

## **Broadband deployment and living in the island : A case study in Ogasawara, Japan**

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### **1. Introduction**

Geographical gaps in Internet access increased after broadband services became widely available in developed countries in the 2000s. The conditions for broadband deployment in less favored regions, such as mountainous areas or small remote islands, are particularly severe because of their small populations. (Arai et al., 2012a; Arai et al., 2013) Broadband deployment in an island is particularly difficult because of a large cost of the telecommunication channel connecting the island to the mainland. In the later half of 2000s, however, broadband have been deployed in almost all of inhabited islands in Japan. Massive subsidies of the Japanese Government were injected into the broadband deployment projects in islands. (Arai et al., 2012b)

Ogasawara, which is a region of islands located 1,000km away from the Japanese Mainland, is under the most severe conditions for telecom services in Japan. No broadband services had been provided until recently in this region. Ogasawara had symbolized the “geographical digital divide” in Japan. In the case of Ogasawara, a submarine optical cable was laid from the Mainland subsidized by the Japanese Government in 2011. Although many handicaps of islands remain despite the broadband deployment, the use of the Internet is expected to overcome partially the difficulties in living of islands. A close examination of the changes of everyday life in Ogasawara can conduct some useful insights about the improvement of quality of life utilizing the Internet in a handicapped region.

We carried out a questionnaire survey focusing “Internet use and quality of life”. This survey targeted all households in Ogasawara. In this paper, we will analyze the results of the survey and

discuss the possibilities of the improvement of quality of life utilizing the Internet in the island.

## 2. Ogasawara (Boning Islands)

Ogasawara, Boning Islands in English, are located in Pacific Ocean, around 1,000 km away to the southward from the Japanese Mainland. All islands in Ogasawara are under the administration of Ogasawara Village, Tokyo Metropolis. Total population of Ogasawara Village is 2,785 in 2010. General residents are inhabited only in two islands: Chichi-jima and Haha-jima.

### (1) History

In early half of the 19th century, several American and British people settled in Ogasawara Islands for the first time. Japanese began to settle in the mid-19th century. In 1876, the Japanese Government established the territorial right in Ogasawara. Residents with Western origins were naturalized as Japanese citizens following the establishment of Japanese territorial right. Residents in Ogasawara had increased caused by the growth of subtropical farming from the end of the 19th century to the early 20th century. The number of residents in those days was more than twice of the present.

During the World War II, general residents were evacuated from Ogasawara. After the end of the war, the former residents other than ones with Western origins had not been permitted returning to Ogasawara, because the region was kept under the rule of the U. S. Forces.

In 1968, Ogasawara returned under the rule of the Japanese Government and Ogasawara Village was established. The Japanese Government legislated a special law aiming the development of Ogasawara and began to inject the national budget to promote the region of Ogasawara. (Yamaguchi, 2005; Ogasawara Branch Office, Tokyo Metropolitan Government, 2012)

### (2) Population

The characteristics of the population of Ogasawara quite differ from general islands in Japan reflecting the singular history of the region. Numbers of residents and households have continuously increased after the return under the rule of Japanese Government of 1968. Because few residents had dwelled before the return under Japan's rule, Ogasawara's aged population rate, which is 11% in 2013, is quite lower than the national average.

(Figure 1 and 2)

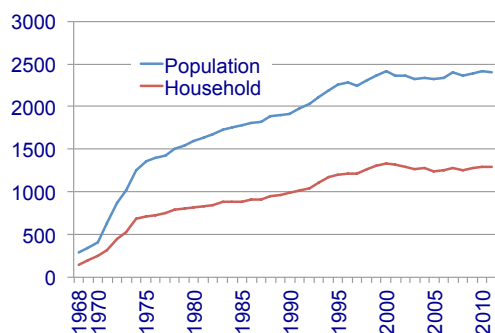


Figure 1 Population change of Ogasawara

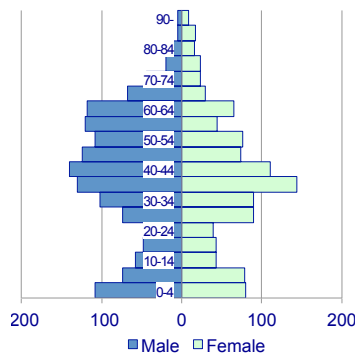


Figure 2 Age structure of Ogasawara

The industrial composition is inclined toward the tertiary industries, especially tourism industry. In addition, there are many government workers, because some local agencies of the Japanese Government are located. The primary industries are divided half agriculture and half fishery. The construction industry amounts the major part of the secondary industries and manufacture is quite small. (Figure 3)

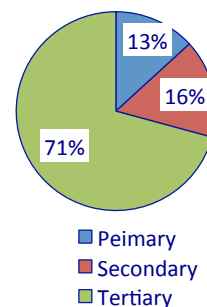


Figure 3 Employees by industry in Chichi-jima and Haha-jima

## (2) Transportation

For the transportation between Ogasawara and the Japanese Mainland, Ogasawara-maru, a ship for liner service, runs one or two round trips every week. A single trip requires 25 hour 30 minute. Annual number of the passengers is around 46,000. (Ogasawara Kaiun Co., Ltd., 2013) No commercial aircraft cannot take off and land in Ogasawara, because the airfield has not been recovered after the war.

## (3) Living environments

Living environments in recent Ogasawara are better maintained compared with general Japanese islands with similar population size, because the Japanese Government has eagerly promoted recovery and development of the region.

### 1) Commerce

Shops selling daily necessities are not so many in Ogasawara. There are two supermarkets in Chichi-jima. People can get convenience goods but not shopping goods such as dresses, electrical appliances and books. Although some kinds of alcoholic drinks like beer are sold, but the assortment of drinks is limited. There are a few shops in Haha-jima. They keep a minimum supply of good necessities.

### 2) Information Media

Newspapers and magazines are delivered once or two times every week matching the Ogasawara-maru's schedule. Television broadcasting cannot to rely using terrestrial radio channels. Television programs broadcasted in Tokyo had relayed to Chichi-jima and Haha-jima using satellite channels since 1996 until 2011. (Ogasawara Village, 2009a)

## 3. Development of telecommunications in Ogasawara

### (1) Telecommunication preceding the deployment of a submarine optical cable

The first telecommunication channel between Ogasawara and the outside of the region was the submarine telegraph-line between Tokyo and Guam Island, U. S. by way of Ogasawara. It was constructed in 1906. (Figure 4) The international telegraph service between Japan and the U. S. was launched using these telegraph-lines. (Ishihara, 2008; Ohno, 2013; Submarine Telecommunication-line Office, Nippon Telegraph and Telephone, 1971)

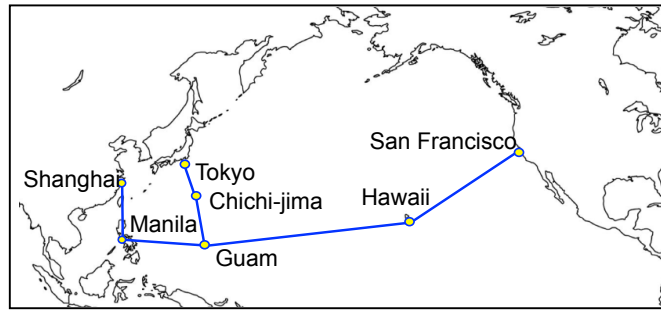


Figure 4 The first submarine telegraph-line of Ogasawara

After the war, no public telecommunication service between Ogasawara and the Japanese Mainland had been provided under the rule of U. S. After the return under Japan’s rule, telephone service was launched using short wave radio in 1969. (Website on Nazaki Transmitting Station, 2009) The short wave channel was replaced to new communication satellite channels in 1983. The telephone service in Ogasawara was greatly improved by the satellite channels. (Ogasawara Branch Office, Tokyo Metropolitan Government, 2012)

Although narrow-band ISDN service for the Internet was launched using communication satellites in 1997, no broadband service was provided caused by the limitation of communication capacity. Browsing service of cellular phones was also not provided (Ogasawara Village, 2009a).

**(2) Deployment of the submarine optical cable**

Tokyo Metropolitan Government deployed the submarine optical cable between Ogasawara and the Japanese Mainland in 2011. Preceding the deployment projects of the submarine optical cable, the Government of Ogasawara Village deployed optical networks connecting every homes, or “fiber to the home (FTTH) ” networks, in Chichi-jima and in Haha-jima. The Japanese Government covered substantially almost all of expenses of these projects. (Table 1 and Figure 5)

2002-6	Deployment of the fiber to the home (FTTH) networks in Chichi-jima and Haha-jima Total expense: 8.1 billion yen (64 million euro)
2010-11	Deployment of the optical submarine cable between the Japanese Mainland and Ogasawara Total expense: 9.6 billion yen (78 million euro) Purposes: telephone, Internet, cable TV, government use
2012	Subscribers to FTTH networks per 100 persons : 36.6 (national average: 17.6)

Table 1 Broadband deployments in Ogasawara

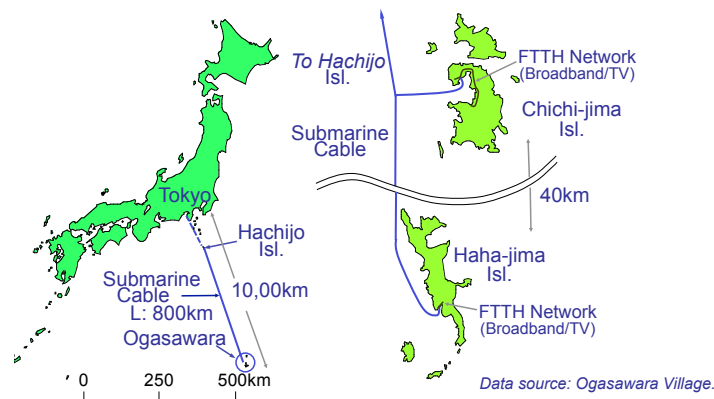


Figure 5 Submarine optical cable between Ogasawara and the Japanese Mainland

New submarine optical cable is used for telephone service, the transmission of terrestrial digital television broadcasting and government services as well as Internet services. Television broadcasting and Internet services are provided through the FTTH network. Number of the subscribers of Internet services is 941 in July of 2012. Number of subscribers of optical fiber services per person is near to the twice of the national average. (Ogasawara Village, 2002; Ogasawara Village, 2009a; Ogasawara Village, 2009b)

#### 4. Internet use and the change of daily life

We carried out the questionnaire survey on Internet use and daily life in Ogasawara to grasp the change of daily life caused by the penetration of Internet use after the improvement of the Internet access.

The survey is conducted in May 2013 targeting to the all households dwelling in Chichi-jima and Haha-jima. The questionnaires were distributed and collected by postal mail. 1,350 questionnaires were distributed and 403 responses were collected. The return rate is 29.9%. The basic characteristics of the respondents are shown in the table 2. We will analyze the data collected by the survey in the following.

Basic characteristics of respondents		
Family type: Single or couple	55.5%	Duration of residence: - 9 years old
Parents and children	39.6%	10 - 29 years old
Three generations	5.0%	30years -
Occupation: Employee	63.5%	
Self-employed	26.0%	
Others	10.5%	

Table 2 Basic characteristics of respondents

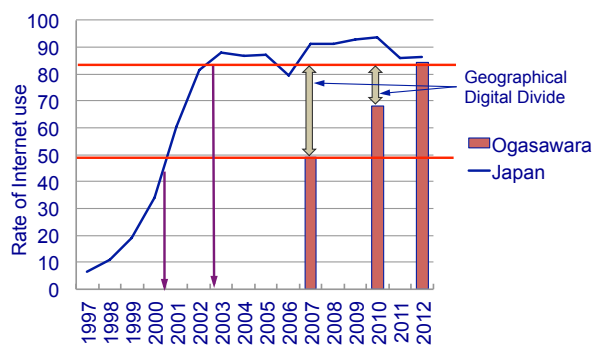
#### (1) Internet use of the residents

##### 1) Penetration of Internet and the geographical digital divide

The condition of Internet use in Ogasawara had been largely changed by the fixed charge Internet service by the village government from 2008 and the broadband services using the submarine optical

cable from 2011. However, 58.1% of the responding households had used before 2008. This rate suggests that Internet use had been widely penetrated to the residents under the narrowband conditions.

National average of the rate of Internet use on household basis, which is estimated from the Telecommunications Usage Trend Survey by the Ministry of Internal Affairs and Telecommunications, rose from the later half of the 1990's to the beginning of the 2000's. Then the rate was saturated with around 85% level. (Ministry of Internal Affairs and Telecommunications, 2013) Contrasting to the national average, the rate of Internet use of Ogasawara was less than 50% in 2007. The gap of the penetration rate between the national average and Ogasawara disappeared after the launch of broadband services. The penetration of Internet use in Ogasawara was around seven years behind the national average. (Figure 6) The delay of the penetration of Internet use represents Ogasawara's geographical digital divide.

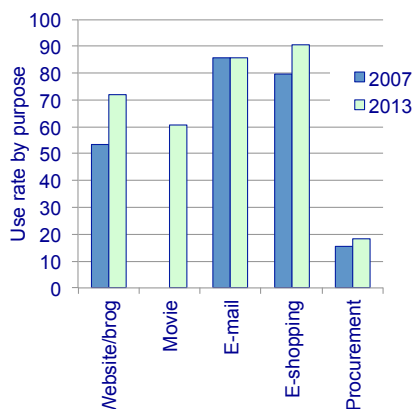


Data: the questionnaire survey by the authors and the Communications Usage Trend Survey by the Ministry of Internal Affairs and Telecommunications

Figure 6 Household rating of the Internet use in Ogasawara

## 2) Purposes of Internet use

The most popular purpose of Internet use is e-shopping. The rate of e-shopping users is more than 90.7% and exceeds e-mailing (85.6%) and website browsing (71.9%). In addition, movie viewing has considerably high percentage (60.7%). The uses of the other purposes are quite low. (Figure 7)



Data: the questionnaire survey by the authors

Figure 7 Household rating of Internet use by purpose

The comparison of the rates of Internet uses by purpose between our questionnaire survey and the Telecommunications Usage Trend Survey mentioned above illustrates the features of Internet use in Ogasawara. Because we cannot contrast the figures of both surveys, we converted the use rates by purpose to the indices so that the index for e-mailing becomes 100 for Ogasawara and for the whole of Japan respectively. The comparison of the indices suggests that e-shopping of Ogasawara is significantly more popular than the national average and the website browsing is less popular. The index of movie viewing is more than twice of the national average. (Figure 8)

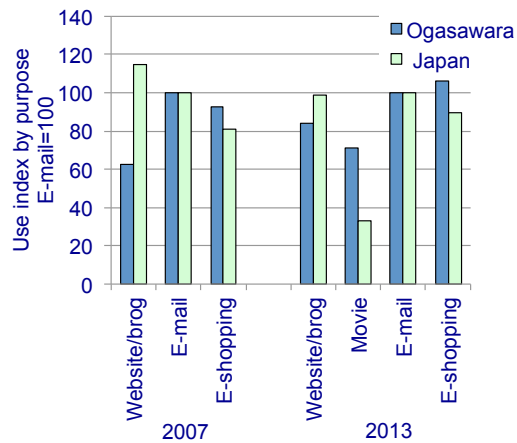


Figure 8 Use index of Internet use by purpose (E-mail =100)

Obviously, the Internet works a powerful means for shopping in Ogasawara. The variety of shopping options is restricted and goods are rather expensive in islands. E-shopping must be attractive for the residents in islands. The fact that around 70% of self-employed persons in Ogasawara procure the business goods using the Internet reflects the same situation.

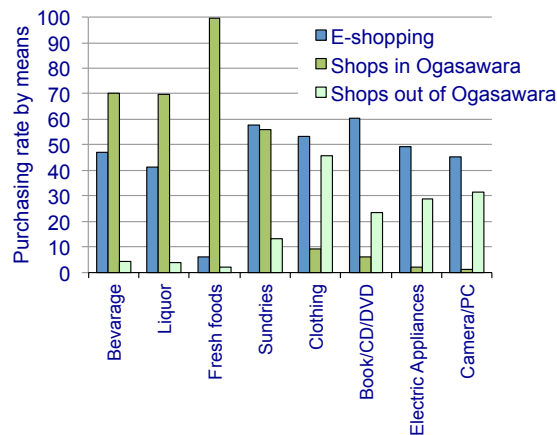
The popularity of movie viewing may be also caused by the severe living conditions in Ogasawara. The need for movie viewing is expected quite large in island, where the choice of entertainments is limited.

It is quite noteworthy that the use rates of e-shopping and e-procurement in 2007 had been near to the present. The heavy use of the Internet for shopping and procurement was established before the broadband deployment. (Figure 7)

## (2) E-shopping

### 1) The reasons for the diffusion of e-shopping in Ogasawara

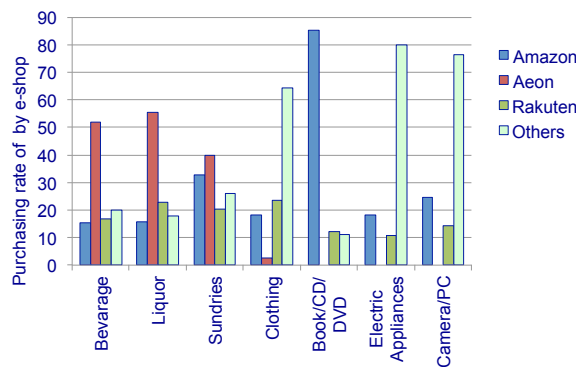
The comparison of the purchasing means by shopping item clearly shows the fact that the use of “real shops” shifts from the shops in Ogasawara for convenience goods to the shops out of Ogasawara for shopping goods. For the use of e-shopping, the difference between convenience goods and shopping goods is not clear. Significant use of e-shopping can be seen for almost all of shopping items. (Figure 9)



Data: the questionnaire survey by the authors

Figure 9 Purchasing rate by means

Although e-shopping has rapidly expanded in 2000's throughout Japan, the use is usually confined almost to shopping goods. (Ministry of Economy, Trade and Industry, 2013) In Ogasawara, e-shopping for convenience goods is popular as a complimentary means to the shops in the region.



Data: the questionnaire survey by the authors

Figure 10 Purchasing rate by e-shop

Why Ogasawara people, who live in the island 1,000km apart from the Mainland, can buy convenience goods by e-shopping? Major sellers for e-shopping are Amazon and Aeon, which are a world leading e-commerce company and a leading retail company of Japan. (Figure 10) They operate their e-retailing services at a flat rate distribution fee utilizing courier services throughout Japan. The costumers can get the products with no additional charge even in a remote island as Ogasawara. There is substantially no disadvantage of islands in the respects of the assortment of goods and prices not to speak to the long delivery time due to the ship transportation. Thereby e-shopping is quite attractive for the island consumers.

## 2) Impact of e-shopping on the retailing in Ogasawara

After the diffusion of e-shopping, some shops confronted to difficulties to keep going due to the shrink of the sales. For example, an independent liquor shop located in the central area of Chichi-



jima was closed in 2007. At the present, a supermarket nearby took over the license for liquor shop and sells only beers and beverages using automated vender machines placed in front of the old shop.

### (3) Medical care and telecommunications

Medical care is a major factor that affects the quality of life in the island as well as the supply of good necessities. Although there is a pharmacy in Chichi-jima, they sell very narrow assortment of drugs. Thereby people must see a doctor of the village clinic in a slight illness that needs only marketed drugs in a general region. Otherwise they must get drugs from the pharmacy out of Ogasawara by some means. E-purchase of drugs is commonly used to get market drugs. The use rate of e-purchase of drugs is 25% and is near to the rate of the purchase from the “real” pharmacies out of Ogasawara. (Figure 11)

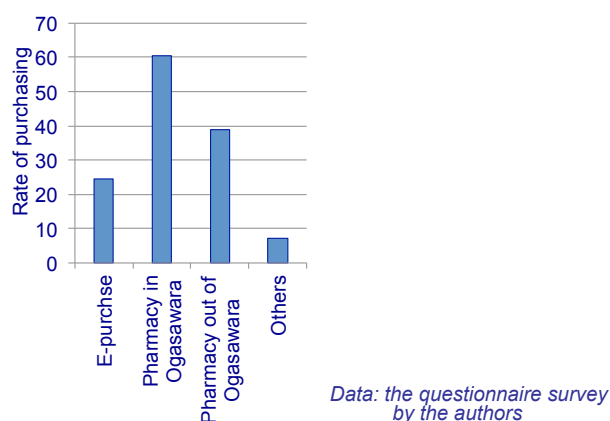


Figure 11 Purchasing rate of medical drugs by means

Although the village clinics are located in Chichi-jima and Haha-jima, there is no medical institution for specialized medical care in Ogasawara. A patient with serious illness must be received the medical examinations in a large hospital in the Japanese Mainland. Actually, more than 70% of the respondents have the experience of family members’ ambulatory and/or hospitalization. Remote medical diagnosis using telecommunication networks is an effective measure to this difficulty. The doctors in the village clinics consult with the medical specialists in a large general hospital transmitting the diagnostic images of computerized tomography and X-ray. After the open of the submarine optical cable, the time for the image transmissions is drastically reduced. The broadband communications contribute greatly the improvement of the remote diagnosis in the village clinics.

Because no commercial aircraft is available in Ogasawara, they must ask the rescue flying boat of Maritime Self-Defense Force for the emergency transportation of patients to the Japanese Mainland. (Ogasawara Village, 2012) Broadband channels reduce largely the time required for the examinations by the medical specialists in the mainland hospital using numerous transmitted images. Actually, 32% of diagnostic image transmissions are used for the emergency transport. (Figure 12)

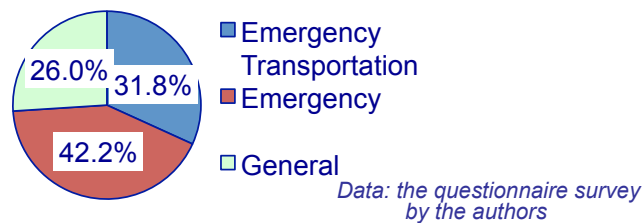


Figure 12 Purpose of diagnostic image transmissions (Apr. 2011 – Jun. 2013)

## 5. Concluding remarks

In Ogasawara, which is the remotest island in Japan, the restriction of telecommunication channels to the Japanese Mainland had hindered the expansion of Internet uses. The deployment of submarine optical cable channels, however, resolved almost completely the geographical digital divide of Ogasawara.

Does the expanded use of Internet contribute the improvement of the quality of life in the island? The questionnaire survey by the authors reveals the fact that e-shopping is quite popular and is used for the purchase of not only shopping goods such as clothing, books and electric appliances but also convenience goods as foodstuff and sundries. The difficulties that the assortment of goods is poor and prices are high are considerably improved by the penetration of Internet use. On the other hand, a negative effect can be found that local retailing is impacted due to the decrease of demand caused by the expansion of e-shopping.

People can get easily marketed medical drugs using the Internet even in Ogasawara, where the supply of medical drugs is limited. In the respect of advanced medical treatments, remote diagnostic imaging reduced the medical disadvantage of islands where medical specialists cannot be assigned.

The Internet had already utilized of in the respect of daily life before the broadband deployment. In Ogasawara, the Internet had been considerably penetrated and had been used for e-shopping even under the narrowband conditions. E-shopping using narrowband brought a large benefit that people can get a wide variety of goods even in an island despite the poor usability. The availability of Internet access, slow or fast, is a decisive factor under the extreme conditions of the island. Broadband is effective to resolve the geographical digital divide only in the quantitative respect.

This kind of usefulness of the Internet cannot be put into practice only through the deployment of telecommunication means. For the full service of e-retailing, a mail-order company dealing the wide variety of goods and an efficient courier service that provides secure and inexpensive delivery are essential. These conditions are fulfilled in the most part of Japan. The Internet can be utilized to improve the quality of people's life in almost all of handicapped regions.

The Internet can eliminate completely the disadvantage of the island in the respect of information. It is needed, however, the infrastructures to support everyday life such as distribution systems and transportation systems are needed to expand the benefit to the quality of life.

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