

Chapter 218

A Game Analysis on Stakeholder Theory in Forestry Industry

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Abstract This paper analyzed the behavioral strategies based on forestry stakeholder perceptions, different perspectives highlight the importance of decision-making, because the goals of forestry stakeholder are inconsistent, the government is the ecology benefit primarily, the peasant household take oneself home economics benefit primarily, the place by the place economic efficiency primarily, which will cause the game among them, in order to maximize their own interests, they will use all kinds of strategy and action to achieve their goals. The result indicates that cooperative's participation in forestry is a better way.

Keywords Stakeholder theory • Game • Forestry • Payoff

218.1 Introduction

Since the United Nations Conference on Environment and Development (UNCED) (1992), the forestry development has become the focus of attention. The global environment is being confronted with serious problems as a result of rapid industrialization, population explosion and unsustainable resource exploitation. While forests are essential parts of the planetary ecosystem, they are among the natural

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habitats that are exploited most as a result of human activities and industrialization. To realize forestry sustainable development, government departments will turn their attention to the green industries of forestry [1–3].

Forestry development involves with government, forest companies and local farmers, who have different objectives, act on the same system or share the same resources. Interests of the stakeholder will inevitably give rise to different changes of game strategies; game theory provides a mathematical process for selecting an optimal strategy. So, it defines the stakeholders of forestry, researches how their stake motivation and restriction affects their action based on stakeholders theory and game theory, we should deeply explore and analyze the main institutional factors to innovate management mode of forestry project and improve the efficiency of forest management [4, 5].

218.2 Forestry Stakeholder

Stakeholder theory has been studied as early as Dodd of Harvard Law School in 1932, but the theory is developed step by step until the 1960s, and then was used in public administration and policy analysis activities. Currently, stakeholder theory is widely used in forestry. On one hand, participation is seen as an important aspect of sustainable forest management (SFM); on the other hand, forest policy reforms are happening globally to increase participation of local stakeholders in forest management decision making [6].

218.2.1 Government

Government is policy-maker, and the civil servant is policy performer and the strong interest groups, under the domination of advantageous interest group, to redefine social interest relations and power relations in order to maximize their interests, the primarily presented between the central and local forestry department in the forestry industry. Driven by the motive of local profits, forestry department will necessarily strive for more preferential policies to seek the optimal allocation of forest resources and the maximization of local forestry interests, which reflects the interests of the game between them. Since financial support and favorable policies are limited, every department and the central government formed benefit relations and benefit gaming [7].

218.2.2 Agro-Forestry

Forest farmers are the main subject of the development of forestry, who are participants of ecological environmental construction and forestry industrial development. They are weak interest groups; their interests are affected with the policy. In forestry, particularly in the developing world, this often applies to indigenous people or forest communities living in or near forest concession area. To express their interest demands fully, it is necessary to strengthen the power of interest groups and encourage moderate concentration of woodland usufruct, resulting in the large household of forestry, which expedites the interests' representatives of the forest farmers [8].

218.3 Game Analyses among the Governments, Forestry Firms and Farmers

218.3.1 The Game of the Local Forestry Departments

In order to maximize their interests, the forestry departments favor in bargaining and constitute benefit gaming in the horizontal forestry departments. It is assumed that: (1) Only two forestry department A and B, they negotiate to distribute the government budget, we set for a , both sides want to enable their gain, and then conduct intense bargaining; (2) Given two days of negotiations, if A puts forward a scheme and B agree in the first day, then they allocate by this way, otherwise B can put forward another in the second day, if the agreement is not reached within two days, the higher authorities will recover the money, A and B will discount their future income individually according to the discount factor of x and z , $0 < x$, $z < 1$. In addition, we add a simplified condition, if they cannot deny the other's proposal to get more revenue; the player will accept the other's proposals. If A's distribution scheme is (a_2, b_2) in the first day, $(a_2$ and b_2 is their respective quotas, the later as similar as this), B rejects the plan, his proposal is (a_1, b_1) in the next day, if A rejected, the higher authorities will withdraw this money. The game tree is seen in Fig. 218.1.

By using backward induction, we can find out the perfect equilibrium of sub game. In the fully dynamic game, the first-player is the rational economic agent who selects strategy in the front stage must take into account of the second-player at a later stage. Therefore, only in the final stage in the game, the players can make a judicious choice. When the game strategy is confirmed in the later stages, the previous player will be relatively easy to choose a strategy. Considering the circumstances that A faced in the second day, no matter what B's proposal is, if A disagree, then his earning is 0, so only when B's proposal $a_1 \geq 0$, A will accept it. Because B is a rational player, he is bound to make the other side get the

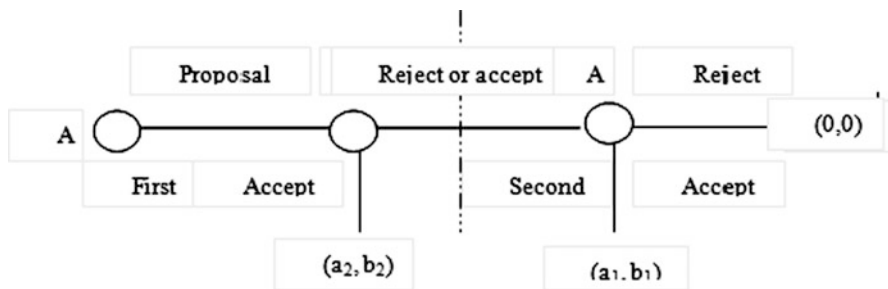


Fig. 218.1 The game tree of allocating fund

least amount of money, so his proposal is $(a_1, b_1) = (a, 0)$. When A see B's choice $(a, 0)$, he'll has to accept B's proposal. Of course, A will give a careful attention to make sure B's money in tomorrow only equal to today's y . So A will propose a scheme, which is $(a_2, b_2) = (a-z, z)$. Now we analyze A's proposal at the beginning: A is very clear if his proposal was rejected in the first day, B's proposal will be $(a, 0)$ in the next day and he have to receive passively. Otherwise the money will be taken backed by higher authorities. In order to maximize their incomes, A can only put forward a good plan to make sure that B's get in the second day cannot less than the income of A's plan, then the optimal solution is $(a_2, b_2) = (a-z, z)$. So, the perfect equilibrium is: A propose $(a-z, z)$, B will accept it. The game will end on the first day. Similarly, if B is the first, the perfect equilibrium of sub-game is $(x, a-x)$.

218.3.2 The Game Between Forestry Enterprise and the Farmers

For simplicity we assume that the forestry enterprises and farmers make a game in incomplete information, the enterprise has an advantage of information, so enterprise has two kinds of types, while farmers has a disadvantage, we assume that it has only one type. Farmers do not know the kind of enterprise, but the farmers know the probability type 1 is 30 %, the probability type 2 is 70 %, both parties can choose the pay and the strategy as this following Table 218.1.

In this game, no matter farmers take efforts or not, the enterprise of type 1 will choose effort, that is, type 1 has only one dominant strategy "effort". The enterprise of type 2 has also a dominant strategy "hard". But farmers don't know enterprises' type in this asymmetric information situation, so farmers can only judge their income according to the probability. If farmers choose work hard and enterprises' type is 1, then the enterprise will choose "effort", so farmers' gain is 4, while if enterprises' type is 2, farmers' gain is 2, so if the farmers choice "effort", their expected return is $4*30\% + 2*70\% = 2.6$.

Table 218.1 Income matrix of farmers and enterprises

		Enterprises			
		Type2		Type 1	
Farmers	Effort	(4, 5)	(2, 1)	(2, 5)	(3, 1)
	Inexertio	(2, 3)	(0, 0)	(1, 3)	(1, 1)

Table 218.2 The game between forestry enterprise and the government

Government			
Enterprises	Increasing investment	$(\delta Y_2/\delta K_2 + \delta Y_1/\delta K_1, \delta Y_1/\delta K_1 + \delta Y_2/\delta K_2)$	$(\delta Y_2/\delta K_2, \delta Y_1/\delta K_1)$
	No increasing investment	$(\delta Y_2/\delta K_2, \delta Y_1/\delta K_1)$	(0, 0)

When farmers chooses “no effort”, and enterprise of type 1 will choice “hard”, then incomes of farmers is 2, while the enterprises belong to type 2, then incomes of farmers is 1, so the expected return of farmers is 21.3. Therefore, the optimal strategy of farmers is choice “hard”. However, the choice of enterprise depends on decision level in reality.

218.3.3 The Game Between Forestry Enterprise and the Government

The aim of the government is ecological benefit, but forestry enterprises pursue the maximum of economic benefit. For simplicity we call the profit function of forest companies is:

$$Y_1 = f_1(K_1, L_1) + f_2(K_2, L_2) \tag{218.1}$$

And profit function of government is:

$$Y_2 = f(f_1 + f_2) + f_3 \tag{218.2}$$

Suppose Y_1 is government’s investment income, Y_2 is forestry enterprise investment income, and f_1, f_2 is income of non-forestry industries respectively, f_3 is the income of government’s investment of non-forestry industries, K_1 is forestry enterprises’ investment for forestry, K_2 is government’s investment for forestry, the return rate of non-forestry industry is more than forestry industry. We assume, $\delta Y_1/\delta K_2 > 0, \delta Y_1/\delta K_1 \leq 0; \delta Y_2/\delta K_1 > 0, \delta Y_2/\delta K_2 \leq 0$ (Table 218.2).

If the government pays more attention on enterprise's benefits in making and executing forestry policy, and reduces the burden of forestry enterprise, then forestry enterprise will be benefited, thus forestry enterprise will participate in forestry construction actively, Pareto optimal equilibrium point should be in first quadrant; if the government only concerns about ecological benefits and neglects the interests of forestry companies, the forestry companies will be forced to sacrifice their own interests and meet the other social subjects, that point should be in second or third quadrant; if forestry enterprises have complete information of their comparative advantage that they can invest in other comparative advantage industry, and then the equilibrium point of forestry enterprise and the governments are in the fourth quadrant, which mainly because of the inconsistencies of benefit among them.

218.3.4 The Game Among Governments, Forestry Companies and Farmers

We assume that the government, enterprises and farmers are economic man; they will conduct a dynamic game in the case of incomplete information. The government and enterprise collect information easily, while it is relatively difficult to farmers and government. So, the government acts firstly, and then enterprises, farmers act successively. For simplicity, A represents government, B represents the enterprise, C represents farmers, when the governments do not make effort to implement the economic policies of forestry, enterprises and farmers will choose to not make effort, and then the enterprises and farmers will get nothing, however, the government can get additional revenue through taxes whether it efforts or not, assuming the payoff is 1, the gains is (1, 0, 0), and the game will end immediately. When the government make efforts to implement economic policy of forestry, the enterprise may choose efforts or not, if the enterprise work hard, because of information asymmetry, farmers will do not know what the enterprises' choose is, while farmers is a rational economic man, in the case of uncertainty, they could estimate the possible variety, the farmer's belief on enterprise's effort is p , if they all choose efforts, the economic benefits is higher, it is (6, 5, 4). When the government and enterprises choose effort, but farmers don't try to support local economic development of forestry, the payoff is (5, 3, 1); if only the government choose efforts, the other don't support the local economic development of forestry actively, the payoff of them is (3, 1, 0); if government choose efforts, and forestry enterprises do not actively support local forestry economy development, but the farmers choose efforts, then the payoff is (3, 1, 2). The game is shown below.

We can see the on-the-path is a particular equilibrium, if the probability of information set visited in the subsequent game is more than zero, it called the

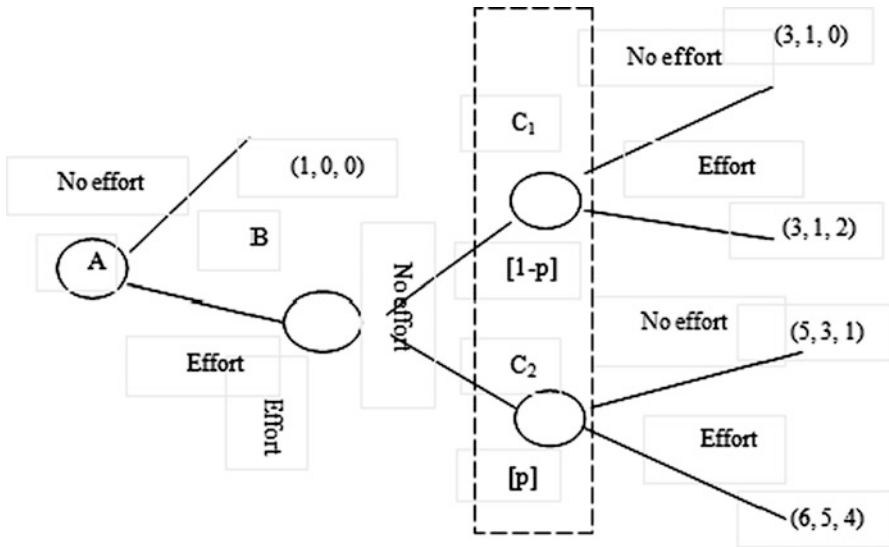


Fig. 218.2 The game tree of government, enterprises and farmers

equilibrium path, and otherwise it called off-the-path. Now we analyze whether C's faith is correct or not, the payment is higher if A's selection is effort, thus his choice belongs to sequential rationality. If $P = 0$, the player of C is off-the-path, there is no doubt that B will do not choose no effort, because he is a rational economic man. So C's belief ($P = 0$) is wrong. Therefore, the best choice of governments, forestry enterprises and farmers is mutual cooperation; supporting each other in this game, only then they can gain maximize returns (Fig. 218.2).

218.4 Conclusion

In this paper, we analyzed the behavioral strategies based on forestry stakeholder perceptions, different perspectives highlight the importance of decision-making and should be considered by policy makers and forest managers. The goals of forestry stakeholder are inconsistent, the government is the ecology benefit primarily, the peasant household take oneself home economics benefit primarily, the place by the place economic efficiency primarily, which will cause the game among them, in order to maximize their own interests, they will use all kinds of strategy and action to achieve their goals. Thus, it is important to clear property rights of forest in the game. In addition, the government should pay very careful attention to the conditions worked out in this paper and frame its policies and strategies accordingly in order to manage these forest resources in a sustainable way.

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