

## 博士論文審査結果報告

Report on Ph.D. / Doctoral Dissertation Defense

National Graduate Institute for Policy Studies (GRIPS)

Associate Professor (joint-appointment) MOHAMED, Rasmy

審査委員会を代表し、以下のとおり審査結果を報告します。

On behalf of the Doctoral Thesis Review Committee, I would like to report the result of the Doctoral Dissertation Defense as follows.

学位申請者氏名 Ph.D. Candidate	Md Khairul Islam		
学籍番号 ID Number	DOC16132		
プログラム名 Program	防災学プログラム Disaster Management Program		
審査委員会 Doctoral Thesis Review Committee	主査 Main referee	MOHAMED, Rasmy	主指導教員 Main Advisor
	審査委員 Referee	竹内 邦良 TAKEUCHI, Kuniyoshi	副指導教員 Sub Advisor
	審査委員 Referee	菅原 賢 SUGAHARA, Masaru	副指導教員 Sub Advisor
	審査委員 Referee	細江 宣裕 HOSOE, Nobuhiro	博士課程委員会委員長代理 Acting Chairperson of the Doctoral Programs Committee
	審査委員 Referee	TOFAEL, Ahmed 筑波大学 Tsukuba University	外部審査委員 EXternal Referee
論文タイトル Dissertation Title (タイトル和訳)※ Title in Japanese	Developing a Methodology for Integrated Flood Risk Assessment in a Transboundary River Basin Using Multi-Platform Data Under Global Change– the Case of the Meghna River Basin 地球規模変化の下での多重基盤データを用いた越境河川流域での統合洪水リスク評価手法の開発ーメグナ川流域の事例		
学位名 Degree Title	博士 (防災学) / Ph.D. in Disaster Management		
論文提出日 Submission Date of the Draft Dissertation	2019年5月8日	論文審査会開催日 Date of the Doctoral Thesis Review Committee	2019年6月5日
論文発表会開催日 Date of the Defense	2019年6月5日	論文最終版提出日 Submission Date of the Final Dissertation	2019年08月21日
審査結果 Result	合格 Pass		
	不合格 Failure		

※ タイトルが英文の場合、文部科学省に報告するため、和訳を付してください

Please add a Japanese title that will be reported to MEXT.

## 1. 論文要旨 **Thesis overview and summary of the presentation.**

Flood disasters are recurrent and on an increasing trend around the world due to global warming and its impact on the weather and climate, increase in population, and land-use change due to rapid urbanization. Integrated Flood Risk Assessment (IFRA) is an effective way to assess the possible hazard and vulnerabilities and thus to plan strategies and allocate the resources for enhancing the preparedness for effective response and recovery processes to build-back-better. However, implementing IFRA is very challenging, particularly in developing nations, due to the limitations in the recorded data. It is even more challenging in the transboundary basins, which include several low- and middle-income countries.

The candidate developed a methodology to overcome the limitations in data availability in the transboundary basin and thus to implement IFRA under global change (e.g. climate and land-use changes). As IFRA framework consists of three major components (i.e. flood hazard, vulnerability, and exposure), the limitation in data availability in all major components were addressed by the candidate in his thesis. For flood hazard assessment, the limitation of the rainfall data in the transboundary regions was overcome by generating a reference dataset through the integration of available ground data obtained at few locations in Bangladesh with the multi-satellite gridded rainfall products, which were produced and available freely at the leading space agencies (e.g. JAXA and NASA). The reference rainfall dataset was verified by checking the simulated river discharges from a calibrated hydrological model against ground river discharges. After the verification, the hazard maps for flood depths, duration, and inundation extents were generated for a past flood event. The data unavailability for flood vulnerability assessments was overcome through conducting a field questionnaire survey and then developing vulnerability curves for Boro rice (main crop of the area), house buildings, and in-house properties using the surveyed data. The surveyed results showed that Boro paddy fields can allow water to be stored without causing any damage up to an average

height of 25 cm (at which rice tiller evolves), and rice damage becomes ~100% at 70–75 cm water height (at which grains start to flourish). These findings provides additional opportunities, in addition to the available practices (e.g. embankment construction), for effectively managing flood disasters and planning different approach for adaptation and mitigation strategies. His results further showed that the household damage is mainly dependent on inundation height above floor level, construction method, and building material of different house types. Flood exposure data for rice was obtained from available global data and household distribution map was derived from population distribution data. After overcoming the limitations in the data availability, the candidate estimated the flood damages using the proposed methodology to Boro rice, household, and in-house properties during 2017 major flood and validated the results with the reported results by the national and international organizations.

In addition, flood risks to Boro rice was assessed under the global changes in climate and land use using the validated IFRA model that was developed in this study. Future hazard parameters were produced using Global climate models' outputs. Damage functions (at present value) developed in this study and rice extent maps predicted for future climate, were used for vulnerability and exposure assessments. The results showed that the effect of climate change will increase the hazard and vulnerability of the study area under global change.

Based on these findings, the candidate recommended new policy implications to reduce flood disaster risk through mainly non-structural measures such as dissemination and implementation of hazard maps, allowing water to be inundated in the Boro fields up to a 25 cm or more water height to facilitate excess water, near-real-time flood forecasting and warning, and introduction of flood insurance program that are more effective and environment friendly. These recommended non-structural measures have to be promoted by the government as well as non-governments organizations to reduce increasing flood risk in the study area in order for

achieving sustainable development goals and building back better. This study can contribute significantly to develop IFRA in other several transboundary river basin around the world.

The dissertation is organized as follows. Chapter 2 introduces the study area and methodology of the study. Chapter 3 presents the methodology and results of developing reliable reference rainfall. The methodology and results of establishing flood damage functions are described in Chapter 4. Chapter 5 describes flood damage assessment methodology and results of past flood damage assessment with validation. Flood risk assessment under global change of climate and land use is outlined in Chapter 6. Summary and conclusions are drawn in Chapter 7, and finally several policy implications are discussed in Chapter 8.

**2. 審査報告 Notes from the Doctoral Thesis Review Committee (including changes required to the thesis by the referees)**

The committee members reviewed the thesis as well as evaluated final presentation at the defense meeting. They shared their common impression that this research methodology is original and dissertation work can contribute to science as well as society, significantly. To improve the dissertation, several comments and suggestions were recommended. The major comments and suggestions were listed below,

1. More description of the field survey and the issue of subjectivity should be described
2. Policy implication not only for policy makers but also for people in the vulnerable region should be proposed to maximize the benefits of hazard information.
3. Clear description on the applicability, limitations, and scope of the research should be given.
4. Transferability of the methodology and policy implication to other transboundary river basins such as Mekong, Nile, La Plata, Ganges, should be outlined.
5. Description on the contribution to the literature should be included.
6. Effectiveness of proposed flood counter measures and dredging should be compared.

7. Estimation of the damages not only for crop and houses but also for other infrastructures and mortalities can be included.
8. Uncertainty range in the damage estimation should be assessed.
9. Several minor corrections on the local terms, paragraph formulation, and grammar are recommended.

The review committee members recommended the candidate to address these comments and suggestions and submit back to the committee within a month for the final confirmation. In case, if there are any further corrections from the committee members, the candidate will revise the thesis in the second round.

### **3. 最終提出論文確認結果 Confirmation by the Main Referee that changes have been done to the satisfaction of the referees**

The first revised version and the responses to the reviewers was submitted by the candidate on time and it was sent to the committee members. They checked the revised version. Three of the reviewers found the revisions were made appropriately and one reviewer recommended few more minor corrections. After addressing those comments, the candidate sent the revised version again to all the reviewers and all the reviewers approved the revised version. Finally, the main adviser checked the revised version, together with the result of the plagiarism check by Turnitin and the main adviser found it satisfactory. The final version of the thesis was submitted to GRIPS on August 21, 2019.

### **4. 最終審查結果 Final recommendation**

The doctoral thesis review committee recommends that GRIPS award the degree of Ph.D. in Disaster Management to Mr. Md Khairul Islam.