(Format No. 3)

SUMMARY OF DOCTORAL THESIS

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Title: **Synchronizing Irrigation Development with hydrology of the local catchment areas by use of Rainfall-Runoff modeling in Lilongwe basin in Malawi**
(マラウイのリロングウェ流域における降雨－流出モデルによる局地流域の水文特性に連関した灌漑開発)

The study's first part deals with a situational analysis of successes, challenges and failures of irrigation farming in Malawi. A presentation is made of a case study which was conducted based on four major irrigation schemes in Malawi; Bwanje Valley Irrigation Scheme, Domasi Irrigation Scheme, Likangala Irrigation Scheme and Kasinthula Smallholder Sugarcane Growers Irrigation Scheme. In summary, highlights were made of Malawi's agricultural sector as being the main contributor to the national economy with its activities very dependent on rain-fed farming, leading to the sector suffering from the consequences of poor policy implementation and management. It also explains the paradox where irrigation has, for a long time, been viewed as a major component in agriculture though its implementation continues to be challenged by numerous problems. The second part tries to present a futuristic consciousness and views on hydro-politics surrounding the waters of Malawi. Water related issues in Malawi were studied in the context of their potential to causing conflicts especially where catchments and waters overlap into foreign territories. In this study, it was found that water related issues have become some of the most contentious in the world. It was found that countries have fought contesting control of shared waters. While this is the case elsewhere, Malawi, endowed with a vast amount of fresh waters has relatively enjoyed a peaceful political stability internally and a relatively harmonious coexistence with its neighbors for a long time. However, as population increases, industrial development rises, there tend to be mass consumption, misuse and pollution issues setting in as a result creating subtle issues which may be a precursor to conflicts. This part examined these issues internally and followed them up as they affect the lower riparian in the shared waters of the country. It has also tried to put forward recommendations as to how best policies can be tackled and implemented to strengthen the regional cohesion in the cross border integrated water resource management. In the third part, Hydrological Modeling (HM) in Malawi has been discussed. A general overview of the availability and usage of the HM in the sub-Saharan region in general and in Malawi, in particular has been presented. It was found that there is very low usage of HMs, particularly in Malawi, despite the presence of many models that are suitable for the region. A presentation on how models could be useful in water resources management and planning was also outlined. The fourth part is a follow-up to the previous discussion where a study of the effect of reservoir construction on peak discharge of Lilongwe River was carried out. It assesses and reports the need for using HM in water resources studies and management in Malawi. It also proposes a methodology that would be useful in using the available data on the ground in Malawi to make necessary decisions especially in the view that Malawi is in the process of building more dams to strengthen the irrigation and other water resources sectors.

The final part concludes the studies by looking at the effect of climate change on rain-fed maize production where an assessment of maize production vs. a changing rainfall pattern in Malawi was carried out. Here, it was shown that maize, a staple food crop in Malawi has been grown under rain-fed conditions for many years but many factors affect its production. Changing rainfall pattern has been a main factor which is believed to have come about due to the changing climate in recent years. It was found that rainfall distribution characteristics have changed over time becoming more unpredictable and, hence, reducing production. The study recommends building more sustainable irrigation systems and a paradigm shift from policies that depend on rain-fed agriculture to ones that hinge on irrigated agriculture on food production and economic activities to prevent consequences associated with the changing rainfall pattern.