

Broadband Deployment and Daily Life on an Island: A Case Study in Ogasawara, Japan

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Key words: island, Internet, online shopping, medical care, optical submarine cable

I Introduction

Geographical gaps in Internet access have widened since 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 2015; Arai et al. 2012a; Arai et al. 2012c). Broadband deployment on an island is particularly difficult because of the large cost of the telecommunication channels connecting the island to the mainland. However, in the latter half of the 2000s, broadband has been deployed on almost all of the inhabited islands of Japan. Massive subsidies from the

Japanese Government were injected into broadband deployment projects in islands (Arai et al. 2012b; Arai et al. 2014).

Ogasawara is an island region located 1,000 km from mainland Japan. It has the most difficult conditions for telecommunication services in Japan. Broadband services have only recently been provided in this region. Ogasawara symbolized the “geographical digital divide” in Japan until the Japanese Government subsidized the laying of optical submarine cables from mainland Japan to Ogasawara in 2011. Although many disadvantages of islands remain despite the deployment of broadband, Internet use is expected partially to overcome the difficulties of daily life. A close examination of the changes in everyday life in

Ogasawara could provide some useful insights into improving the quality of life in a less-favored region by utilizing the Internet.

The authors conducted a questionnaire survey focusing on “Internet use and quality of life.” This survey targeted all households in Ogasawara. In this paper, the authors analyze the results of the survey and discuss the possibilities for improving the quality of life on the island using the Internet.

II Ogasawara (Bonin Islands)

Ogasawara, called the Bonin Islands in English, is located in the Central Pacific Ocean, around 1,000 km to the south of mainland Japan. All islands in Ogasawara are under the administration of the Ogasawara-mura (Ogasawara Village) government, Tokyo Metropolis (Tokyo-to). The total population of Ogasawara-mura was 2,785 in 2010. General residents dwell only on two islands: Chichi-jima and Haha-jima.

1. History

In the early half of the 19th century, several American and British people settled in the Ogasawara Islands for the first time. The Japanese began to settle there in the mid-19th century. In 1876, the Japanese Government established its territorial right to Ogasawara. Residents with Western origins were naturalized as Japanese citizens following the establishment of Japanese territorial rights. The number of residents of Ogasawara had increased because of the growth of subtropical farming crops such as coffee, rubber, olives, lemons and sugarcane from the end of the

19th century to the early 20th century. In those days, the number of residents was more than twice the present population.

During World War II, general residents were evacuated from Ogasawara. After the war, former residents without Western ancestry were not permitted to return to Ogasawara, because the region was occupied by U.S. Forces.

In 1968, Ogasawara was restored to the rule of the Japanese Government and Ogasawara-mura was established. The Japanese Government promulgated special laws for the development of Ogasawara and began to inject funds from the national budget to promote the Ogasawara region (Yamaguchi 2005; Tokyo-to Ogasawara Shicho 2012).

2. Population

The population of Ogasawara has significantly different characteristics from those of most Japanese islands, reflecting the singular history of the region. The resident population has increased continuously since the return to Japanese Government rule in 1968 (Figure 1). Because there were few residents before that time, the proportion of elderly people in Ogasawara’s population, which was 11.1% in 2011, is significantly lower than the national average (25.0%) (Figure 2).

The industrial composition is skewed toward tertiary industries (70.8% of the total number of people employed on Chichi-jima and Haha-jima in 2010), especially the tourism industry. In addition, there are many government workers, because some local agencies of the Japanese Government are located there. The primary industries (13.2%) are divided evenly between agriculture and

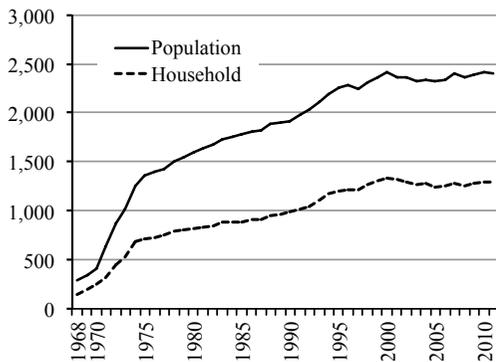


Figure 1. Population changes in Ogasawara
(Source: Tokyo-to Ogasawara Shicho 2012)

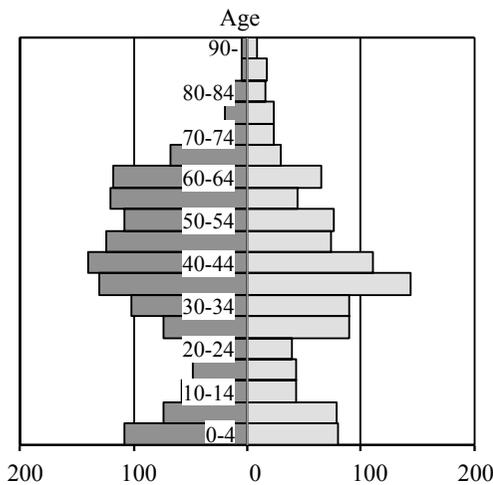


Figure 2. Age structure in Ogasawara (2011)
(Source: Tokyo-to Ogasawara Shicho 2012)

fisheries. The construction industry is the largest of the secondary industries (16.0%), and few people are employed in manufacturing.

3. Transportation

Transportation between an island and the mainland has a strong effect on living conditions on an island. The Ogasawara-maru, a ship for a liner

service, runs one or two round trips every week between Ogasawara and mainland Japan. A single trip requires 25 hours and 30 minutes.¹⁾ The annual number of passengers is around 65,000.²⁾ No civil aircraft can take off or land in Ogasawara because the airfield was never restored after World War II.

4. Living conditions

Living conditions in Ogasawara were greatly improved after its return to Japanese rule in 1968, because the Japanese Government has eagerly promoted the recovery and development of the region.

(1) Commerce

There are few stores selling daily necessities in Ogasawara. There are two supermarkets in Chichi-jima. Although people can buy foodstuffs and daily necessities, goods other than fish and vegetables gathered from the island are delivered to stores only when the Ogasawara-maru docks. The supply of fresh foods is limited for a few days before the ship arrives. However, consumer goods such as clothes, electrical appliances and books cannot be obtained from shops on the island. Although some kinds of alcoholic drinks such as beer are sold, the range of available drinks is limited. There are a few stores in Haha-jima. They keep a minimum supply of good necessities.

(2) Media

Newspapers and magazines are delivered once or twice a week following the Ogasawara-maru's schedule. Terrestrial television broadcasting cannot be relayed because no relay points exist

between the island and mainland Japan. Television broadcasts from Tokyo were relayed to Chichi-jima and Haha-jima via satellite channels from 1996 until optical submarine cables between the islands and mainland Japan were laid in 2011.

III Development of telecommunications in Ogasawara

1. Telecommunications preceding the optical submarine cables

The first telecommunication channels between Ogasawara and the outside were submarine telegraph cables constructed in 1906 between Tokyo and the U.S. territory of Guam Island via Ogasawara (Figure 3). International telegraph services between Japan and the U.S. were launched via these telegraph lines (Ishihara 2008; Ohno 2012; Nippon Denshin Denwa Kosha 1971).

After World War II, no public telecommunication services between Ogasawara and mainland

Japan were provided under U.S. occupation. After the return to Japanese rule, telephone services were launched using shortwave radio channels in 1969 (Hoshi 2009). The shortwave radio channels were replaced by communication satellite channels in 1983. The telephone services in Ogasawara were greatly improved by these satellite channels. Direct distance dialing services were launched and the residents became to be able to call to mainland Japan with no waiting time (Tokyo-to Ogasawara Shicho 2012).

Although narrowband Internet services were launched using communication satellites in 1997, no broadband service was provided because of the limited communication capacity. Browsing services for cellular phones were also not provided (Ogasawara-mura 2009a).

2. Deployment of optical submarine cables

The Tokyo-to government deployed optical submarine cables between Ogasawara and mainland Japan investing 9.6 billion yen,

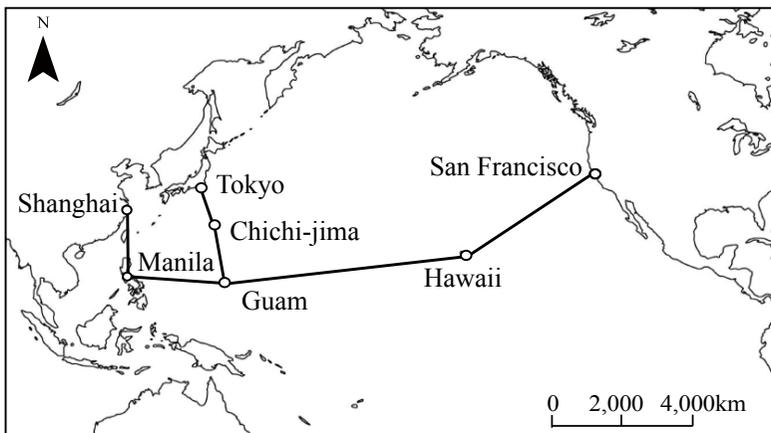


Figure 3. First submarine telegraph lines via Ogasawara (Source: Nippon Denshin Denwa Kosha 1971 et al.)

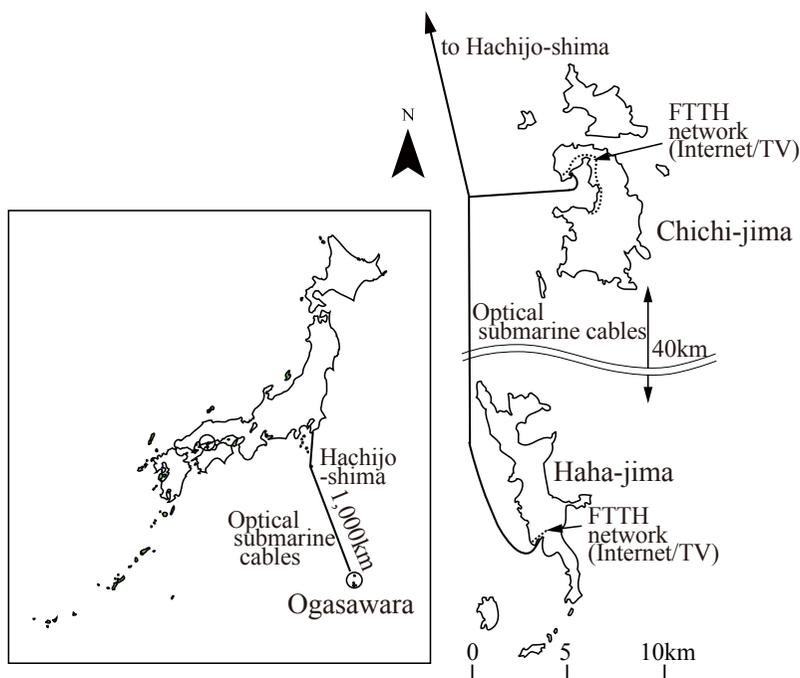


Figure 4. Optical submarine cables between Ogasawara and mainland Japan
(Source: Ogasawara-mura 2009a et al)

or 120 million dollars in 2011. Preceding the deployment projects of optical submarine cables, the Ogasawara-mura government deployed optical networks connecting every home, or “fiber to the home (FTTH)” networks, on both Chichi-jima and Haha-jima (Figure 4). The Japanese Government covered substantially almost all the cost of 8.1 billion yen, or 98 million dollars, for these projects.

The new optical submarine cables are used for telephone services, transmission of terrestrial digital television broadcasting and government services as well as Internet services. Television broadcasting and Internet services are provided through the FTTH networks. There were 941 Internet service subscribers in July 2012. There are 36.6 subscribers of optical network services

per 100 people, nearly twice the national average of 17.9 (Ogasawara-mura 2002; Ogasawara-mura 2009a; Ogasawara-mura 2009b, Somu Sho 2013a).

IV Internet use and changes in daily life

The authors and colleagues conducted a questionnaire survey on daily life and Internet use in Ogasawara to investigate the changes in daily life following the improvement of Internet access.

The survey was conducted in May 2013, and targeted all households on Chichi-jima and Haha-jima. The questionnaires were distributed and collected by postal mail—1,350 questionnaires were distributed, and 403 responses collected. The return rate was 29.9%. The basic characteristics of

Table 1. Basic characteristics of the respondents

		Number of responses	Percentage
Family type	Single or couple	223	55.5
	Parents and children	159	39.6
	Three generations	20	5.0
	Total	402	100.0
Occupation	Employee	254	63.5
	Self-employed	104	26.0
	Others	42	10.5
	Total	400	100.0
Duration of residence	Less than 10 years	139	34.9
	10 - 29 years	153	38.4
	More than 30years	106	26.6
	Total	401	100.0

Source: Questionnaire survey by the authors in 2013

the respondents are shown in Table 1.³⁾

The following results were obtained from an analysis of the survey data.

1. Internet use

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

The residents of Ogasawara were first able to use low-speed Internet services via satellite channels in 1992. Subsequently, Internet services in Ogasawara were significantly improved when the village government introduced fixed-charge Internet services in 2008 and when the broadband services were launched via optical submarine cables in 2011.

However, 58.1% of the respondent households had used Internet services before 2008. This rate suggests that dial-up Internet services had reached many residents. Only 19.0% of all households in the islands began using the Internet after the commencement of broadband services. This

fact suggests that broadband deployment had no significant impact on the enlargement of Internet use in Ogasawara.

The national average rate of household Internet use was estimated from the Tsushin Riyo Doko Chosa by Somu Sho. This rate rose along the theoretical diffusion curve (logistic curve) from the latter half of the 1990s to the beginning of the 2000s and reached saturation at around the 85% level (Somu Sho 2013b). The rate of Internet use in Ogasawara was only 48.9% in 2007, in contrast to the national average (91.3%). This disparity between the national average and the rate in Ogasawara disappeared after the launch of broadband services in 2011. The penetration rates at the time of the survey were almost the same: a national average of 86.2% and 84.3% in Ogasawara. The penetration of Internet use in Ogasawara was approximately seven years behind the national average in 2007 (Figure 5). The delay of Internet penetration represents Ogasawara's geographical

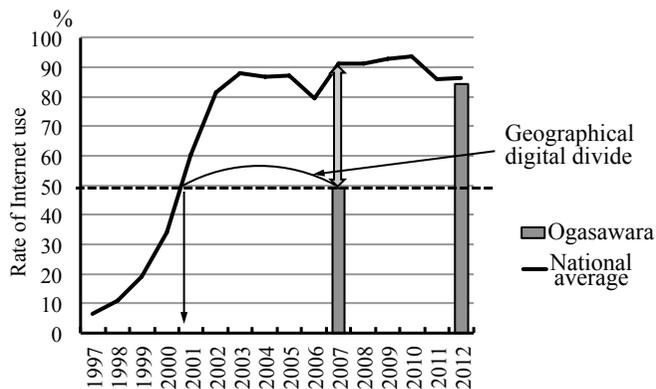


Figure 5. Household rating of Internet use in Ogasawara
 (Source: Questionnaire survey by the authors in 2013 and Somu Sho 2013b)

digital divide.

(2) Purposes of Internet use

As mentioned above, the penetration of Internet use in Ogasawara was almost complete at the time of the questionnaire survey by the authors. Then, for what purpose do the residents use the Internet? The survey data revealed that the most popular purpose of Internet use among the respondents is online shopping (Table 2). The proportion of online shopping users is 90.7%, which exceeds the proportions using the Internet for emailing (85.6%) and website browsing (71.9%). In addition, movie viewing accounts for a considerable percentage (60.7%). Few use the Internet for other purposes.

The comparison of rates of Internet use by purpose between the authors' questionnaire survey and the Tsushin Riyo Doko Chosa by Somu Sho illustrates the features of Internet use in Ogasawara (Figure 6). Because the figures of the two surveys cannot be directly contrasted owing to differences in methods, the use rates by

purpose were converted to indices so that the index for emailing, which was expected to be the most popular application, becomes 100 for both Ogasawara and Japan. The comparison of the indices suggests that online shopping in Ogasawara is significantly more popular than the national trend, while website browsing is less popular. The index for movie viewing is more than twice the national average.

Obviously, the Internet is a powerful tool for shopping in Ogasawara. Although several stores at least provide convenience goods, the variety of shopping options at "real stores" in the islands is restricted. Moreover, goods sold on the islands are rather expensive because of the high overseas transportation costs and the small volume of sales. Online shopping would be attractive to the residents of the islands. The fact that around 70% of self-employed people in Ogasawara procure their business goods using the Internet reflects the same situation.⁴⁾

It is noteworthy that the rates of online shopping and online procurement until 2008 were

Table 2. Household rating of Internet use by purpose

Purpose	(Multiple answer)			
	Until 2008		2013	
	Number of responses	Percentage	Number of responses	Percentage
Website browsing	86	53.4	225	71.9
Movie viewing	-	-	190	60.7
Emailing	138	85.7	268	85.6
Online shopping	128	79.5	284	90.7
Procurement	25	15.5	57	18.2
Total number of the respondents	161	100.0	313	100.0

Source: Questionnaire survey by the authors in 2013

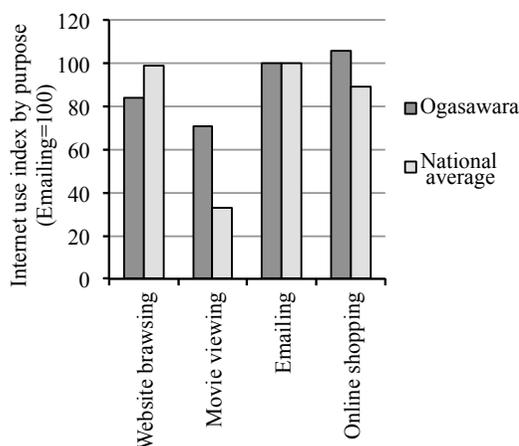


Figure 6. Index of Internet use by purpose (Emailing = 100)

(Source: Questionnaire survey by the authors in 2013 and Somu Sho 2013b)

close to present rates. The extensive use of the Internet for shopping and procurement was established before broadband deployment (Table 2).

The popularity of movie viewing may also be attributable to the severe living conditions in Ogasawara. The demand for movies is expected to be quite strong on an island where the choices of entertainment are limited. Although the residents of Ogasawara can view the same terrestrial

television programs as in central Tokyo, no multichannel broadcast cable television service has been available since the deployment of the optical submarine cables to mainland Japan. Therefore, it can be understood that the residents prefer movie streaming via the Internet.

2. Online shopping

(1) The reasons for the diffusion of online shopping in Ogasawara

How do the residents in Ogasawara use Internet online shopping? Table 3 shows the methods of purchasing goods according to the results of the questionnaire survey. Beverages, liquor, fresh food and sundries are mainly purchased from the stores on the islands. In contrast, clothing, books/CDs/DVDs, electrical appliances and cameras/PCs are rarely purchased on the islands. This dichotomy clearly indicates that the use of “real stores” was divided between stores in Ogasawara for convenience goods and those outside Ogasawara for retail goods. Most retail goods are purchased outside the islands because few stores sell them. Differences in the use of online shopping between convenience goods

Table 3. Method of purchase by retail item

(Percentage; multiple answer)

Item	Online shopping	Telephone/ FAX shopping	Stores in Ogasawara	Stores outside Ogasawara	Total number of the respondents
Bevarage	46.9	4.2	70.4	4.2	382
Liquor	41.3	4.9	69.7	4.0	327
Fresh foods	6.0	2.0	99.5	2.3	397
Sundries	57.7	8.4	55.9	13.3	392
Clothing	53.4	13.9	9.2	45.5	382
Books/CDs/DVDs	60.6	7.0	6.2	23.6	386
Electrical appliances	49.1	7.1	2.0	29.0	393
Cameras/PCs	45.4	5.4	1.0	31.7	388

Source: Questionnaire survey by the authors in 2013

Table 4. E-commerce seller by retail item

(Percentage; multiple answer)

Item	Amazon	Aeon	Rakuten	Others	Total number of the respondents
Bevarage	15.3	51.9	16.8	19.8	131
Liquor	15.8	55.4	22.8	17.8	101
Sundries	32.9	39.9	20.3	25.9	158
Clothing	18.3	2.6	23.5	64.3	115
Books/CDs/DVDs	85.2	0.0	12.2	11.1	189
Electrical appliances	18.3	0.0	10.8	80.0	120
Cameras/PCs	24.5	0.0	14.2	76.4	106

Source: Questionnaire survey by the authors in 2013

and other retail goods are not clear. Significant use of online shopping can be seen for almost all items except for fresh foods, which are difficult to convey on ships.

Online shopping rapidly expanded throughout Japan in the 2000s. People can get almost all retail items via online shopping, even with some limitations of delivery cost and time. However, the use of online shopping is usually confined to retail goods (Keizai Sangyo Sho 2013). Widespread online shopping in Ogasawara partially

reflects this nationwide trend. In Ogasawara, online shopping for convenience goods is popular as a complement to real stores in the region.

The major online shopping retailer of books/DVDs in Ogasawara is Amazon, a world-leading e-commerce company, and that for convenience goods is Aeon, a leading Japanese retail company (Table 4). The range of items offered by Aeon's e-commerce is quite wide because it operates a number of large supermarkets. Therefore, Aeon's e-commerce is suitable for the purchase of food,

Table 5. Comparison of purchasing rates of the respondents with/without family members residing outside Ogasawara

(Percentage; multiple answer)

	Item	Online shopping	Telephone/ FAX shopping	Stores in Ogasawara	Stores outside Ogasawara	Total number of the respondents
Respondents WITH family members outside Ogasawara	Bevarage	37.6	4.6	24.9	5.8	173
	Liquor	36.2	6.0	73.8	6.7	149
	Fresh foods	5.1	2.2	99.4	3.4	178
	Sundries	49.2	10.7	58.8	14.7	177
	Clothing	42.8	15.6	11.0	45.1	173
	Books/CDs/DVDs	53.8	7.5	8.1	28.9	173
	Electrical appliances	42.1	9.6	1.7	36.5	178
	Cameras/PCs	41.5	5.7	1.7	35.2	176
Respondents WITHOUT family members outside Ogasawara	Bevarage	57.1	3.2	35.4	2.6	189
	Liquor	48.1	3.8	65.2	1.3	158
	Fresh foods	7.1	2.0	99.5	1.0	198
	Sundries	68.0	6.2	52.1	12.9	194
	Clothing	64.4	11.7	7.4	45.7	188
	Books/CDs/DVDs	67.4	5.7	4.1	19.2	193
	Electrical appliances	56.7	5.7	2.1	21.6	194
	Cameras/PCs	49.2	5.2	0.5	26.9	193

Source: Questionnaire survey by the authors in 2013

beverages or sundries.

How can Ogasawara people, who live on islands 1,000 km from mainland Japan, buy convenience goods, which are very frequently consumed? Amazon and Aeon operate their e-commerce services for a flat-rate distribution fee using courier services, such as Yamato Transport and Japan Post, throughout Japan. The customers can obtain the goods at no extra charge, even on such a remote island as Ogasawara. Certainly, the delivery to a remote island via a limited ship service would take longer than usual. In Ogasawara, it takes a maximum of 10 days. However, apart from the delivery time, there is no substantial disadvantage for islands with respect to the range of goods and their prices. Therefore,

online shopping is quite attractive for island consumers.

Before the penetration of mail-order services and online shopping, a resident of the islands could only obtain goods that were not sold in the islands when a family member bought them during a visit to mainland Japan or by asking a family member or friend living on the mainland to buy and mail them. Although general mail-order services and telephone/facsimil shopping had been used to a certain degree, online shopping became overwhelmingly popular after the introduction of the Internet.

Although dependence on the family networks has been significantly reduced by the diffusion of the Internet, it may affect the

frequency of online shopping by residents of Ogasawara if they can ask family or friends to buy goods to send them. The survey indicates that residents that do not have family members on the mainland tend to use online shopping more than those who do (Table 5). Previously, daily life on the islands was partially supported by family networks spread over the islands and on the mainland.

(2) Impact of online shopping on retail business in Ogasawara

The deep penetration of online shopping for general retail and convenience goods impacted the business of physical stores in Ogasawara. There were no specialty stores selling electrical appliances, cameras, PCs, books, DVDs and so on, because of limited demand on the islands. However, several specialty stores sold beverages, liquor and sundries. After the diffusion of online shopping, some stores faced difficulty remaining in business because of the reduction in sales. For example, an independent liquor shop located in the central area of Chichi-jima closed after the beginning of Internet services. At present, a nearby supermarket has taken over the license for the closed liquor shop and sells only beers and beverages using automated vendor machines placed in front of the old shop. Similarly, a sundries store has closed.⁵⁾

3. Medical care and telecommunications

Medical care significantly affects the quality of life on the islands as well as the supply of good necessities. For medical care in Ogasawara, the village government operates medical clinics on Chichi-jima and on Haha-jima. Among these,

Table 6. Method of purchase of medical drugs

(Multiple answer)

Method of purchase	Number of responses	Percentage
Online purchase	94	24.6
Pharmacy in Ogasawara	231	60.5
Pharmacy outside Ogasawara	149	39.0
Others	27	7.1
Total number of the respondents	382	100.0

Source: Questionnaire survey by the authors in 2013

Ogasawara-mura Shinryosho (the Ogasawara Village Clinic) on Chichi-jima is well equipped with medical facilities. People can receive a wide variety of general medical services. Although there is a pharmacy on Chichi-jima, it sells a very narrow range of drugs. Therefore, people must see a doctor in the village clinic even for minor illnesses that need only over-the-counter drugs in a general region.⁶⁾ Otherwise, they must obtain drugs from a pharmacy outside Ogasawara by some means. Online purchasing is commonly used to buy nonprescription drugs. Of the respondents, 24.6% bought drugs online, which is close to the proportion of purchasing from physical pharmacies outside Ogasawara (Table 6).⁷⁾

Although the village clinics are located on Chichi-jima and Haha-jima, there is no medical institution offering specialized medical care in Ogasawara. A patient with a serious illness must receive a medical examination in a large hospital in mainland Japan. In fact, 71.8% of the respondents have experience of a family member attending a hospital and/or being hospitalized. Ensuring sufficient specialized medical care services is a continuing local challenge in Ogasawara. Remote medical diagnoses using telecommunication networks is an effective measure against this

difficulty. The doctors in the village clinics consult medical specialists in large general hospitals, transmitting diagnostic images of computerized tomography and X-rays. Because remote medical diagnoses employed narrowband satellite channels before the deployment of the optical submarine cables, image transmission was quite slow, requiring more than 10 minutes for one image. The time for the image transmissions was drastically reduced after the introduction of the optical submarine cables to several seconds per image.⁸⁾ Broadband communications contribute greatly to the improvement of remote diagnoses in the village clinics.

Emergency transportation of patients with severe illnesses and injuries to mainland Japan is the most serious challenge for Ogasawara's medical care. Because there has been no airport on Chichi-jima or Haha-jima since the end of World War II, no civil aircraft are available in Ogasawara. For the emergency transportation of patients to mainland Japan, a Maritime Self-Defense Force rescue flying boat must be summoned (Ogasawara-mura 2012). The rescue flying boat can land on the water in front of the port of Chichi-jima and can transport the patient to a hospital on the mainland. Around 30 emergency patients are transported each year. Because it takes from 9 to 10 hours from the request for the emergency transportation to the arrival of the patient at the mainland hospital, a reduction in time for a decision on an emergency request is needed. Broadband channels significantly reduce the time for examinations by medical specialists in the mainland hospital using numerous transmitted images. In fact, 32% of diagnostic image transmissions are used for

emergency transport (Uemura 2014).

4. Internet use conditions for visitors

Considerable people stay in Ogasawara in addition to the local residents. Because visitors to Ogasawara, including tourists, are forced to stay on the islands for a minimum of four days, they demand Internet access to see news websites, movies and to receive weather reports, transportation information, tourist information and so on. The number of visitors during the tourist season in August is estimated to reach about 25% of the local population, based on the records of the tourist associations and the shipping company in the region. The potential demand for Internet access by the visitors cannot be ignored.

However, until recently, Internet access for visitors to Ogasawara was limited. Even after Internet services were launched via ISDN channels using a telecommunication satellite in 1992, no Internet service was available for visitors. At the beginning of the 2000s, two Intanetto Akusesu Kona (Internet access spots) were opened at souvenir shops in the central area of Chichi-jima that provided an Internet access service via PCs for tourists. However, these access spots could provide only a limited service. Although emailing and browsing services for cellular phones, which were easy for the visitors to use, became partially available from 2006, full Internet access services via smartphones were launched after the optical submarine cable channels between mainland Japan and the islands were completed in 2011.

Even under these limited access conditions, there was strong demand for Internet use by visitors. Many lodging businesses on Chichi-

Table 7. Year of the introduction of the Internet and Wi-Fi services to accommodation businesses

Equipment	Before 2008	2008-2010	2011-	No answer	Total
Internet	11	8	1	0	20
Wi-Fi service	1	4	12	3	20

Source: Field survey by the authors in 2013 and 2014

jima began to deploy Internet access facilities using Wi-Fi technology when the optical fiber network on the island was deployed, and full-time Internet connection services via satellite channels were launched in 2006. With the earliest stage of the diffusion of Wi-Fi services around 2007, a restaurant with accommodation facilities started Wi-Fi services for their customers. Although most of accommodation businesses had introduced the Internet for business purposes before 2011, Wi-Fi services by accommodation businesses have become widespread since the optical submarine cable channels were opened in 2011 (Table 7).⁹⁾ In addition, the Ogasawara-mura government started two free Wi-Fi spots in 2014 and 2015. One was in the waiting room for ship passengers and the other was in the visitor center. These free Wi-Fi spots mainly targeted foreigners, corresponding to an increase in the number of foreign visitors since Ogasawara was registered as a World Heritage Site.

Thus, broadband deployment, including the optical submarine cables and optical fiber networks in Ogasawara, improved Internet access via cellular/smartphones and to provide Wi-Fi services for the visitors.

V Conclusion

In Ogasawara, which has the remotest islands in Japan, telecommunication channels more than 1,000 km long to mainland Japan restricted the expansion of Internet use. Recently, Internet channels have been established between the islands and mainland Japan. The construction of optical submarine cables finally almost completely resolved the difficulties of the geographical digital divide in Ogasawara.

Has the expanded use of the Internet improved the quality of life in the islands? The questionnaire survey by the authors reveals that online shopping is quite popular and is used for the purchase not only of retail goods such as clothing, books and electrical appliances but also for convenience goods such as foodstuffs and sundries. A background factor for the popular use of online shopping is that major sellers provide a wide variety of online retailing services at the same prices as in mainland Japan. Therefore, there is no disadvantage on the islands except for long delivery times. The difficulties of daily life on an island—the range of goods is poor and prices high—have been considerably improved by the penetration of Internet services. On the other hand, there is a negative effect that local commerce is impacted because of a decrease in local demand caused by the expansion of online shopping.

Medical care is an example of the improvement of the quality of life from Internet use. People can easily obtain nonprescription drugs using the Internet even in Ogasawara, where the medical drug supply is limited. In regard to advanced medical treatment, remote diagnostic

imaging has reduced the medical disadvantage of the islands, where medical specialists cannot be assigned. Remote diagnosis is also effective in reducing the time required for emergency patient transportation.

The Internet had already been utilized in daily life before the deployment of broadband. In Ogasawara, the Internet had penetrated deeply and has been used for online shopping even under narrowband conditions. If anything, people's desire for online shopping may promote the penetration of the Internet. Online shopping via narrowband brought a large benefit that people could obtain a wide variety of goods even in the islands despite the poor usability. The availability of Internet access, slow or fast, is a decisive factor in the extreme conditions of the island. Broadband is effective only in quantitative terms in resolving the geographical digital divide.

This usefulness of the Internet cannot be gained only through telecommunication systems alone. For the full range of e-commerce services, an online retailing company dealing in a wide variety of goods and an efficient courier service that provides secure and inexpensive deliveries are essential. These conditions are met in most parts of Japan, including on islands far from the mainland, such as Ogasawara. The Internet can be utilized to improve the quality of life in almost all less-favored regions.

The Internet can almost completely eliminate the disadvantages of the island in relation to information. However, this requires infrastructure to support daily life such as distribution systems and transportation systems to improve its benefits to quality of life.

Acknowledgments

The authors would like to acknowledge the assistance and support of the staff members of the Ogasawara-mura Government and the Ogasawara Village Clinic. This work was supported by the Grant-in-Aid for Scientific Research (No. 24320166) of The Japan Society for the Promotion of Science. An early version of this paper was presented on August 5, 2013 at the International Geographical Union Kyoto Regional Conference 2013, Kyoto, Japan.

Notes

- 1) Ogasawara-maru was replaced with a new ship, and the travel time was reduced to 24 hours (Ogasawara Kaiun 2016).
- 2) According to an interviewee at the headquarters of Ogasawara Kaiun in March 2013.
- 3) Around 90% of the respondents are employees or self-employed persons. Most of these working generation people are considered to be non-elderly. The Tsushin Riyo Doko Chosa (the Telecommunications Usage Trend Survey) by Somu Sho (the Ministry of Internal Affairs and Telecommunications) revealed that there is almost no difference in the Internet use by non-elderly for any age groups (Somu Sho 2013b). Therefore the representativeness of the respondents seems to do not matter.
- 4) In the questionnaire survey, the response rate for "Internet procurements" for all respondents is 18.2%. Self-employed people account for about one-fourth of respondents. Therefore, it is estimated that around 70% of self-employed people procure business goods via the Internet.
- 5) According to an interview with a staff member of the Division of Commerce, Ogasawara-mura Government in March 2013.
- 6) According to an interview with a staff member of the Medical Division, Ogasawara-mura Government in March 2013.
- 7) The online retailing of nonprescription drugs had been prohibited by the Pharmaceutical Affairs Law since 2009.

However, the ban was lifted in November 2014 by the amendment of the Pharmaceutical Affairs Law (Kosei Rodo Sho 2014).

- 8) According to an interview with a staff member of the Ogasawara Village Clinic in March 2013.
- 9) According to interviews with 20 selected accommodation businesses of a total of 64 businesses located in Chichi-jima in November 2014.

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