

Review of Nuclear Regulation using Principal-Agent Model

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1. Introduction

Regulation is performed by the government on behalf of the public to accomplish a societal goal. However, the public is not necessarily confident that regulatory authority does well enough for the benefit of the public. That is partly because they have less information, competence and resources for monitoring regulatory activities. However, it is a problem that cannot be solved easily only by efforts of the personnel involved. In nuclear industry and regulation, there is increasing concerns of the local community on the decision making related to the safety matters on nuclear facilities. Resident people on NPP sites realize that radiation risk caused by the NPPs is their first concern, whereas the general public as a whole is less concerned with the radiation risk or nuclear safety. Regulatory organizations have less motivation to do their best because they pursue their private or group interests.

In this paper, the above mentioned issue has been reviewed in terms of principal agent problem(PAP) theory and also the PAP model for Korean nuclear regulatory system has been developed.

2. Review of principal agent problem theory

Principal agent problem is that arises in many spheres of activity, when one person, the **principal**, hires an **agent** to perform tasks on his behalf but cannot ensure that the agent performs them in exactly the way the principal would like. Principal agency models deal with problems resulting from conflicts of interest that may emerge in contractual relationship when parties are differently informed. This agent problem occurs whenever a state of asymmetric information exists because the agent holds information that the principal does not. For example, the insured is the principal and the insurer is the agent. The stockholders are the principal and the management is agent. It is found in many areas in our society.

A **moral hazard** is an opportunity for an agent to take unobserved actions for personal benefit to the detriment of the principal. It arises when the principal cannot perfectly evaluate the effectiveness of agent's actions, because there is a positive cost of monitoring agent's actions. He is not even able to perfectly infer agent's actions by observing the outcome because the agent's actions do not completely

determine the outcome. The outcome may be influenced by some uncertain, exogenous occurrence. **Adverse selection** appears when the agent possesses information that may prove useful to his decision making and the principal does not know about it. Therefore, the principal cannot know if the agent has made the most appropriate decision in light of the information possessed by the agent precisely because the principal does not have this information. It is **asymmetric information** in which one party in a transaction has more or superior information compared to another. Agency costs are the costs of making agents act in the best interest of the principal. The components are direct contracting costs, monitoring costs, and the mis-behavior costs of agents not acting for the best interest of the principal.

3. Principal agent relationship in nuclear safety regulation

It is worth to review issues related to nuclear safety regulation in view of above discussed principal agent problem theory. The principal-agent relationship of nuclear industry and regulation in Korea can be shown in Fig.1.

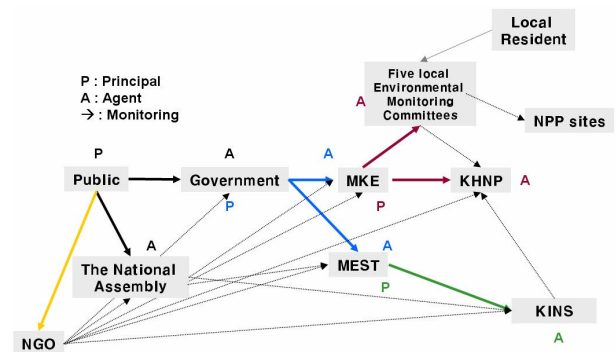


Fig. 1. Principal-Agent relationship in nuclear safety regulation in Korea

For the nuclear industry, regulatory body performs its mission on behalf of the general public. In this sense, general public is the principal and government is the agent. However, government established regulatory body to perform regulatory activities, hence government is the principal and regulatory body is the agent. The MEST,

regulatory body in Korea, established regulatory expert organization, Korea Institute of Nuclear Safety(KINS), which is also the agent whereas MEST is the principal. MKE(Ministry of Knowledge and Economy) is the agent when the government is the principal, and also it is the principal of the KHNP, NPP operating company in Korea, and five local Environmental Monitoring Committees.

As seen in the Fig.1., each organization can be the agent, at the same time, they can be the principal. That is the points of the principal agent problem encountered in the nuclear safety regulation.

4. Discussions

The public delegates the authority of monitoring and ensuring the acceptable level of nuclear safety to the regulatory body. The government acts as the agent delegated from the public as the principal, however, it cannot fully understand what the principal wants such as the degree of safety the public needs. The public doesn't have enough information on nuclear safety because of asymmetric information. Sometimes there exist conflicts between private benefits and social welfare or public goods among regulatory personnel. Therefore regulator fails to perform tasks appropriately. This problem becomes more difficult as the general public is divided into resident people living near the NPP sites and majority people living in remote areas. The principal-agent relationship becomes more complex in Korean nuclear industry and regulatory system.

4.1 Moral Hazard

The problem such as asymmetric information, absence of regulatory effectiveness evaluation or linkage between principals and agents could lead to the moral hazard of organizations involved. The moral hazard could cause the situation that the regulatory body takes unobserved actions for personal benefit to the detriment of the public and even lead to the regulatory failure such as delinquency and corruption. The licensee, government invested company in Korea, might also show this kind of moral hazard. Therefore, elaborate evaluation of regulatory effectiveness or monitoring system is needed to prevent this kind of regulatory failure and further government failure.

4.2 Agency Cost

The stricter monitoring system is added to existing principal-agent relationship and it makes the multi-step agent model. Multi-step agent model increases the monitoring cost as well as complexity of relationship. This agency cost increase means the reduction of principal's

wealth. This cost is another expression of the decrease of the public welfare.

4.3 Suggestions

The public as principal has less information and they cannot monitor regulatory activities appropriately. There is less incentive for enhancing regulatory effectiveness. Government has insufficient information on what regulation the public wants and how much they want in regulation. These make the agency problem serious one.

The proposed principal agent model explains how the organizations involved are linked and shows how they contracts to minimize costs associated with such problems.

Based on the understanding of the problems in nuclear safety regulation using this PAP model, the followings are suggested.

First, it is needed to define the public and resident people as principal and their concerns needs to be understood by the nuclear regulatory organizations and licensee specifically. Regulatory body as the agent needs to communicate more with the resident people as well as general public to perform its mission on behalf of them, which can be the solution for reducing the asymmetric information.

Second, it is necessary for the agents to keep in mind that regulatory activities should be done for the public welfare. It would contribute to ensuring socially acceptable level of nuclear safety.

Third, further study on principal-agent model to explain more elaborately how contracting parties design contracts and how to minimize costs associated with such problems. Multi-step PAP and multiple agent issues could be the topics of further study.

5. Conclusion

Nuclear safety regulation system in Korea has been reviewed using the principal-agent model and several suggestions have been made. There are many social and public related issues and challenges to be addressed in the era of expanding nuclear power in Korea. Understanding the socio-political and also socio-economical aspects of the nuclear-related phenomena in terms of this PAP is therefore very important and useful. More attention on this issue and further study on PAP suggested would be necessary.

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