

Cause Analysis of Decision with Bounded Rationality in Disaster Recovery using Hypergame

University of Tokyo Student Member ○Chang Yeol CHOI

University of Tokyo Regular Member Riki HONDA

1. INTRODUCTION

The outcome of long-term disaster recovery is the cumulative results of decisions during recovery. In order to achieve recovery goals, recovery participants' decisions with bounded rationality should be prevented. The cause of such decisions can be found out in terms of various participants' respective objectives and motive. The interaction among participants is another factor affecting individual decisions. This research aims to analyze the cause of inconsistent decisions with long-term objectives focusing on differently perceived context and interaction in decision making.

2. METHODOLOGY

Hypergame approach represents the 'perceptual games' that different players take actions in the context of their own-perhaps radically different each other-games. For the analysis, players and their strategies are defined by the literature review on the case. And each player has its own individual game based on the interpretation of others. Individual games are analyzed to find the cause of irrational decision in the context of each player. By the mapping of individual games, the condition for changing decisions to desirable direction is checked

3. HOUSING RECONSTRUCTION POLICY IN SRI LANKA AFTER THE 2004 TSUNAMI

As a case to study, the housing reconstruction policy after the 2004 Tsunami was considered. In Sri Lanka, 99,480 houses were completely destroyed. While Government of Sri Lanka (GoSL) could start to relocate 30,602 houses by implementation of INGOs with funds, it didn't achieve much success. The initial reconstruction plan adopting relocation criteria as uniform distance from the coasts is being blamed for the reason. And this decision remained irretrievable negative impacts on overall recovery process. In regards to its reasons, some direct motives have been revealed, e.g. lack of massive relocation experience and motive not to repeat failure of coastal regulation. However, we need to consider the decisions with bounded rationality in the frame of interaction between closely related players with different context.

4. ANALYSIS

4.1 Players and Strategies

The reason why the initial uniform criteria of relocation couldn't be subdivided according to detailed assessment can be analyzed using hypergame between two players specified as GoSL, the policy maker, and INGO, the policy implementer. For the purpose of analysis, INGOs are limited to participants of housing reconstruction projects. Based on literature review, the strategies of both players according to each player's perspective can be defined like **Table 1** below.

Table 1 The Strategies of players according to player's perspective

<i>GoSL's Perspective</i>		<i>INGOs' Perspective</i>	
<i>GoSL</i>	<i>INGO</i>	<i>GoSL</i>	<i>INGO</i>
Relocating with Subdivided Criteria (Sub.)	Support Reconstruction (Sup.)	Acceptable Plan (Acc.)	Join in Reconstruction (Join)
Quick Relocating with Uniform Distance Criteria (Uni.)	Not Support reconstruction (No Sup.)	Unacceptable Plan (Unacc.)	Not Join in reconstruction (No Join)
Reconstructing in Situ (Situ)			

Keywords: Hypergame analysis, Decision with bounded rationality, Housing Reconstruction
Contact address: Hongo 7-chome, Bunkyo-ku, Tokyo, 113-8656, Japan, Tel: +81-3-5841-6091

4.2 Individual Games of Players

Individual games are defined as a 3×2 game for GoSL's perspective and a 2×2 game for INGO's perspective. The preference for strategies' combination can be judged by inference based on literature review.

In the perspective of GoSL, first of all, various INGOs can be divided into two types by whether INGOs support relocation with uniform criteria. With INGO (a), which supports uniform criteria plan, there is equilibrium, $\langle \text{Uni.}, \text{Sup.} \rangle$. In this case, GoSL who has maximum payoff at this equilibrium doesn't have motive to adjust relocation criteria. On the other hand, with INGO (b), which doesn't support uniform criteria, the equilibrium of game became $\langle \text{Uni.}, \text{No Sup.} \rangle$. However, if cooperation is possible, there can be new another outcome as $\langle \text{Sub.}, \text{Sup.} \rangle$ that gives higher payoff to both players. In the actual recovery process in Sri Lanka, most of INGOs joined in GoSL's plan with uniform relocation criteria. While a few organizations in housing field like UN-Habitat requested revision of plan, most of INGOs decided to join in uniform criteria plan. In that context, GoSL couldn't have the motive to adjust 'Uniform' to 'Subdivided'.

In INGOs' perspective, INGOs' individual game has the equilibrium, $\langle \text{Unacc.}, \text{No Join} \rangle$ for both INGO (a) and (b). However, by cooperation with GoSL, dominating outcome, $\langle \text{Acc.}, \text{Join} \rangle$ can be obtained.

According to these two individual games, the reason why initial relocation policy couldn't be improved was that GoSL lacked motivation for cooperation. However, when it is considered that GoSL had motive to motivate in the case of game with INGO (b), a lack of motivation of GoSL in Sri Lanka case is largely attributable to INGOs who gave priority to undertaking recovery works over appropriate recovery plan.

4.3 Analysis of Hypergame

When two individual games are linked, strategy mapping can determine the outcome of hypergame. In the Sri Lankan case, according to INGOs' interpreting 'uniform criteria' as acceptability, hypergame can be defined into two kinds.

If INGO classifies 'Uniform criteria' as 'unacceptable', the equilibrium $\langle \text{Uni.}, \text{No Join} \rangle$ can be replaced by dominating outcome, $\langle \text{Sub.}, \text{Join} \rangle$ by a cooperation. However, if INGO classifies 'Uniform criteria' as 'acceptable', there are two outcomes, $\langle \text{Uni.}, \text{Join} \rangle$ and $\langle \text{Situ.}, \text{No Join} \rangle$. In this game, INGO will pursue higher payoff in 'acceptable plan' that covers 'subdivided' and 'uniform' criteria. And within these options, GoSL will select 'uniform criteria' because of higher preference. Therefore, the equilibrium exists at $\langle \text{Uni.}, \text{Join} \rangle$. It shows that INGO's definition of acceptability can be the crucial variable for overall outcomes. It means that INGOs' criteria to decide participation in recovery can be the influence factor for recovery planning of government.

5. CONCLUSION

In the case of housing reconstruction in Sri Lanka, the reason why shortsighted relocation plan with uniform criteria was not improved is analyzed using hypergame approach. By analysis of individual games, the possibility to improve the recovery outcomes by cooperating each other was found. Actual cooperation to change recovery plan was not conducted because only INGO had the motivation to do so. However, GoSL's lack of motivation for cooperation resulted from INGOs who gave priority to undertake recovery works regardless of plan's feasibility. It shows that the interaction with other players can be one of causes for decisions with bounded rationality in disaster recovery. Finally, hypergame analysis suggests crucial variable in recovery planning as INGO's interpretation of the acceptability of Gov.'s policy.

For the further research, various influence factors in subjective game of each player will be analyzed in detail by comparing to other recovery cases. And influence factors defined by that analysis will be applicable to design the system to improve the outcome of long-term recovery process.

ACKNOWLEDGMENT: We would like to acknowledge MEXT for providing the scholarship for the first author.