AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Urban Planning

# Urban Climate Change Resilience:

# A Study of Sea Level Rise Impacts on Nile Delta Northern Region

A Thesis submitted in partial fulfillment of the requirements of the degree of

Master of Science in Architectural Engineering

(Urban Planning)

by

**Yasmin Zakaria Meshref Kamh**

Bachelor of Science in Architectural Engineering

(Urban Planning)

Faculty of Engineering, Ain Shams University, 2011

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**Cairo- 2015**

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Date: 24 December 2015

# Statement

This thesis is submitted as a partial fulfillment of Master of Science in Architectural Engineering Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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بسم الله الرحمن الرحيم

**" قالوا سبحانك لا علم لنا إلا ما علمتنا**

**إنك أنت العليم الحكيم"**

**صدق الله العظيم**

سورة البقرة - الآية (32)

# Summary

This thesis aims at studying the impacts of the Sea Level Rise (SLR) and measuring the level of urban community resilience on the region of Northern Nile Delta , with special reference to Alexandria (Egypt) as one of the cities subject to the impacts of SLR resulted from climate change. Additionally, the research compares Alexandria to a similar region; namely the Northern Coast of Java Island, with particular focus on Jakarta (Indonesia) as one of the most threatened cities by SLR in terms of exposed population.

In this regard, the current thesis addresses two main problems and suggests suitable recommendations for them. **Firstly**, the lack of resilience strategies in urban planning development in the Northern Coast of Nile Delta, which is considered a highly threatened zone by SLR impacts, specifically floods. Hence, increasing the vulnerability of the inhabitants of this areas. **Secondly**, the undetermined stakeholders and their responsibilities regarding the reduction of the impacts of SLR on this affected zone and lack of coordination, which lead to the incapability of identifying their role in increasing the resilience of the affected community by SLR. Specifically that the severity of floods is expected to increase in the 2070- according to the recent studies of the Organization for Economic Cooperation Development (OECD) , hence, these two problems are expected to increase the vulnerability of the Northern Coast of the Nile Delta region.

This thesis addresses the first problem by exploring various techniques applied in two mega coastal cities: Alexandria (Abo-Qeer zone) in Egypt and Jakarta (Pademangan zone) in Indonesia. This selection is mainly due to their naturally low topography below the sea level and the rank of the two cities in terms of population exposed to coastal flooding by 2070 as the $11^{th}$ and the $20^{th}$ respectively among 20 cities according to the OECD. Lately these ranks have been modified into the $1^{st}$ and the $11^{th}$ respectively according to recent researches.

Moreover, an index has been developed to measure the level of communities' resilience in these mega coastal cities using a Flood Disaster Resilience Index (FDRI). This index is developed on five resilience-based capitals: Governance, Economic, Natural, Physical and Social. Different methods have been employed to measure these capitals using the FDRI; these include literature review, questionnaires, and in-depth interviews held by the researcher.

Furthermore, statistical analysis is carried out using Microsoft Office Excel. This analysis indicated that higher values of resilience are correlated with higher preparedness to cope with flood-related disasters and vice versa. It also shows that there are various types of vulnerability characteristic of each city. Based on this analysis , recommendations are presented to enhance the community resilience against flood-related disasters. In the overall, FDRI performance for both cities showed that the highest performance is achieved in the Governance Capital. However, as for the Natural Capital, Alexandria city has a higher preparedness than Jakarta. Regarding the Social Capital: Jakarta's performance is higher than Alexandria's. In general, results showed strength and weaknesses in one capital or another.

This thesis addresses the second problem which is the overlapping and lack of coordination in the responsibilities of possible stakeholders regarding the reduction of the impacts of SLR on this affected zone by literature review, the in-depth interviews and the questionnaires. The findings of this thesis showed clear determination for the concerned stakeholders and their responsibilities for both cities. Moreover, these findings shown that the availability of cooperation efforts between theses stakeholders are high in Jakarta than Alexandria , especially between the government and academic representatives and between the academic representatives and NGOs. This is resulted from the increase of social awareness of flood disaster in Jakarta which leads to the effective participating between the community individuals, government, NGOs and academics to enhance the community resilience of the affected community by floods.

Key words: climate change, sea level rise, Alexandria, Jakarta, Flood Disaster Resilience Index, community resilient

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