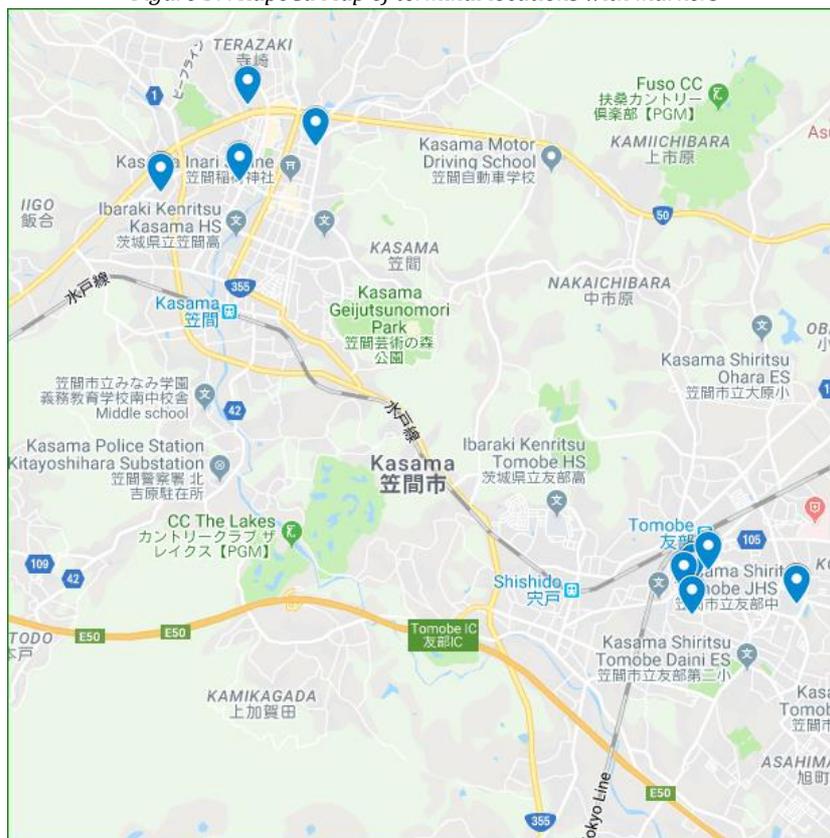
With a click on a marker, you will see the attributes of the KapoCa Terminal.

*Figure 38. A marker with the attributes*
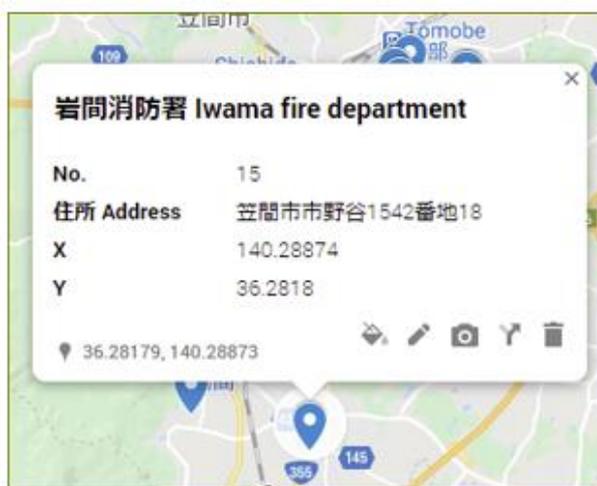
Step7.   Share the Regional Currency Map with your friends.

Figure 39. Share the map
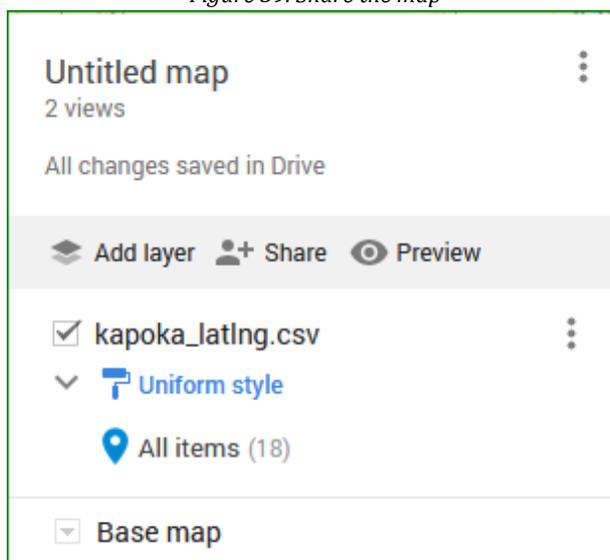
Put a name on your map, click "Share" button. You are ready to share the map with your friends and local people who use regional currency by e-mailing the URL indicated as in Figure 40.

Figure 40. Settings for sharing with friends
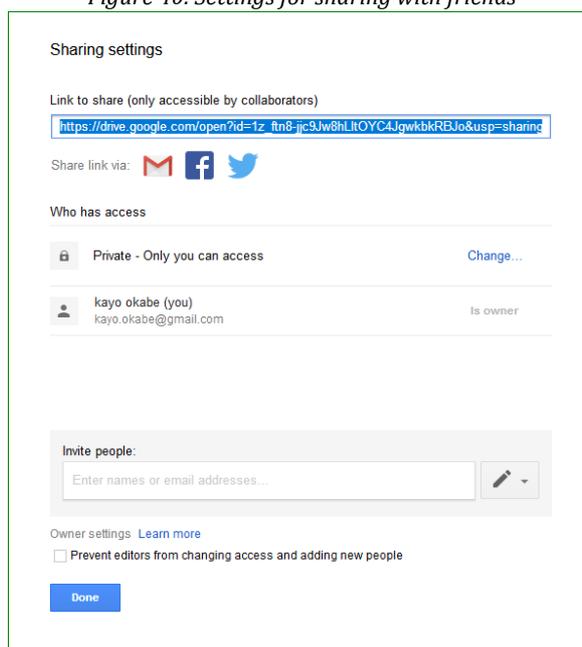
5. CONCLUSION

Vulnerability of many regional currencies in some part, was due to its limitation of geographical spread and marketing aspect, relying on the participants' voluntary work for diffusion. In the case of KapoCa, the local government of Kasama launched the point-coupon exchange system to revitalize community activities by searching and encouraging key persons and groups to activate the local community. However, KapoCa is still relying much on voluntary work of community leaders in diffusing the regional currency system. On the other hand, Crewship, which is comparatively

successful in gaining individual members, has weakness in gaining service establishments accepting Crew Card. Reneria, which has such concrete philosophy of circulating energy to regional products, also faces difficulty in gaining service establishments from a marketing aspect.

Not only to overcome these weaknesses of regional currencies but also to enlarge their capacities, this paper demonstrated that use of GIS would have a large potential to actually visualize and propose strategic approaches for possible developments. As a result, people from every field, from local governments and schools to real estate agencies and bakeries, are able to view the spread of the regional currency and consider it for their own purposes. Our GIS application to KapoCa Terminals in Kasama showed a possible answer to this task.

Another purpose of introducing GIS to the discussion of regional currency is for the younger generation to be more interested in regional currency and thus deepen their geographical acknowledgement of the area through creating 'regional currency maps' with GIS.

Thus, by creating digital maps and analyzing areas spatially with GIS, we can show the actual spread of regional currencies visually, and propose steps toward further diffusion and development of communities.

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ENDNOTES

[1] Kesennuma City experienced magnitude 9.0 on 11 March 2011. Evacuees counted 20,086 persons, and 80.8% of business establishments and 83.5% of employees were affected.

[2] Kesennuma City website:

https://www.kesennuma.miyagi.jp/sec/s021/010/020/090-4/20190307164424.html (2019/05/22)

[3] Maps of tsunami flooded areas are downloadable from GSI website:

https://www.gsi.go.jp/kikaku/kikaku40017.html

[4] Mr. Takahashi is the president of Kesennuma Regional Energy Development Co., Ltd.

[5] Kesennuma Tourism & Convention Association is run by Kesennuma Tourism Strategy Bureau which was established together by Kesennuma City, tourism and economic bodies, with the city mayor as the representative.

[6] Economic circulation rate is calculated by dividing production (value-added price) by distribution (income) to indicate the independence of the regional economy.

[7] SANET is a free software of GIS tools which researchers and university students are using in more than 50 countries in the world. http://www.csis.u-tokyo.ac.jp/

[8] Address in Japan is usually described as name of town and block name, which is an alternative to the street name in other countries.