A Study on the Analysis of National R&D Policy Using Institutional Accountability

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Abstract
In order to carry out National R&D Program successfully, research manager responds various kinds of accountabilities around research environment as well as research capacity and management issue. Considering the source and degree of control over agency actions, institutional accountability is divided into four types as follows: bureaucratic, legal, professional, and political accountability. But all institutional accountabilities are not equally emphasized in every case of National R&D Programs. This paper deals with the question that what kinds of institutional accountabilities should be more emphasized according to implementation structure. For the analysis, previous studies about accountability and governance theory were reviewed. And case study and in-depth interview were used as a research method. Through theoretical review, we have divided the implementation structure into four models using the main modality of governance models of Peters: government, market, deregulation and network models. After that four cases of National R&D Programs of Korea, each represent the one of four implementation structures, were analysed to measure the effect of institutional accountability of National R&D Programs. We have found that institutional accountabilities were highlighted in accordance with implementation structures: bureaucratic and professional accountability in government model, legal and political accountability in market model, professional and legal accountability in deregulation model, and political and bureaucratic accountability in network model. From this study, we could deduce the effect of various kinds of institutional accountability on National R&D Policy and also found that each case study provides better understanding about our research questions.
Keywords: Institutional Accountability, Implementation Structure, National R&D Programs, Performance, Case Study

Introduction
In order to carry out National R&D Program successfully, it is necessary for research manager to respond various kinds of accountabilities around research environment as well as research capacity and management issue. Romzek & Dubnick (1987) put more emphases on the institutional level accountability than the technological and managerial level accountability, analysing the cause of the Space Shuttle Challenger disaster in 1986.
Among the various elements which affect success and failure of National R&D Policy, this study analysed the effect of institutional accountability according to implementation structures. We could deduce the effect of various kinds of institutional accountability on National R&D Policy and understand better about our research question through this study.

Theoretical background
Accountability
According to Behn (2000), since the meaning of "accountability" depends on its context, it is difficult to define, but it is an important concept. Mulgan (2000) says that since the concept of "accountability" is complicated and ambiguous, it is difficult to define accurately, and its concept is not only changeable like a chameleon, but also expanding. Generally, even though

"accountability can be interpreted in various ways according to different aspects, it can be defined as social relations in which an actor who is under obligation that he should explain and justify his action, which is related to transfer of authority, to another important person and group, based on a basic concept that various stakeholders' expectations should be met" (Eom, 2009). More simply, it can be defined as "response to demand of a person who assigns a mission" (Kang & Cho, 2016).

Institutional Accountability

Accountability classified as technical, managerial, and institutional level. Each level has a mutually hierarchical structure and the upper level embraces the lower level. So rather than the technical or the management level, the accountability at institutional level has fundamental influence on success and failure of a policy (Romzek & Dubnick, 1987). They categorize institutional accountability as four different types, indicated in figure 1, including bureaucratic, legal, professional, and political accountability according to the source of control agency and the degree of control over agency actions. They also argue that the executive branch in the United States should be matched with not only the technological and managerial problems but also two or more institutional accountabilities because of the institutional conditions of the environment. They empirically suggested a decline of professional accountability resulting from an increase in political and bureaucratic accountability through the NASA (National Aeronautics and Space Administration)'s the Space Shuttle *Challenger* disaster.

		Source of control Agency	
		Internal	**External**
Degree of Control Over Agency Actions	**High**	1. Bureaucratic accountability	2. Legal accountability
	Low	3. Professional accountability	4. Political accountability

Figure1 Types of institutional accountability
Source: Romzek & Dubnick (1987); Eom (2009); Gormley & Balla (2013)

The contents and features of each type of accountabilities are as follows (Romzek & Dubnick, 1987; Eom, 2009; Gormely & Balla, 2013). First, bureaucratic accountability refers to abiding by supervision of superiors over subordinates, orders or instructions, and standard operating procedures and disciplines in an organization. It is the most widely used form for a control of accountability after priority is determined by hierarchy. Bureaucratic accountability occurs inside an organization and has a high degree of control. It is also expressed as obedience to supervisor's instructions or compliance with rules in an organization. Bureaucratic accountability has a low level of autonomy since a supervisor can impose penalties based on supervisor's rewards and punishments for a subordinate in hierarchical relationships.

Second, legal accountability indicates one that appears in relationships between enacting legislators and officials implementing enacted laws and in the principal and agent relationship through contracts. It appears in obligatory relationships with an external individual or group legal sanctions and contractual liability. Legal accountability is distinguished from bureaucratic accountability in that legal accountability is based on official or implicit fiduciary relationships between autonomous both parties. Legal accountability has a wider area of administrative activities than bureaucratic accountability, is based on a relationship between external groups (legislators, policy coordinators, etc.) and members of a group, and is expressed as implantation of legislators' acts. Specifically, the mechanism of ensuring legal accountability is Constitutional and legislative structure, judicial judgement, an audit, control from Congress, and etc.

Third, professional accountability reflects a circumstance in which a staff with relevant skills and expertise provides solutions to technical and complicated policy issues, having the discretion and autonomy in their work. According to profession accountability, a staff makes a decision, based on internalized norms. The internalized norms are based on socialization as a profession, personal beliefs, training and education, and work experience. Professional accountability has a characteristic that decisions are made on the inside and external opinions are passed indirectly and reflected only in a defensive form. Public administrators solely rely on the solutions provided by staffs with a high level of expertise, and professional accountability is expressed as a form that the staffs themselves have responsibility of performances. Respect for professionalism is the key of professional accountability and it is based on trust that professions will do their best as much as possible on the basis of their expertise.

Fourth, political accountability means officials' response to the needs of external stakeholders such as elected politicians, customer groups, and the general public. Political accountability is a 'reactive' form which arises due to the pressure on the democratization of the public administrative area and expressed as a form that public administrators are responsive to groups (the general public, officials, representative of related institutions, and special interest groups) for which they should be responsible. A high level of control does not happen in political accountability since its sanctions are indirect. While emphasis on political accountability has a high possibility to promote favouritism and corruption, it can also contribute to establishment of open and strong representative government.

Implementation Structure

Implementation structure means patterned role allocation between actors who participated in policy programs. It is distinguished from organization itself, one organization could participate in several implementation structures or several organizations could make up one implementation structure. Implementation structure can be divided into four types according to the design of organization structure (daft, 2009) and degree of implementation power (Yoo, 2007). We named four types of implementation structure using the modality of governance (Meuleman, 2006) and the government model (Peters, 1997). Those are the government, the market, the deregulation, and the network model. The government model implementation structure is related to the hierarchical theory, which uses administrative orders as a form of mediation. The market model implementation structure is related to the new public management theory, which uses price as a form of mediation. The deregulation model implementation structure is related to the Euckenian Liberalism, which emphasize the role of government for keeping competition order in market economy, which uses discretion as a form of mediation. And the network model implementation structure is related to the network theory, where credibility and cooperation are used for mediation.

Research Objective

This study aimed to measure what kind of institutional accountability more affect performance of national R&D policy according to implementation structure.

Research Methodology

Hypotheses

After reviewing previous literatures, following hypotheses for institutional accountability and implementation structure were suggested.

[Hypothesis 1] 1. Bureaucratic, 2.legal, and 3.professional accountability are emphasized under the implementation structure of government model, and securing the emphasized accountability positively affects the improvement of policy performance.

[Hypothesis 2] 1. Legal and 2.political accountability are emphasized under the implementation structure of market model, and securing the emphasized accountability positively affects the improvement of policy performance.
[Hypothesis 3] 1. Professional and 2.legal accountability are emphasized under the implementation structure of deregulation model, and securing the emphasized accountability positively affects the improvement of policy performance.
[Hypothesis 4] 1. Political and 2.bureaucratic accountability are emphasized under the implementation structure of network model, and securing the emphasized accountability positively affects the improvement of policy performance.

Case Study

For the analysis of institutional accountability importance, four cases of R&D projects were selected. To secure objectivity much consideration was given to chosen cases with similar conditions from the greatest extent possible. Chosen cases with which to compare national R&D programs are R&D projects specified by a central administration based on ordinance, their entire R&D cost or part of which supported by contributions or public funds, following the regulations of presidential decrees regarding the management of a national R&D program. The example case for the government model was the production of a transgenic cloned pig by the Rural Development Administration, while the example case for the market model was the low-orbit satellite launch vehicle (KSLV-I: Korea Space Launch Vehicle-I) project of the Ministry of Science and Technology. The example case for the deregulation model was the APCTP (Asia Pacific Centre for Theoretical Physics) program the Ministry of Science and Technology, last of the example case selected for the network model was the WBS (World Best Software) project of the Ministry of Knowledge Economy. A qualitative analysis of these example cases and in-depth interviews were conducted while focusing on the characteristics of the related technology, the project promotion system and outline, accountability at the technical level, accountability at the managerial level, and accountability at the institutional level with the implementation structure.

Research Result

For the analysis, a case which can best show the characteristics of each model was selected and a comparison was conducted on it. Through case study and in-depth interview with related experts and review of theories, derived testing of the hypothesis was attempted and institutional accountability with implementation structure was prioritized.

Case 1: Government Model

As a result of analysing the case of ‘Transgenic Cloned Pig Production Project' of the Rural Development Administration which is a case of government model, the performance of the transgenic cloned pig production project was improved as it was conducted in a form of research organization by the Rural Development Administration that can mobilize a large scale bureaucratic organization and researchers who are in the positions of civil servant of National Institute of Animal Science which is affiliated to Rural Development Administration. Also, because the participating researchers were civil servants, their status were guaranteed strongly and a high level of responsibility was required so it provided the opportunity to improve the research skills through long term study and created an advantageous situation for establishing professional accountability and contributed to improvement of the performance of the project. Therefore, [Hypothesis 1.1] and [Hypothesis 1.3] were supported by the case. However, this case rarely related legislations and the object of project is not targeted on humans but animals, so the problem of legal accountability was able to be responded more easily by regulating in the implementation structure itself and legal accountability was not relatively emphasized, and [Hypothesis 1.2] was dismissed. The priority of institutional accountability was shown to be in the order of bureaucratic

accountability, professional accountability, legal accountability, and political accountability (Cho, 2014).

Case 2: Market Model

As a result of analysing the case of 'KSLV-I (Korea Space Launch Vehicle-I) Project' of the Ministry of Science and Technology, the contract according to the Korea-Russia Space Technology Protection Agreement that was concluded and has come into effect in 2006 negatively affected Korea due to the economic crisis in Russia and questioning of problems related to MTCR by the U.S.A., and principal-agency problem which is a typical problem caused by imbalance of goal conflict and information arose failing to establish legal accountability. Excessive expectation of the government and the people expanded political accountability too much and it was confirmed that the result which could not control this political accountability moderately negatively affected the result of the project. Therefore, [Hypothesis 2.1] and [Hypothesis 2.2] were supported and the priority of institutional accountability was shown to be in the order of legal accountability, political accountability, bureaucratic accountability, and professional accountability (Cho et al., 2012).

Case 3: Deregulation Model

As a result of analysing the 'APCTP (Asia Pacific Centre for Theoretical Physics) program' of the Ministry of Science and Technology which is case of deregulation model. The APCTP was established not in a top-down approach by APEC but in a bottom-up approach by leading participation of theoretical physicists. The field of theoretical physics requires a high level of expertise and its research is carried out by researchers' autonomy so that professional accountability is strongly realized. It carries out cooperation research through constant meetings without requiring any specific equipment. Thus, the APCTP, a form of a platform, could achieve relatively great performance considering its budget.

APCTP has continuously grown through private leadership thanks to weak bureaucratic accountability. APCTP was established as a private institution, a form of a member country centred foundation, under Civil Code Section 32. So it has advantages in that it keeps a favourable position for benefits from international organization and international human resource network can be constituted freely from government's interference. Without any specific legal support to date, the APCTP has functioned as a platform for theoretical physicists (approximately 3000 of total visiting researchers, etc.) and a great deal of achievement. But if the establishment of the APCTP is legally supported by an agreement with international organizations such as APEC rather than domestic laws, it will secure budget more easily and achieve private-led development sustainably. Gyeongsangbukdo Province and Pohang city's promise of active support caused favourable results hosting APCTP. A wise role of local politicians is important to develop the APCTP since spread of awareness that the APCTP is a local program tends to make central government's interest distracted. Therefore, [Hypothesis 3.1] and [Hypothesis 3.2] were supported and the priority of institutional accountability was shown to be in the order of professional accountability, legal accountability, political accountability and bureaucratic accountability (Kang & Cho, 2016).

Case 4: Network Model

As a result of analysing the 'WBS (World Best Software) Project' of the Ministry of Knowledge Economy which is case of network model, although it had a implementation structure which required bureaucratic accountability for pushing ahead the project and managing complex network with various subjects involved, the person who in charge of the project were not fully understand the importance and the characteristics of software. And due to absence of ministry in charge and frequent changes in the department and civil worker in charge, bureaucratic accountability was not secured and it negatively affected the performance of the project. Also, despite unconditional government absolute support by the

president and the minister of supervision, communication and cooperation among the department, management organization and participating companies were not established very well. Because of these reasons, improvement of policy result was not able to be achieved even in an advantageous political situation. Therefore, [Hypothesis 4.1] and [Hypothesis 4.2] were supported and the priority of institutional accountability was shown to be in the order of political accountability, bureaucratic accountability, professional accountability, and legal accountability (Cho, 2014).

Discussion

Four types of implementation models were derived from literature review and each structure affect the institutional accountability. In government model, internal accountability, bureaucratic and professional, have been emphasized according to the classical administrative theory and the bureaucratic theory. In market model, based on the new public management theory and principal and agency theory, external accountability, legal and political, were emphasized. On the other hand, network model is related to network theory, political and bureaucratic accountability were emphasized, and deregulation model is related to the theories of deregulation theory and order liberalism, professional and legal accountability were emphasized.

Conclusion

Summary

[Case 1: Government Model] Hypothesis 1 were partially supported. Bureaucratic and professional accountability are emphasized under the implementation structure of government model. Diverse accountabilities around research environment as well as technical problem should be responded in order to product a transgenic cloned pig. After reorganized the program as a ministry research program under bureaucratic management, which was in trouble under private research group, the efficiency of the program was raised. Because ministry researchers' status was public servant, it was possible to improve the researchers' stable and long-term technical skill.

[Case 2: Market Model] Hypothesis 2 were supported. Legal and political accountability are emphasized under the implementation structure of market model. This program was established principal-agent relationship through a contract between Korea and Russia, and principal and agent problem was occurred due to information asymmetry and target conflict. Even though there were several times of schedule change and budget reduce, there were so many reasons which were enforcing unfeasible launch in the Korea Space Launch vehicle program. Politicians forced impossible launch on researchers to overcome unfavourable political situation.

[Case 3: Deregulation Model] Hypothesis 3 were supported. Professional and legal accountability are emphasized under the implementation structure of deregulation model. Diverse accountabilities around research environment as well as strengthening of research capacity should be responded in order to develop APCTP. Even though enhancement of its status was limited by the lack of legal support, voluntary participation and endeavour, because the APCTP was establish a bottom-up approach, made good performance as research and innovation platform considering its budget.

[Case 4: Network Model] Hypothesis 4 were supported. Political and bureaucratic accountability are emphasized under the implementation structure of network model. Because the complicated network must be handled through bureaucratic management, network model implementation structure needs bureaucratic accountability. Each participant acts as a team member when accomplish their common goal in network model, but they pursue each

individual's goal and coincidence of interests between individual and common goal. So coordination of each participant goal is the most important factor in network model.

Implication

Through this research, the following new facts and implications were deduced. First, it was discovered that the implementation structure affected which type of institutional accountability was more emphasized, and internal accountability and external accountability manifested differently according to the implementation structure. In a government model which has an internal implementation structure, an internal form of accountability such as bureaucratic accountability and professional accountability were emphasized, while in a market model which has an external implementation structure, external types of accountability such as legal accountability and political accountability were emphasized. Also, in the deregulation model in which internal and external structures are combined, professional accountability, a form of internal accountability, was emphasized for aspects highly specialized person and field. While legal accountability, a form of external accountability, was emphasized in terms of minimum discipline and legal support. In the network model in which also internal and external structures are combined, bureaucratic accountability, a form of internal accountability, was emphasized for aspects pertaining to the management of organizations, while political accountability, a form of external accountability, was emphasized for the aspect of managing stakeholders.

This study focused on institutional accountability and the implementation structure of each National R&D Program. From this study, we could deduce the effect of various kinds of institutional accountability on National R&D Policy and also found that each case study provides better understanding about our research questions. They could be utilized as a good reference to the implementation and evaluation of National R&D Policy in the near future.

Reference

Behn, R. 2001. **Rethinking Democratic Accountability**. Washington DC.: Brookings Institution.

Cho, S. & Kwon, G., & Kim, D. 2012. "A Study on the Accountability of Research and Development Organizations: Focused on the launch of the KSLV-I." **Journal of Korea Technology Innovation Society** 15 (1): 163-184.

Cho, S. 2014. **An Analysis of the Effect of Institutional Accountability Types by Implementation Structure on Policy Success.** Doctor of Philosophy in Public Administration, Yonsei University.

Daft, R. 2009. **Organization Theory and Design**. Tennessee: South Western Educational.

Eom, S. 2009. "Public Accountability: Theoretical Conflict and Debates between Public Administration Theories." **Korean Public Administration Review** 43 (4): 19-45.

Gormley, W. & Balla, S. 2013. **Bureaucracy and Democracy: Accountability and Performance.** Washington DC.: CQ.

Kang, J. & Cho, S. 2016. "A Study on the accountability of the regional R&D program: the case of APCTP." **Journal of Open Innovation: Technology, Market, and Complexity** 2 (3):1-15.

Meuleman, L. 2006. **Public Management and the Metagovernance of Hierarchies, Networks, and Markets.** Heidelberg: Physica-verlag.

Mulgan, R. 2000. "Accountability: An Ever-Expanding Concept?." **Public Administration Review** 78 (3): 555-573.

Parsons, T. 1960. **Structure and Process in Modern Societies.** New York: The Free Press of Glencoe.

Peters, B. 1997. **The Future of Governing: Four Emerging Models.** Lawrence: Kansas University.

Romzek, B. & Dubnick, M. 1987. "Accountability in the Public Sector: Lessons from the Challenger Tragedy." **Public Administration Review** 47 (3): 227-238.
Yoo, H. 2007. **Policy implementation.** Seoul: Park Moon Gak.