A Risk Assessment Model for Wastewater Treatment and Seawater Desalination PPPs in Egypt

By

Rania Raafat Mohamed Shams El-Din

A Thesis submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY

in

Structural Engineering

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Title of Thesis: A Risk Assessment Model for Wastewater Treatment and Seawater Desalination PPPs in Egypt

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Summary :

This study aims to identify risks encountered by Domestic Wastewater Treatment (DWWT) and Seawater Desalination (SWD) PPPs in Egypt and develop a preferred risk allocation scheme as well as risk assessment models for such projects. A risk factors list was established through literature review and content analysis followed by experts' interviews. The top significant risks were then identified through statistical analysis. A preferred risk allocation scheme was developed using the "majority opinion" approach. The attributes affecting top significant risks were identified through Delphi interviews. Two Hierarchical Fuzzy Logic Models were developed for risk assessment of DWWT and SWD PPP projects, namely RA-DWWT-PPP and RA-SWD-PPP respectively. The developed models are formed of Mamdani fuzzy logic controllers, where fuzzy rules were generated automatically through fuzzy arithmetic and linguistic approximation. RA-DWWT-PPP model was evaluated via two case studies; New Cairo wastewater treatment plant (WWTP) and Abu Rawash WWTP, while RA-SWD-PPP model was verified by means of degeneracy testing. The study shall help PPP practitioners assess the overall risk rating of the targeted types of projects which is a vital input to the overall investment decision in PPP projects, as well as identify project risk areas of the highest concern and develop effective risk allocation strategies, which facilitates establishing more balanced contracts.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Date:

Signature:

Dedication

I dedicate this work to my Mum, the pillar of my soul, as well as my Dad, my role model, for believing in me and giving me strength in my weakest times. To my grandma Zeinab Heikal who's unrelenting prayers are what kept the geer running. To my grandpa, peace be upon him. To my brother, sister, brother in law, colleagues and friends for their encouragement and support.

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Table of Contents

List of Tables

List of Figures