Journal of Asia-Pacific Studies (Waseda University) No. 16 (May 2011)

Economic Effects of Digitizing Terrestrial Broadcasting: the Case of Japan*

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This paper aims to show an estimation of economic effects of digitizing terrestrial broadcasting in Japan, which was conducted by a research group in Ministry of Internal Affairs and Communications in Japan. It is expected that digitization creates a large economic benefit and it should be sufficiently larger than the cost of digitization such as expenditure on TV sets and investment in digital facilities. An input–output approach is applied for the measurement. The total net and gross economic effects estimated for the twenty years amount to 69.2 and 249.0 trillion JPY, respectively, which are categorized into those from a) investment in digitization; b) businesses and services of digital terrestrial broadcasting; and c) expected businesses and services utilizing vacant bandwidth.

1. Introduction

Digital terrestrial broadcasting in Japan started on December 1, 2003, and analog broadcasting is designated by law to be terminated on July 24, 2011. Since the digitization of terrestrial broadcasting is still an ongoing national project, it is not yet known whether the uptake will reach 100% by the date of termination. To justify such a nationwide project, the government should demonstrate that the expected benefit is sufficiently larger than the associated cost. Ministry of Internal Affairs and Communications (hereinafter, MIC) which is in charge of telecommunications and media policy in Japan organized a study group (hereinafter, the Group) on the economic effects of digitization. The author joined the group as the chair.

Along with discussion in the group, this paper estimates the economic benefit derived from digitization of broadcasting in Japan. The paper firstly identifies businesses and service sectors in which the direct economic effect of digitization is generated and all possible influences on the sectors are quantified as direct effects with particular attention to double-counting and leakage. Then, the indirect spill-over effect derived from the direct effects is calculated by input–output analysis.

The influence of digitization of broadcasting is expected to be much more conspicuous in Japan than in other countries which have introduced digital broadcasting, because broadcasting in Japan relies greatly on terrestrial broadcasting. Despite considerable cost burdens, consumers are requested to replace their TV sets to enjoy better quality services such as high definition TV programs enabled by digitization. Meanwhile, digitization requires the supply side to invest heavily in facilities.

There are pros and cons on the investment and expenditure as an effect because they are sometimes perceived as unfavorable cost burdens on both industries and

* The author is indebted to the members of the study group on the economic effects of digitization, organized by MIC. Any views shown in this paper are of author's own and do not necessarily represent the opinions of the group or MIC.

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citizens, and the government seems to force them to bear the burdens without apology. However, it is evident that the investment and expenditure will create a wide range of spin-off effects in other industries through their interdependent relationship. To create a national consensus, it is important to show that the project will yield enormous benefits compared to the cost. The government should undertake coordination and promotion. At the same time, the government expenditures have an additional impact on the national economy.

Theoretically, the welfare effects of such a nationwide project should be modeled in a general equilibrium framework. A straightforward approach, however, may cause difficulties in calculating the real economic benefits. In order to maintain the feasibility of calculation, this paper employs an input–output approach. The time horizon for the estimation is twenty years, which is divided into the first ten years from the beginning of the project through to the termination of analog broadcasting, and the next ten years after the termination. In the former, investment and expenditure for introducing digital broadcasting and their influences are aggregated, while in the latter the economic effect of using the vacant frequency bandwidth is estimated. In addition to the gross economic effect, the net effect is also calculated in which investment and expenditure are deducted which are even necessary if analog broadcasting were to be maintained.

This paper is organized as follows: In the next section, the progress of digitization of terrestrial broadcasting in Japan is explained. In Section 3, the framework of the estimation is given, which is followed by the result in Section 4. Section 5 considers some implications of the result and gives a concluding remark.

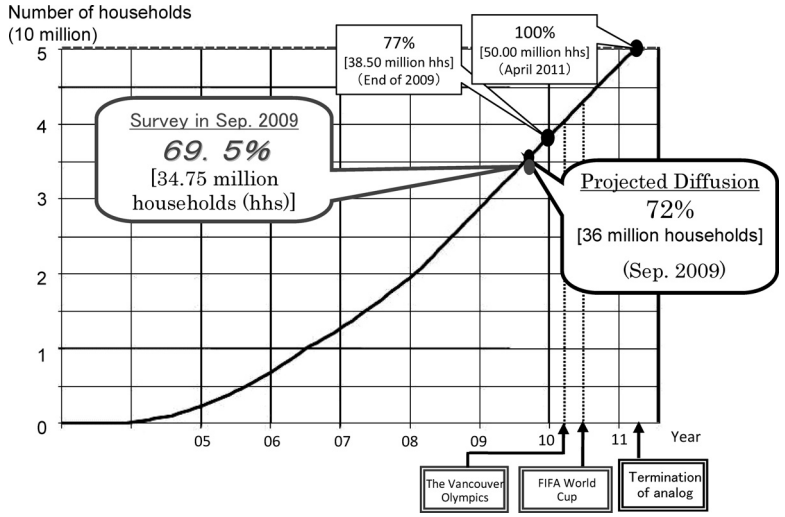
2. Digitization of Terrestrial Broadcasting in Japan

Digitization of terrestrial broadcasting in Japan has lagged behind that in other developed countries. The decision to digitize terrestrial broadcasting was made in July 2001 when the Radio Act was amended. In the Act, it was stipulated that analog broadcasting should be terminated within ten years, which means that digitization should be completed by July 24, 2011. Table 2-1 shows the process of digitization in some representative countries. In Japan, analog broadcasting will be terminated simultaneously nationwide. Since many people watch TV through terrestrial broadcasting in

Table 2-1. Digitization of Terrestrial Broadcasting in Representative Countries

	Date of Start	Date of Completion	Process of Analog Termination
Sweden	April 1999	2005 – Oct. 15, 2007	Stepwise
Finland	August 2001	Sept. 1, 2007	Simultaneous
Germany	November 2002	2003 – Nov. 25, 2008	Stepwise
Netherlands	April 2003	Dec. 11, 2006	Simultaneous
Switzerland	August 2003	July 2006 – Feb. 25, 2008	Stepwise
United States	November 1998	June 12, 2009	Simultaneous
Great Britain	August 1998	2008 – 2012	Stepwise
France	March 2005	4th Quarter, 2009 – Nov. 30, 2011	Stepwise
Korea	October 2001	Dec. 31, 2012	Stepwise
Japan	December 2003	July 24, 2011	Simultaneous

Figure 2–1. Diffusion Rate of Digital Broadcasting for Households



Source: http://www.soumu.go.jp/main_content/000043398.pdf

Japan,[1] there is great concern whether analog can be terminated successfully. Digital broadcasting started in December 2003 in three metropolitan areas, while simultaneous broadcasting for mobile TV, called "One-Seg", which uses one segment of bandwidth allocated to each broadcaster, started in April 2006. In December 2006, digital terrestrial broadcasting started in all prefectures.

Figure 2-1 shows the transition of diffusion among households. According to the survey conducted in September 2009, the actual diffusion rate is estimated to be 69.5%, which is a little lower than the corresponding projected diffusion rate but is an increase of 8.8% in six months.

The Government has taken various policy measures to encourage and support people and industries to cope with digitization. Government spending on these measures has had direct effects.

Japan has adopted the ISDB-T (Integrated Services Digital Broadcasting-Terrestrial) standard, which is similar to the European standard, DVB-T (Digital Video Broadcasting-Terrestrial) but not compatible with it nor with the American standard, ATSC (Advanced Television Systems Committee). As of March 2010, six countries in South America have adopted ISDB-T.

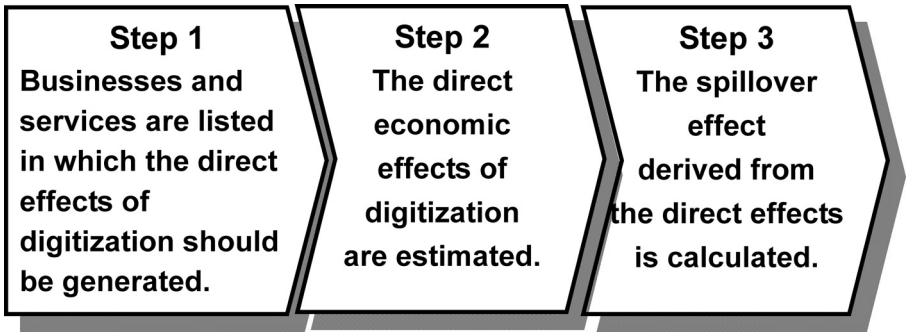
3 Framework of the Measurement

(1) Three Steps in Estimating the Economic Effects

There are several methods to quantify the economic effects of a project. The Group adopted an ordinary input-output analysis, which is the most practical and often used for evaluating public projects. The economic effects of the transition to terrestrial

[1] 48 million out of 53 million households in total receive terrestrial broadcasting (MIC, 2004). http://www.soumu.go.jp/main_sosiki/joho_tsusin/policyreports/chousa/digi-sinten/040727_2.html

Figure 3-1. Estimating the Economic Effects of the Transition to Terrestrial Digital Broadcasting



digital broadcasting are estimated in three steps, as shown in Figure 3-1 above.

In Step 1, the capital investment, businesses and services in which economic effects (consumption and expenditure) arise from the transition to terrestrial digital broadcasting are determined.

In Step 2, the revenue in the service and business sectors identified in Step 1 is estimated as a direct effect on the economy. The reason for defining the revenue as a direct effect is that it is composed of sales revenue from intermediate business transactions and from consumers and is regarded as direct investment, expenditure and consumption for the digitization. The term "direct" effect is used in contrast to a "spillover" effect which is defined in Step 3.

In Step 3, the effect of the direct effect estimated in Step 2 spreading over all industries is estimated. This effect is defined as the spillover effect. Adding this effect to the direct effect yields the total economic effect. Suppose that a direct effect arises from the transition to terrestrial digital broadcasting in an industry, then the mechanism of producing a total economic effect is as follows: a production spillover resulting from the direct effect takes place in other industries (primary spillover), which results in an increase in income. This increase in income stimulates further consumption, which yields additional production spillover in each industry (secondary spillover), and so on. The Group defined the sum of the above-mentioned direct effect, primary spillover effect and secondary spillover effect as the total economic effect.

(2) Gross and Net Direct Effects

Direct effects include two types of economic effects: one is the revenue which arises from the existing services or businesses continuing from analog broadcasting such as the revenue from advertising, sales of TV sets/receivers, etc.; and the other is the revenue from new digital services such as "One-Seg" broadcasting for mobile, and the revenue from services and businesses expected to emerge utilizing the post-analog vacant frequencies.

As for the services or businesses that have existed since the time of analog broadcasting, it is hard to distinguish between those that will continue after digitization and those that will terminate when digitized. Therefore, two concepts of direct effects are introduced: the gross direct effects and the net direct effects. The gross direct effects

Figure 3-2. Composition of Direct Economic Effects–Gross and Net Effects

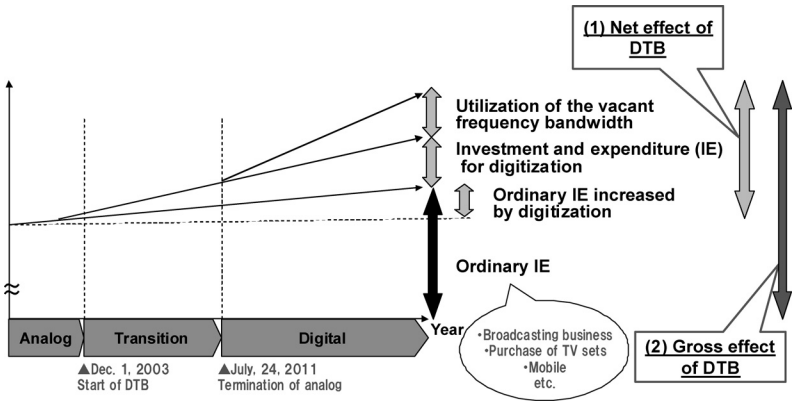
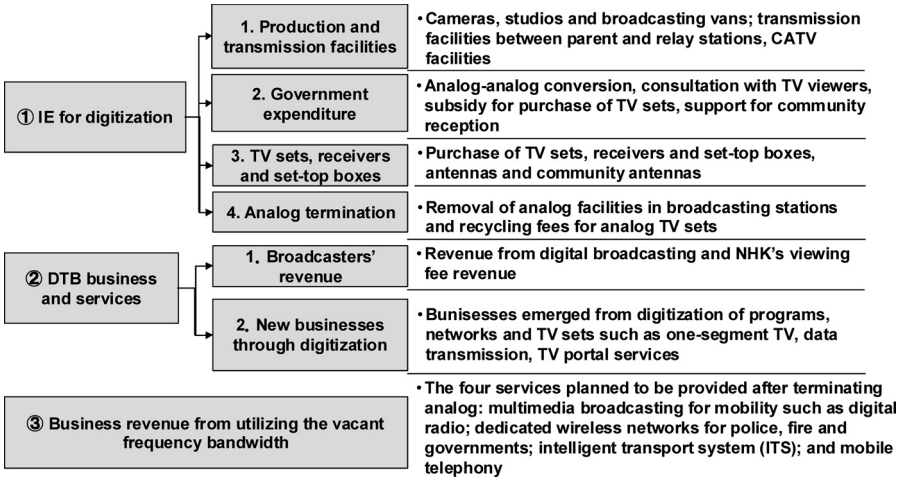


Figure 3-3. Items Included in Direct Effects



are defined as the total of

i) ordinary investment and expenditure continued from analog broadcasting
ii) revenue from the utilization of vacant frequency bandwidth
iii) investment and expenditure for digitization, and
iv) ordinary investment and expenditure induced by digitization.

The net direct effects are composed of components ii) to iv). Figure 3-2 visualizes the two concepts of direct effects. In Figure 3-3, detailed services and businesses to be included in the direct effects are listed.

Detailed descriptions for each item are given in the Group's final report (MIC, 2009).

(3) Time Horizon for Measuring Economic Effects

The period for measuring direct effects was set to twenty years from the amendment of the Radio Act in July 2001, when the digitization of terrestrial digital broadcasting was decided, till July 2021, ten years after analog broadcasting is terminated. It is assumed that broadcasters would start making capital investments immediately after

the decision to digitize and that it will take time for the emergence of new services and businesses utilizing vacant frequencies after digitization.

(4) Other Assumptions

In the estimation, any changes in the economic and living environments are not considered, such as unexpected economic recession and increases or decreases in population. Thus, the impact of the economic downturn in 2008 is not included in the estimation. The calculation of economic effects is based on the "Input–output Table, 2005 Edition", the latest version available in 2009, published by the Ministry of Internal Affairs and Communications.

4. Estimated Economic Effects

(1) Direct Effects

The results of estimating economic effects (direct effects) are given in Figure 4-1. The total gross direct effect during the planning horizon, that is, in the twenty years from the decision to digitize till the 10th year after analog termination, amounts to JPY 101 trillion, and the corresponding total net direct effect comes to JPY27.8 trillion. Among others, the total net direct benefit is regarded as the net economic value created by digitizing terrestrial broadcasting. The gross direct effect during the first ten years from the decision to digitize till the termination of analog (from July 2001 to July 2011) is estimated to be JPY29.3 trillion, of which the net direct effect is JPY10.3 trillion. The gross direct effect in the next ten years from the analog termination (from July 2001 to July 2010) is estimated to be JPY71.7 trillion, of which the net direct effect is JPY17.5 trillion.

It should be noted that the revenue from utilizing vacant frequency bandwidth shows the highest net economic effect, reaching JPY10.8 trillion. This means that the greatest economic effect (direct effect) derived from the transition to terrestrial digital broadcasting will be brought about by the services and businesses that utilize the

Figure 4-1. Estimated Direct Economic Effects

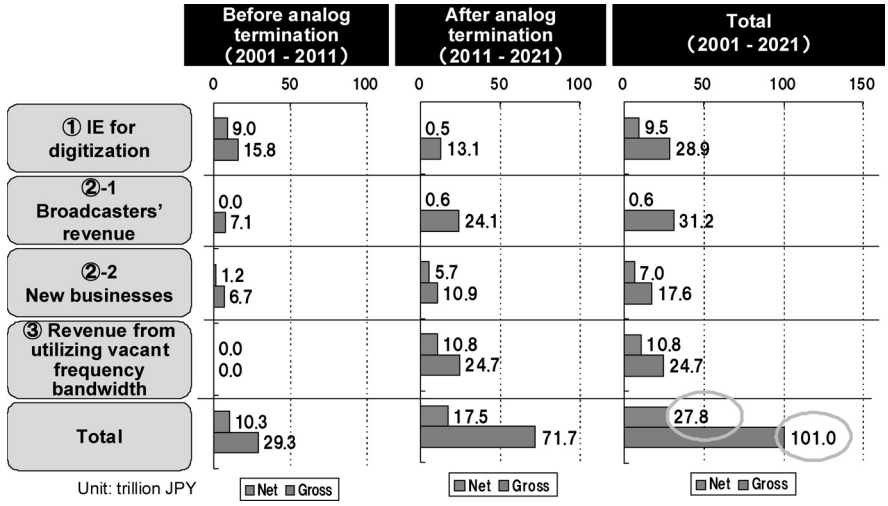


Figure 4-2. Inter-Annual Prediction of the Revenue from Utilizing Vacant Frequency Bandwidth

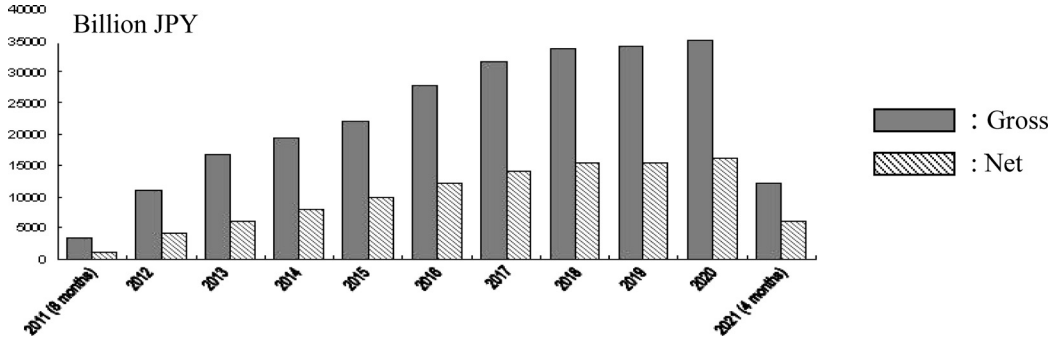


Table 4-1. Spillover Effects

Production inducement	Before analog termination (2001–2011)		After analog termaination (2011–2021)		Total (2001–2021)	
	Net	Gross	Net	Gross	Net	Gross
Direct effects	10.3	29.3	17.5	71.7	27.8	101.0
Primary spillover effects	11.9	31.3	16.5	70.0	28.4	101.3
Secondary spillover effects	4.8	13.6	8.2	33.2	13.0	46.7
Total economic effects	27.0	74.1	42.2	174.9	69.2	249.0
Production inducement coefficient	2.6	2.5	2.4	2.4	2.5	2.5

post-analog vacant broadcasting frequencies. Figure 4-2 shows the inter-annual prediction of the revenue from vacant frequencies. It will reach JPY3.5 trillion (gross) and JPY 1.6 trillion (net) in 2020.

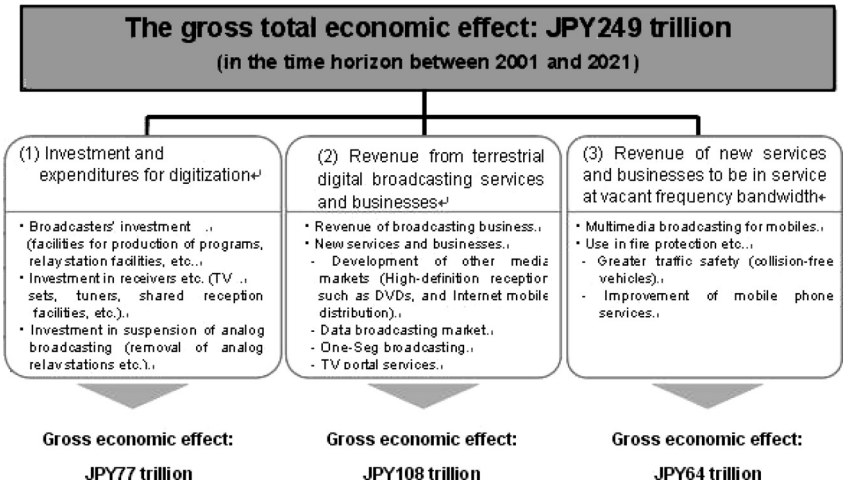
(2) Spillover and Total Effects

Table 4-1 shows the estimated economic spillover effects derived from the direct effects as identified in the previous subsection. The gross spillover effect and the gross total economic effect arising from the direct effects in the first ten years between the decision to digitize terrestrial broadcasting and the termination of analog (July 2001 to July 2011) are JPY44.9) trillion and JPY74.1 trillion, respectively. On the other hand, the respective net values of these effects are JPY16.7 trillion and JPY27.0 trillion.

In the same way, the gross spillover effect and the gross total economic effect arising from the direct effects in the second ten years after analog termination (July 2011 to July 2021) are JPY103.2 trillion and JPY174.9 trillion, respectively. The respective net values of these are JPY24.7 trillion and JPY42.2 trillion. Consequently, the gross and net total effects in the time horizon amount to JPY249.0 trillion and JPY 69.2 trillion, respectively.

The ratio of the total effect to the direct effect is called the production inducement coefficient, or simply the “multiplier”, which defines how large an economic effect is created by direct expenditure and investment. The multipliers in the estimation range

Figure 4-3. Disaggregated Gross Total Economic Effect



from 2.4 to 2.6. Compared with other large-scale public projects, the value seems relatively large but still within a plausible range.

The distribution of the gross economic effects over the items producing direct effects is shown in Figure 4-3. The gross effect is around JPY77 trillion for (1) investment and expenditures for digitization, JPY108 trillion for (2) revenue from terrestrial digital broadcasting services and businesses, and JPY64 trillion for (3) revenue from new services and businesses utilizing vacant frequencies. The items that include new businesses and services such as (2) and (3) are expected to have a higher and continuous effect.

The scale of economic effects can be measured in the number of employees theoretically induced by the created value (*i.e.*, the economic effects of digitization). This alternative measure is often adopted when emphasizing the scale of economic effects. In the first ten years, the average induced employment is around 127,000 persons per year, while in the second ten years it is around 172,000 persons per year. However, these values merely show how many people can be theoretically sustained by the effect and have no further meaning.

(3) Evaluation

The MIC conducted a similar estimation in 1998 when the digitization of terrestrial broadcasting was under discussion (MIC, 1998). As is often the case with the evaluation of public projects, high expectations might inflate the estimation. The estimated total economic effect was JPY212 trillion for ten years. Compared with the GDP of Japan, which was JPY502 trillion (nominal) in 2005 (MIC, Statistics Bureau, 2010), the scale of the broadcasting industry, which was JPY3.5 trillion in 2009 (MIC, 2010) and the scale of broadcasting equipment manufacturers, which was JPY1.1 trillion in 2008 (ARIB, 2009), the annual economic effect of JPY21 trillion seems to be an overestimate.

In our estimation, the annual net economic effect derived from the net direct effect of JPY1.4 trillion and the annual gross economic effect derived from the gross direct effect of JPY5.0 trillion are approximately JPY3.5 trillion and JPY12.5 trillion, respec-

tively. Since the economic scale of the telecommunications and media industries excluding telecommunications service providers was around JPY25.1 trillion in 2008 (ARIB, 2009), these values seem to be more accurate than those in the previous estimation.

The multiplier calculated in the previous study conducted in 1998 was 2.8. This may also be an overestimate. The multiplier in this study seems still a little high. This is because, in this study, the direct effect arises in those industries that have higher spillover effects such as electronic and telecommunications appliances, construction and telecommunications services. In an input–output analysis, the scale of spillover effects of an industry can be identified by the corresponding column-sum of the inverse input-output matrix. In the input-output table for 2005, these industry sectors have relatively higher column-sums.

5. Conclusion

There are pros and cons of the Japanese government's method of digitizing terrestrial broadcasting. Many consumers and businesses feel that this nationwide project places a large burden on them. For consumers especially, they have to purchase digital TV sets and replace antennas at their own expense. In Japan, in order to emphasize the advantages of digital TV such as high-definition images and better sound quality, the replacement of TV sets is being recommended rather than using digital-analog conversion set-top boxes. The government has an additional objective of boosting the weak economy by stimulating personal consumption and business investment. This estimation was conducted in accordance with government policies to show updated estimates of the effect of digitization.

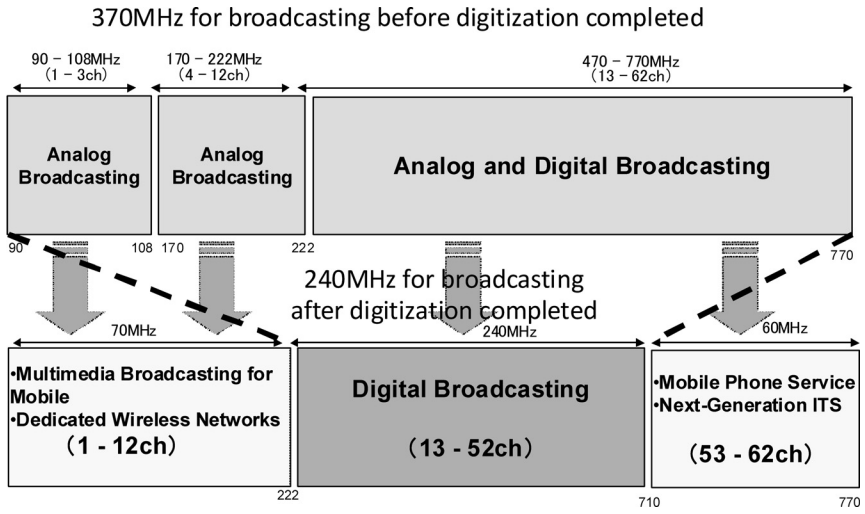
As shown in the previous subsection, MIC apparently overestimated the effect of digitization in 1998. This is often the case with evaluations of public projects. In addition to justifying such projects, the expectations of concerned parties may lead to estimations tailored to their own purposes. In an input–output analysis, if the estimated direct effect is inflated, the resulting spillover effect is also inflated even if the intermediate process is appropriate.

This estimation is no exception, and is probably influenced by the desire to justify digitization. Although the estimation was in principle conducted to support the digitization of terrestrial broadcasting, the Group strived to keep the estimation neutral and independent of any other pressures.

To ensure the accuracy of this estimation, special attention was paid to i) show assumptions, preconditions and the process of estimation used in the calculation in order to ensure follow-up; ii) avoid double-counting and leakage; iii) explicitly show limitations and issues; and iv) avoid overestimation.

The result suggested that the gross total economic effect, which covered all possible economic impacts across all sectors in Japan, amounted to JPY240 trillion in the twenty years between 2001 and 2021. The pure effect of digitization, which arose from net investment in and expenditure on digitization, came to JPY69.2 trillion in the same period. On an annual basis, the estimated economic effects are approximately half of those in the former estimation conducted in 1998. The estimated values seem to be more accurate with reference to other economic indicators.

Figure 5-1. Utilization of Frequency Bandwidth before and after Digitization



Source: http://www.digisuppo.jp/index.php/watch/briefing/4/

Whether the estimated values come true or not depends on the businesses and services that emerge and utilize the vacant frequency bandwidth after digitization has been completed. As shown in Figure 5-1, four types of business are expected to start after digitization: multimedia broadcasting for mobile, dedicated wireless networks, mobile phone service and next-generation ITS. To realize the expected economic effects, it is undoubtedly more important to encourage new businesses than to focus on the accuracy of the estimation.

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