（別紙様式６）
(Attached Form 6)

学位論文の要旨（論文の内容の要旨）
Summary of the Dissertation (Summary of Dissertation Contents)

論　文　題　目
Dissertation title

A Study of Indigenous Knowledge in the Context of Urbanization and Sustainable Water Resource Management in the Kathmandu Valley of Nepal

広島大学大学院国際協力研究科
Graduate School for International Development and Cooperation, Hiroshima University
博士課程後期　教育文化専攻
Doctoral Program　Division of Educational Development and Cultural and Regional Studies
学生番号
Student ID No.　D132065
氏　名　□
Name　RANJAN PRAKASH SHRESTHA　Seal

Please see attached.

備考　論文の要旨はＡ４判用紙を使用し，4, 000字以内とする。ただし，英文の場合は1, 500語以内とする。
Remark: The summary of the dissertation should be written on A4-size pages and should not exceed 4,000 Japanese characters. When written in English, it should not exceed 1,500 words.

The overall objective is to study and analyse the relationship between indigenous knowledge and urbanization with a view to assessing the potential for sustainable water resources management as a common-pool resource (CPR), with a particular focus on traditional water resources, stone spouts and their management both in the past and present urbanized context, in the Kathmandu Valley of Nepal. The study uses Elinor Ostrom and Garrett Hardin theories as an academic framework to examine potential managing CPR to contribute to reducing water scarcity problem in the Kathmandu Valley.

The study focuses on Newar inhabitants, who are the Indigenous Nationalities of Nepal with the Kathmandu Valley as their ancestral domain. Newars have mastered using and managing the traditional water conveyance and resources through the use of indigenous technology (*raj kulo,* aquifers, stone spouts), indigenous institutions (Guthi, Sithi Nakha) and indigenous practices (*nag panchami, kshyama puja etc.*) for generations.

In view of the functioning of stone spouts, continuing to help meeting water demands of people in the Valley, against all odds, the study stresses on Ostrom's work on institutional analysis examining governing the commons, in contrast to the proposition of the tragedy of the commons argument, highlighting how new institutions have contributed to sustaining this knowledge and practices in the Kathmandu Valley, as of today.

A conceptual framework has been developed to examine Business-As-Usual (BAU) case, provides a model of the functioning of CPR, following principles of the governance or management of the commons, whereas the second part examines how the governance of CPR functions in circumstances where changes or challenges are imposed due to external factors or anthropogenic activities, thereby transforming the management of the commons into a tragedy of the commons. Also, it examines whether, when CPR is exposed to such a risk, it could be mitigated or averted to maintain or restore effective governance of the commons if the BAU case applies. Further, the analytical framework guided by the conceptual framework examines a dynamic inter-active relationship between what will be initially identified as 'indigenous knowledge' and 'urbanization', both of which are of course simplified heuristic devices but which will be examined critically to provide a more sophisticated framework for the analysis of the development of water management systems in the Kathmandu Valley.

The study was conducted in the Kathmandu Valley which consists of three administrative districts, namely Kathmandu, Lalitpur and Bhaktapur. These three districts are Nepal's main centers for political, administrative, economic, education, health, trade and other activities which play an important role in the national economy.

The study collected both qualitative and quantitative data during both primary and secondary data collection. As the study targeted water users of stone spouts, respondents and locations were selected using the snowballing sampling technique in identifying information-rich key informants and people with a similar trait of interest. The survey consisted of key informant interviews and focused group discussions. The study used semi-structured questionnaires for interviews which were conducted in each stone spout location. The interviews were complemented by direct observation, in order to triangulate data with the interviews, and between primary data and secondary data. The study reveals that there are more than 507 stone spouts at various locations and conditions in the Kathmandu Valley.

In the past, the Guthi, social institution of Newars used to manage stone spouts for their operation and maintenance. The study also found few Guthis are still functional and involved in conducting the conservation activities of the stone spouts. The study reveals that significant numbers of stone spouts are functioning well in the urbanized context as well. The stone spouts have been managed by newly established institutions, such as, Local Community Groups, Cooperatives, Users' Group, Womens' Group, Conservation Group, Tole Sudhar Samiti (Locality Improvement Committee), Youth Clubs etc. These institutions have been evolved during the process when community see these CPR were exposed to a risk of tragedy.

The microbiological analysis of water samples from main water sources (Upstream), ponds and wells (Intermediary points) and stone spouts (Downstream) show a very high amount of Escherichia Coli (E. Coli) and Total Coliform. Overall, the results show that Total Coliform bacteria was common in all samples from stone spouts, wells, ponds and main sources (Downstream, Intermediary and Upstream sources). Similarly, the chemical analysis shows a very high amount of Lead (Pb), Ammonia (NH_3), Iron (Fe), Nitrate (NO_2), Fluoride (F), Residual Chlorine, etc., in the water samples from stone spouts, however they were within the National Drinking Water Quality Standards, except the water sample from Dattatraya well of Bhaktapur.

The study reveals that local Newars largely reflect the principles of Ostrom compared to the responses of local non-Newars and migrants. About 78% of the local Newars reflect that the stone spouts are largely managed by the collective actions, against 51% of non-Newars, followed by the Migrant Newars and non-Newars of 29% and 21% respectively. It is found that the migrant communities' responses are far less compared to the Newars and Non-Newar of the Valley.

The Newars of the Valley also highlighted that the stone spouts are managed as a common-pool resource with an access to defined numbers of the users, in general, limiting access to the same community people in the locality. The Newars have also highlighted that the stone spout users' rights were well respected in the past. About 49% of the respondents expressed that the stone spout users' rights were recognized in the past, however, about 7% of the people representing the non-Newars migrant communities state that the users' right were not respected in the recent days.

The 29% of the migrant community believed that the stone spouts can be well managed with the proper monitoring systems and enforcement of the rules by the users. However, the monitoring and enforcement of the rule is not highlighted by the Newars rather they mentioned that the conflict management was much more effective in the past as they could modify the rules to suit local needs and conditions for larger benefits. About 42% of the respondents mentioned that conflict management was effective in the past, where the *thakali* (team leader) plays a key role in the conflict management. There were no rules in the written format and everything used to be in the verbal communications, trust and orders.

About 20% of the local Newar respondents expressed that the monitoring and enforcement of the rules are comparatively lesser than other means of management. This shows that the stone spouts were in operation in an informal way, mainly based on ethics, trust, faith, believes are the driving factors for their management. The response of the Newars are largely dominated by the sense of community and mutual support and shows that the Newar communities are linked to the community principles in the form of Guthis, that value the importance of managing the common-pool resource as a community property, for the community people and services to the people.

It is worth noting that 41% of the local community who are non-Newars highlighted that the stone spouts users' right to be limited to the people from the same locality or community for a better management. The ownership is strong when they are the users of a similar cultural and practices.

In conclusion, the findings suggest that stone spouts managed by local Newars communities using their indigenous knowledge system largely follow Ostrom principles. Similarly, the tragedy of the commons will always remain possible because of the changing context or scenario of the way in which the governing of the commons is managed.

In both cases, the assumption is that if the challenges imposed by these two 'external factors' are not managed within the system of governance of the CPR, the tragedy of the commons will follow; but if the risks or challenges resulting from these 'external factors' are effectively managed - using Ostrom's postulate, especially applying 8 principles - those CPR can be governed, enabling the stone spouts to serve the local communities with a continuous supply of water free of cost and 24 hours a day.

The empirical data suggest that the effective functioning of stone spouts and response to water demands, even in the modern urbanized context is possible given the application or adoption of the community sense or principles. It requires, however, that new institutions are developed to underpin these principles of community sense and that strong ownership and community property values are established as they were by Guthis in the past in line with Ostrom. The assumption (or hypothesis) of the conceptual framework, that the tragedy threatened by external factors could be managed by applying Ostrom's principles if the appropriate institutions can be developed is found to be valid.

This study contributes to document the existing indigenous knowledge, which is depleting, and validated its value in water resource management in the course of urbanization. The major recommendations drawn to contributing knowledge, policy and practice are that indigenous knowledge is a valuable knowledge system developed over generations by local communities. This study of indigenous knowledge through the comprehensive mapping of stone spouts and documentation of local practices will be useful for researchers and local communities to meet water scarcity.