Study on the Effects of Measures to Reduce Timber Production and Distribution Costs Based on a Timber Production and Distribution Flow Model

Summary

In order to establish a sustainable woody biomass system, it is important to expand the use of forest resources within the region, and conceivable measures for this end include ICT-supported operations, mechanization of operations, and smarter distribution. The effects of implementing the measures were analyzed using a flow model developed by means of system dynamics. As a result, the following were found: ICT technology may reduce forest survey costs in the surveys of no less than 40 hectares; introduction of mechanization in production may improve labor productivity by nearly 1.4 times ; introduction of smarter distribution may have an economic effect 0.5 to 1 times greater than the introduction of mechanization. It is probable that these measures may make foresters become economically independent, and eventually encourage the expansion of the use and stable supply of forest biomass resources.

Proposals for Policy Development

- The forest administration in Japan has adopted a system in which the right to own mountain forests is protected, but it is necessary to establish a system, like that in Europe, in which people are accountable for their rights[1]. It is still important to clarify the structure of forest ownership and to take measures to promote the consolidation of operations.
- Consolidation of operations (and the introduction of large machinery to improve production efficiency) and smarter distribution based on matching supply and demand are both equally important as measures to reduce timber production and distribution costs for foresters. In particular, it is necessary to develop and spread a supply-demand matching system which is inexpensive and easy to use even for elderly people, in order to promote smarter distribution.

1. Timber production and distribution flow model

The system dynamics software Vensim was used to graphically represent forestry processes of survey, production (logging), timber distribution, etc. (Fig. 1). The equations and parameters encompassed in this flow diagram can be set according to local conditions, and effects of individual factors on the foresters' annual profits can be analyzed.

2. Creation of individual process models

The following flow model was established to quantitatively evaluate the production, distribution, and other processes discussed in this proposal report among the wood production and distribution processes described in Section 1. (1) Timber production process: Model adopting mechanization needed for production; (2) Timber distribution process: Model adopting "Smarter distribution" to match timber supply and demand, and to allow direct delivery to sawmill by bypassing timber market for part of distribution. Intermediary's expenses, timber market service charges, and other costs can be suppressed.

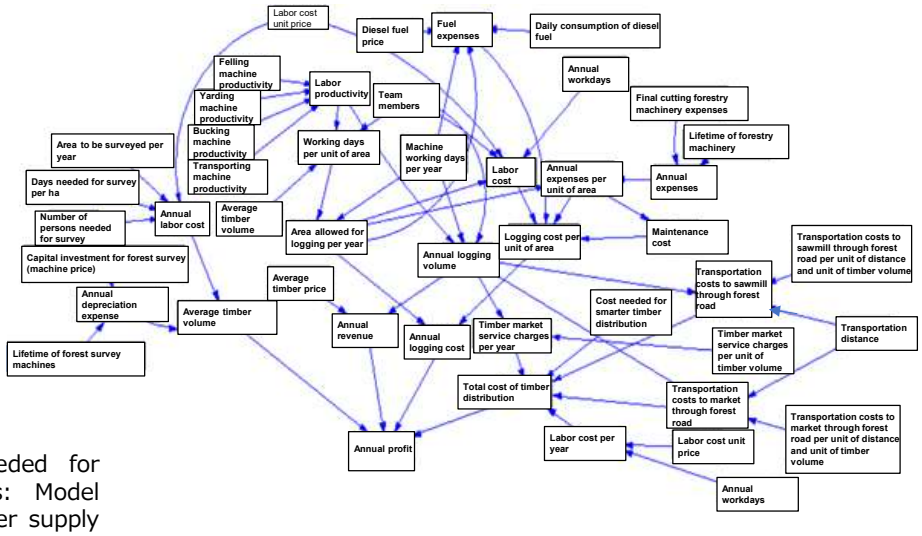

Fig. 1 Overview of timber production and distribution flow model

3. Case study

Using the models created above in paragraph 2, a case study was conducted to verify the effects of individual models by applying the models to the Chusei Forestry Cooperative (an example case of Excellent Tackling Efforts selected by the Forestry Agency), which controls the whole area of Tsu City, Mie Prefecture. Devices for mechanization are given in Table 1 [2], and three scenarios were selected for the "Smarter distribution": current distribution (no direct delivery to sawmill), 60 percent direct delivery, and full direct delivery. Results of the annual income and expenditure simulation per logging volume of 1 m^3 are shown in Fig. 2. It was shown that the introduction of mechanization resulted in a nearly 1.4 times improvement of labor productivity (from 5 to 7.06 m^3/ man-day), and the introduction of smarter distribution resulted in half to the same comparable effects of cost reduction compared to the introduction of mechanization.

Table 1 Devices used in the forestry mechanization scenarios

	Felling process	Yarding process	Bucking process	Carrying out process
Before mechanization	Chainsaw	No mechanization		
Mechanization 1	Chainsaw	No mechanization	Forestry processor	Forestry forwarder
Mechanization 2		Grapple skidder		

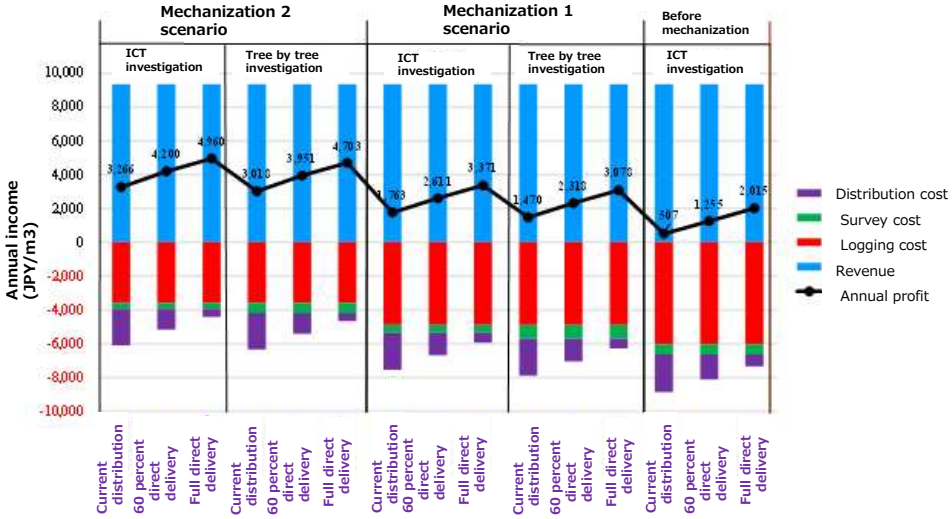

Fig. 2 Results of simulation per logging volume of 1 m^3

[1] Hiroshi ISHII, "Development and features of forest policy in France, Germany, and Japan," Forestry Economic Research Vol. 39, No. 1, pp. 3-12, 2003.

[2] Forestry Agency web site, "FY2018 Introduction of Forestry Mechanization Promotion Projects" https://www.rinya.maff.go.jp/j/kaihatu/kikai/attach/pdf/30jirei-1.pdf (Day of access: Mar. 30, 2021)