

Special Feature 5

The future of civil engineering in Japan: After *mottainai* happens, it's too late!

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Japan's current issues and near future

Japan's status as an economic superpower is an undisputed fact. Accordingly, the Japanese earn among the world's highest wages. Nonetheless, in comparison to other advanced nations, the Japanese standard of living is not correspondingly high. The reason is clear based on a comparison of lifetime income and expense structures. Figure 1 is a diagram of per-household lifetime income and expenses, and the same trends apply to per-household lifetime income and expenses in society as a whole.

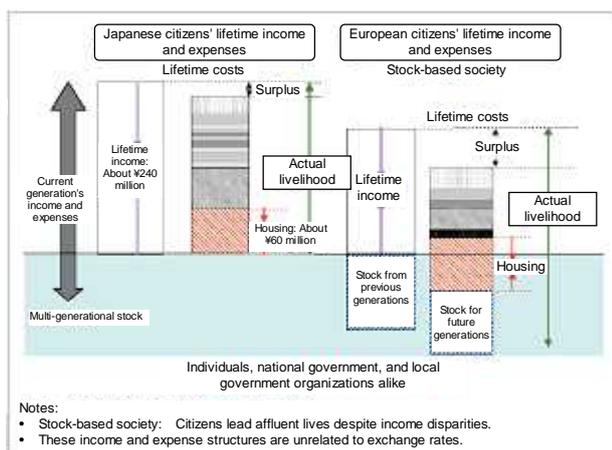


Fig. 1. Stock-based society and citizens' livelihoods (lifetime income and expense comparison)

In the course of economic growth, it appears that the Japanese have one-sidedly emphasized flow and the income side regarding the labor movement and formation of the industrial economic structure. There has been little interest in pursuing prosperity by controlling lifetime income and expenses and

accumulating a stock of capital and resources. As a result, we have lost the chance to achieve true prosperity. Moreover, in the wave of globalization that began in the 1990s, because of our high wages (high costs), the overseas relocation of industry has led to job loss, the hollowing out of domestic industry, ultra high-density labor, and economic disparities. For a fundamental resolution of many problems facing Japan today, it is essential to transform Japan into a stock-based society that can lead a comfortable lifestyle even with a lower level of flow, by means of cross-generational efforts to accumulate a stock of long-lived assets. People can no longer prosper by means of this circulation-based (stockless) economic system, which is oriented toward expanding consumption, although it was a powerful force in the course of postwar reconstruction.

Many have expressed concern that Japan's declining birth rate and aging population may have a detrimental effect on its economic vitality. However, economic vitality can be maintained through the accumulation of capital. In terms of income and expenses for biological resources such as food, Japan's sustainable population capacity is said to be 70 million persons. It may not be necessary to take such a pessimistic view of the declining birth rate. If metals, cement, and other non-biological resources are accumulated as a stock of long-lived assets that will be used by multiple generations, it will save on the energy consumption (and carbon dioxide emissions) that would be needed to produce that capital again.

If we begin now to build up long-lived assets and production infrastructure, including biological resources and energy, we can move away from dependence on foreign resources and change Japan into a resource-independent society with its own stock of resources. As shown in Fig. 2, changing Japan into a stock-based society will simultaneously resolve a wide range of problems in areas such as standards of living, the economy, resources, and the environment.

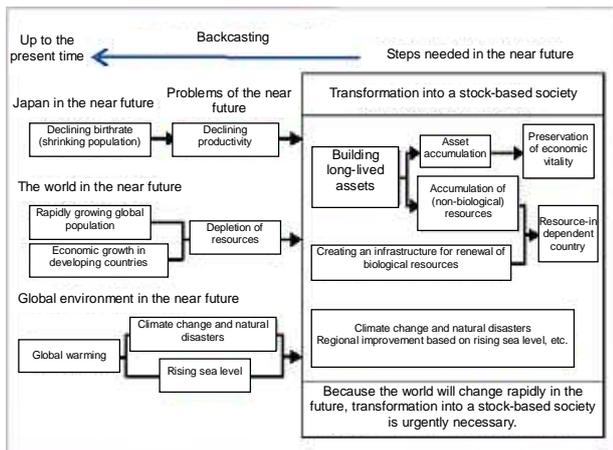


Fig. 2. Transformation into a stock-based society

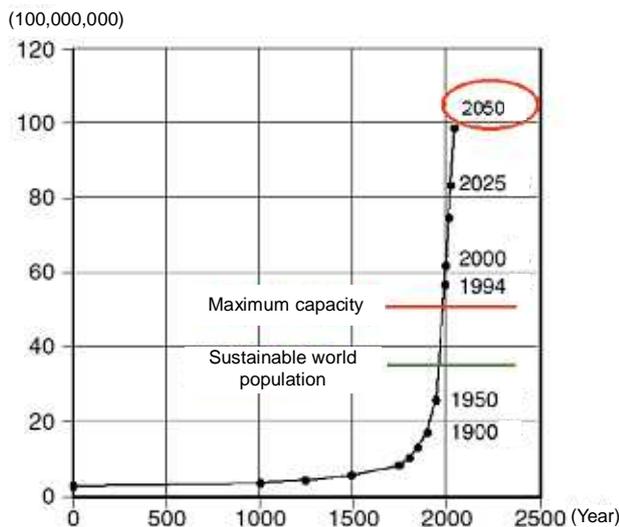


Fig. 3. Total world population from 0 C.E. to 2050 (Source: *The World Through Statistics: Outlook on the 21st Century* [in Japanese])

Unlike Japan with its declining birth rate, the world population will continue to grow exponentially in the future, as shown in Fig. 3. By

2050, the global population will be greater than 9 billion. Meanwhile, if economic growth continues in developing countries, all resources will be rapidly depleted. There is concern that the current international competition to obtain resources will soon change into conflict and contention over resources. Japan needs to transform itself into a resource-independent society before that happens. Food is one type of resource; and for Japan, which has an extremely low ratio of food self-sufficiency compared to other advanced nations, it is essential to greatly increase the food self-sufficiency ratio for the sake of national security.

All of the social indices are now changing exponentially, not only the world's population. In an exponentially changing society, dramatic changes may occur before they are predicted or foreseen. Therefore, if we wait until the changes are noticed before responding, it may be too late. The later the response, the greater the reaction (damage) for our society and environment. To avoid this, it is necessary to forecast the near future situation and to begin taking the necessary steps now on the basis of those predictions. This type of policy development is called "backcasting" (Fig. 2). Unfortunately, the current emphasis in Japan is on measures for problems which have already become apparent, and this type of policymaking is still unfamiliar. The reason may be related to the Japanese national character.

Role of civil engineering in building a stock-based society

A 200-year housing vision policy has already been proposed in the field of building construction. However, for the infrastructure of a stock-based society, a 200-year vision is also needed in the field of civil engineering in order to increase the lifespan of the country's infrastructure of all kinds, in

addition to buildings.

Modern society has achieved remarkable development through the specialization of individual fields of technology and societal functions. However, when this specialization is taken too far, society becomes increasingly complex and mutual understanding among the individual fields is impossible, so that optimization is only pursued in limited areas. These partial steps for optimization do not necessarily add up to overall optimization. Examples of partial optimization in Japan include cityscapes that look cobbled together, and road construction projects that involve repeated digging up and filling in. To approach the ideal goals, it is necessary to take an integrated view of fields that have become separated through specialization, including roads, electric power, gas, water supply, and sewer service, as well as civil engineering, building construction, city planning, and inter-city linking functions. This is the necessary approach for long-lived assets that should be passed on to future generations after 50 or 100 years.

Beginning with the initial design, it is important to distinguish clearly between the skeleton or durable building frame, whose performance and value is not affected by technological progress and changing tastes, and the buffer portion, which is designed with flexibility so that its functions can be changed or it can be switched to a different purpose in response to changing times in the future, as in the "skeleton/infill" approach for building construction. The functional design of the buffer portion is based on the assumption of change, thereby absorbing the impact of future changes that cannot be foreseen at present, and securing the building's potential with regard to future progress.

Allocation with regard to the accumulation of long-lived assets of this nature (the positioning of safety and peace of mind) is determined on the basis

of factors such as hazard maps, including global environmental predictions, and the geological and meteorological conditions of the region. This should not reflect the interests, land rights, or values of the present generation. First, 50-year and 100-year goals should be formulated for community development and regional development. These are regional goals from backcasting based on predictions of global trends, world population, and other factors of those future times, considering the potential of the region's natural resources including its farming, forestry, and fishery industries, according to the concept of local production for local consumption. For near-future regional design, determining regional resource potential is also important for the sake of utilizing natural energies, which will become indispensable in the future. Among projects to be commenced from now on, only those that meet the design of these goals should be built with a long-lived skeleton portion. Otherwise, the result could be significant *mottainai* that is passed on to future generations. When cross-generational *mottainai* has already occurred, it's too late. The resource security and environmental security of future generations of Japanese citizens will depend on the policies adopted by our generation today.

Scenario of transformation into a stock-based society

As shown by Fig. 4, the national government needs to implement policy measures to induce the development of a stock-based society by enacting [1] laws for building a next-generation society by integrating existing individual laws (e.g., Year 2050 Planning Law); [2] laws on building multi-generational Japanese assets with Japanese capital; and [3] laws on building a resource-independent infrastructure for the sake of

resource security for future generations. Next, each region from Hokkaido to Okinawa needs to formulate a regional stock-based society design for year 2050 goals reflecting its respective climate, natural features, natural resources, and regional resource potential. This will be implemented by the region's industries, academic institutions, government organizations, and private citizens in efforts aimed at regional priority themes such as affluence, disaster prevention and safety, beauty, history, and culture. Each region will then carry out its own transformation process by 2050 with regard to each theme included in the goals, such as building a stock of long-lived assets and achieving resource independence. Last, transformation into a stock-based society will be pursued at the regional level by establishing the organizations and specialized fields needed to realize those goals, beginning with

the most feasible portions.

Since the initial investment is greater in the case of long-lived assets, it is important that the design for the year 2050 goals should involve truly attractive investment destinations for the people of Japan.

As of 2006, Japan's total assets are approximately ¥8,500 trillion, of which financial assets are about ¥6,000 trillion and physical assets are about ¥2,500 trillion. Japan's international balance of income and expenditures is ¥21 trillion, of which the trade surplus is ¥7 trillion and the financial investment surplus is ¥14 trillion. Japan's money management is operating smoothly, but it is being used to create overseas jobs and overseas assets. Part of this Japanese capital will be invested in building physical assets in Japan. There are many

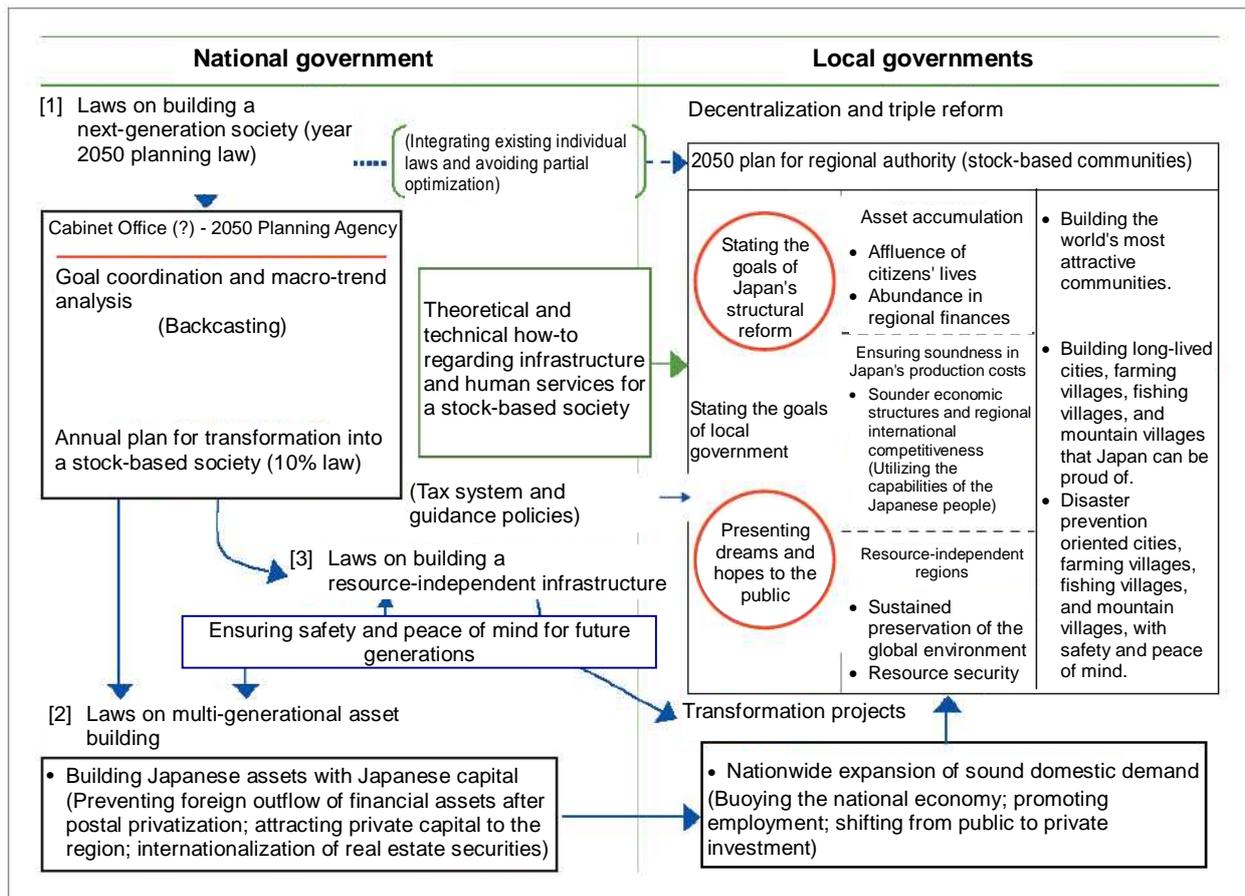


Fig. 4. Policy measures for a stock-based society: A call to citizens

ways to accomplish this, including real estate securitization and mutual funds. People will invest with confidence in long-lived assets which will not decline in value over time. If the return is higher than the rate of interest paid on bank deposits, this will cover the difference for a greater initial investment. The people of each region will invest in their own future, and there will also be investment from overseas. Projects to build capital for future generations through private investment, instead of public investment as in the past, will be a sound way to increase internal demand while creating jobs throughout Japan.

Achieving this scenario is a common goal that cuts across the boundaries of national and local governments, all government offices, and all areas of industry. Backcasting policy measures by the legislature are needed, based on strong leadership, in order to obtain comprehensive optimization instead of partial optimization. In the field of civil engineering as well, there is a need for passion and enthusiasm in order to form a comprehensive theory for all related functional areas and put it into practice. We who live in the twenty-first century are the first generation in the history of humanity who will come to the limits of the earth's resources. The survival of our children's and grandchildren's generations will depend on our eliminating cross-generational *mottainai*. As the world is undergoing rapid changes, we need to begin working on transformation into a stock-based society as rapidly as possible. The field of civil engineering bears an important responsibility in this regard. We need to recognize our role and speak out confidently to the rest of society.