Comparison of the “Real Addition to Stock" and "Net Addition to Stock” for Railways in Japan

Nagoya University, JSCE Member, Cherry Myo LWIN
Nagoya University, JSCE Member, Ji HAN, Hiroaki SHIRAKAWA, Hiroki TANIKAWA

1. Introduction

Real Addition to Stock (Gross Addition to Stock) means the amount of new materials, which are added to economic stock each year. Net additions to stock (NAS), which is an indicator, based on economy-wide material flow accounting and analysis is a measure of the physical growth rate of an economy. It could be calculated using two methods: The indirect method of calculation is a simple difference between all input and output flows, whereas the direct method involves measuring the amounts of materials added to particular categories of physical stock and the amounts of waste flows from these stocks. The study will focus on direct calculation method for finding NAS for railways in Japan and will evaluate the compared results of real addition to stock and NAS for Japan Railways.

2. Objectives

This study had one leading objective: to make available direct NAS, which could later be used for predicting future waste flows data for railways in Japan. Two additional objectives emerged from the first: (1) To develop a method for direct NAS calculation from data availability and (2) To make a clear difference between NAS and real addition to stock in an economy.

3. Methodology

The research is done for 5-yearly study period from 1970 to 1990. Firstly, the author used the material stock of railways that was done in her another research paper of which methodology is shown in Fig.1. Then, the real addition to stock and net addition to stock are calculated and compared the results by using three scenarios in the following sections.

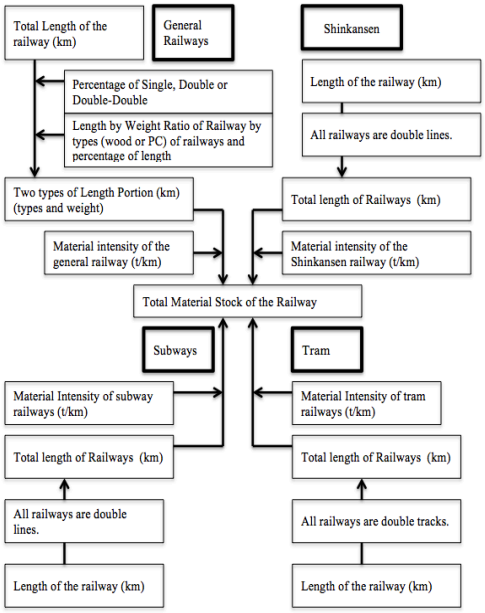

Fig.1 Calculation of Material Stock of Railways

3.1 Calculation Real Addition to Stock for Railways

To be more clearly about real addition to stock position in EW-MFA, it could be depicted as shown in Fig.2. Some amount of stock became stock loss in the next study year and so, gross addition has to be done not only to upgrade infrastructure but also to compensate stock loss to catch the necessity of infrastructure demand for that year. The following equation is used to calculate the Real addition to stock for Railway for the respective years. There is no data available for Shinkansen, Tram and subway regarding with their abolishment during the study period (1965-1990).

$GAS_{A+5} = AW_{A+5} + MS_{A+5} - MS_{A}$ ……..**Eq.1**

Where: GAS_{A+5} = Gross Addition to Stock at (A+5) year

AW_{A+5} = Abolished waste at (A+5) Year

MS_{A+5} = Total Material Stock at (A+5) Year

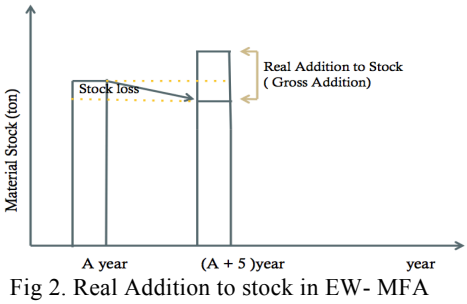

Fig 2. Real Addition to stock in EW- MFA

MS_A = Total Material Stock at (A) Year

Nevertheless, abolishment was done in some specific years for JR and private railways and so, abolishment waste is calculated according to their respective railway type as shown in Fig.1. The calculated result of real addition to stock is shown in Fig.3.

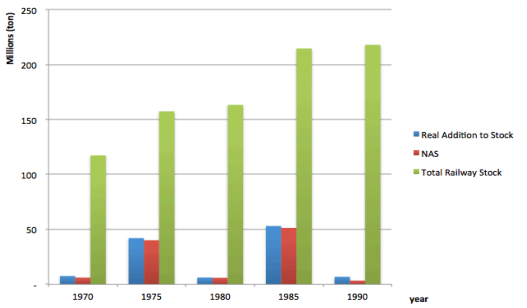

Fig.3 Real Addition to Gross, NAS and Total Railway Stock with 2nd Scenario

3.2 Calculation NAS by using Direct Method

This research estimated the NAS of Japan Railways by separately estimating the flows that make up the net change (i.e., gross additions and removals from stocks) as shown in the equation 2.

$NAS_A = GAS_A – (TDW_A - DRW_A)$ **Eq.2**

Where: NAS_A = Net Addition to Stock at A year

GAS_A = Gross Addition to material stock at A year

TDW_A = Total demolition waste from decommissioned or reconstructed railways at A year

DRW_A = Demolition waste from decommissioned or reconstructed railways which are recycled and used again for construction or other purposes at A year

Table 1 Total Stock, GAS and NAS for Japan Railways

Year	1970	1975	1980	1985	1990
Total Stock (ton)	117,326,222	157,402,936	163,326,867	214,615,915	217,924,119
GAS (ton)	7,474,539	42,029,052	6,134,063	53,029,886	6,799,974
NAS 2nd Scenario (ton)	6,086,850	40,076,714	5,923,930	51,289,048	3,308,204
NAS 3rd Scenario (ton)	6,054,490	39,630,523	4,786,658	50,857,670	2,642,220

1st Scenario (all recycle**):** The first assumption is that NAS and Real addition to stock for railways will be the same only if all material is recycled and if all the recycled material is again used for construction of railways and not for other purposes (e.g. construction of housing). Nevertheless, this scenario is under much uncertainty due to the concern of the quality of recycled material.

2nd Scenario (no recycle**):** The NAS and real addition to stock will be different if there is no recycle, and so, there will be no subtracting amount of recycles for using the above equation (2). The result could be shown as in figure 3. If the recycle data for railway is available for the period of 1970 to 1990, the exact answer will be between the results of two strong scenarios (1) and (2).

3rd Scenario (all new extension distance of railway was built by recycled materials from old demolished railways or other demolished infrastructure**):** All estimated results are shown in Table 1. There is more different amount between real addition to stock and net addition to stock between 2nd and 3rd scenarios.

As conclusion to above three scenarios, the real addition and gross addition could not be the same amount practically. By evaluation material stock accumulation case for Railways in Japan from 1970 to 1990 (20 years study period), the NAS was about 3 million ton in 1990 but real addition to stock was about 6 million while the total material stock of the railway is 217 million ton.

5. Conclusion

This research is intended to show that calculation of NAS using direct method is possible in Japan with respect to data ability and how the NAS and real addition to stock could be different. It is said that a sustainable economy would be characterized by zero NAS, i.e. flow equilibrium between inputs and outputs of the material flow balance. Nevertheless, effective and efficient usage of existing infrastructure to a certain extent but producing more economic outcomes is a more practical way for Japan to go to sustainable material consumption economy.

References: Eurostat. 2001.Economy-wide material flow accounts and derived indicators: A methodological guide. Luxembour, Eurostat.