UNEP

ECONOMIC VALUATION OF WASTEWATER

THE COST OF ACTION AND THE COST OF NO ACTION

GPA Global Programme of Action for the Protection of the Marine Environment from Land-based Activities

UNITED NATIONS UNIVERSITY

IWMI International Water Management Institute

This report was commissioned by:
The Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA), through the Global Wastewater Initiative (GW²I).

The Global Wastewater Initiative

The Global Wastewater Initiative (GW²I) is a voluntary multi-stakeholders platform aiming to initiate comprehensive, effective and sustained programmes addressing wastewater management.

The Secretariat for the GW²I is provided by the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA).

P. O. Box 30552 (00100), Nairobi, Kenya
T +254 20 762 4793
E gpa@unep.org

United Nations University

5–53–70 Jingumae,
Shibuya-ku, Tokyo 150-8925
Japan

T +81 3 5467 1212
F +81 3 3499 2828

The International Water Management Institute

P. O. Box 2075, Colombo, Sri Lanka.
127, Sunil Mawatha, Pelawatte,
Battaramulla, Sri Lanka

P. O. Box 2075, Colombo, Sri Lanka
T +94-11 2880000, 2784080
F +94-11 2786854
E iwmi [at] cgiar.org

ECONOMIC VALUATION OF WASTEWATER

THE COST OF ACTION AND THE COST OF NO ACTION

Acknowledgements

Citation: **Economic Valuation of Wastewater - The cost of action and the cost of no action**

Authors: Francesc Hernández-Sancho (*University of Valencia*), Birguy Lamizana-Diallo (*UNEP*), Javier Mateo-Sagasta (*IWMI*) and Manzoor Qadir (*UNU-INWEH*).

Designer: William Orlale

Photo credit: ©H.A. Leslie.

Cover photo: Birguy Lamizana-Diallo, Allan Harris via Flickr Creative Commons.

The UNEP **coordination team** provided essential support, in particular *Vincent Sweeney (Coordinator, GPA, UNEP-DEPI), Birguy Lamizana-Diallo (Programme Officer, GPA), Maite Aldaya (Senior Researcher, UNEP-DTIE), Sonia Valdivia (Secretariat, UNEP/SETAC Life Cycle Initiative), Djaheezah Subratty (Programme Officer, UNEP-DTIE), Mick Wilson (DEWA) Pushpam Kumar (Head, ESE, UNEP-DEPI), Geraldine Deblon (Communication, GPA), Milcah Ndegwa (Communication, FMEB) and Marjorie Nyabuti (Associate Project Officer, GPA).*

We would like also to thank those who provided their valuable time to carry out the external peer review of the report: *Dr Gueladio Cisse (Swiss Tropical and Public Health Institute), Drs. Munir Hanjra and Pay Drechsel (IWMI), Prof. P.S. Minhas (National Institute of Abiotic Stress Management, India), Prof. Ziad Al-Ghazawi (Water Resources and Environmental Engineering Group, Jordan) and Dr Othniel Mintang Yila (Stockholm Environment Institute, Kenya).*

ISBN: **ISBN: 978-92-807-3474-4**
Job Number: **DEP/1938/NA**

Division of Environmental Policy Implementation

Disclaimer

The contents of this publication do not necessarily reflect the views or policies of UNEP or contributory organizations. The designations employed and the presentation do not imply the expressions of any opinion whatsoever on the part of UNEP or contributory organizations concerning the legal status of any country, territory, city or area or of its authority, or concerning the delimitation of its frontiers or boundaries.

Contents

FOREWORD 5

LIST OF FIGURES, TABLES AND BOXES 6

ACRONYMS 8

EXECUTIVE SUMMARY 9

1 INTRODUCTION 10

Purpose of the book **11**

Structure of this book **11**

2 COST OF NO ACTION 14

2.1 Introduction **15**

2.1.1 Impacts of no action 15

2.1.2 Economic analysis 16

2.2 Valuation methodologies **16**

2.2.1 Valuing impacts on human health 16

2.2.2 Valuing impacts on the environment 17

2.2.3 Valuing impacts on economic activities 18

2.3. Empirical applications **19**

2.3.1. Health implications for children in wastewater-irrigated peri-urban area of Aleppo, Syria 19

2.3.2 Impact of industrial wastewater pollution on rice production in Viet Nam 20

2.3.3 Environmental benefits from wastewater treatment in Spain 20

2.3.4 Conclusion regarding cost of no action 22

3 COST OF ACTION 24

3.1 Introduction **25**

3.1.1 Wastewater collection 26

3.1.2 Wastewater treatment 27

3.1.3 Resource recovery and water reuse from wastewater and sludge 27

Contents

3.2. Valuation cost methodologies 29

3.2.1. Valuing internal costs 29

3.2.2 Valuing external costs 29

3.3. Empirical applications 29

3.3.1 Cost on sewerage systems and on-site sanitation 29

3.3.2 Cost of wastewater treatment 34

4 COMPARISON OF COST OF ACTION AND COST OF NO ACTION 42

4.1. Methodology 43

4.2. Comprehensive empirical applications 44

4.2.1 Extensive wastewater treatment: Cost of action vs cost of inaction in a hypothetical case 44

4.2.2. Case study about cost-benefit of wastewater for irrigation in Haroonabad, Pakistan 47

4.2.3. The economics of water reuse projects: some empirical applications 48

4.2.4. Public perception about sanitation, wastewater treatment and water reuse 51

5 CONCLUSION 54

6 RECOMMENDATIONS 56

7 GLOSSARY 58

REFERENCES 62

TABLE ENDNOTES 68

Foreword

Over the years, wastewater has been a source of pollution due to urbanization, growing cities, industrialization and improved material consumption, among other factors. Today, an estimated 80 per cent of global wastewater is being discharged untreated into the world's waterways. This affects the biological diversity of aquatic ecosystems and disrupts the fundamental web of our life support systems, on which a wide range of sectors from urban development to food production and industry depend.

With only 8 per cent of the required capacity to treat wastewater effectively, low-income countries are the hardest hit by contaminated water supplies and resulting impacts: loss of ecosystem services and economic opportunities; climate change aggravation through wastewater-related emissions of methane (CH_4) and nitrous oxide (NO_2); spreading of "Dead Zones" impacting fisheries, livelihoods and the food chain; and health impacts due to waterborne diseases.

Yet, if properly managed, wastewater could be a source of water, energy, fertilizer and other valuable materials and services. Each year, for instance, approximately 330 km^3 of municipal wastewater are generated globally. A recent study showed that resources embedded in this wastewater would be enough to irrigate and fertilize millions of hectares of crops and produce biogas that could supply energy for millions of households.

Adequate wastewater collection, treatment, and safe use or disposal can lead to significant environmental and health benefits. From a business perspective, valuation of the costs of no action in wastewater management is necessary to justify suitable investment in this domain. Economic analysis provides the information needed for public policy decisions that support improvements in wastewater management.

Countries have finalized the next development agenda and endorsed a new set of Sustainable Development Goals (SDGs), which include a goal to ensure sustainable water and sanitation for all. With this in mind, Economic Valuation of Wastewater therefore identifies economic benefits for municipalities associated with wastewater treatment. This book further highlights that including external benefits (environmental and health) in economic feasibility analysis generates positive results for all the evaluated water reuse projects. As illustrated by the successful stories from around the world in this report, investing in wastewater management is economically feasible, and produces benefits of higher value than non-action.

Through the Global Wastewater Initiative and other relevant activities, UNEP is committed to working with all stakeholders to reduce the impacts of untreated wastewater on the environment and to promote it as a valuable resource worthy of investment. This will require cross-sector global collaboration with governments and other agencies to develop effective legislation, innovative financial mechanisms and waste management infrastructure, especially in developing countries. All involved parties may need to digest the findings of this book and consider the benefits of investing in wastewater management from an economic, environmental and social point of view.

ACHIM STEINER
United Nations Under-Secretary-General and
Executive Director, United Nations Environment Programme

LIST OF FIGURES, TABLES AND BOXES

FIGURES:

Figure 1: Schematic of the approach followed to assess the cost of action and the cost of no action for wastewater management. 12

Figure 2: Steps for cost modelling from the collection of the raw data to the generation of the cost functions 25

Figure 3: Operational cost of wastewater treatment per volume treated (€/m3) 35

Figure 4: Operational cost of wastewater treatment per unit of eutrophication reduction (in €/kg PO4 eq. removed) 35

Figure 5: Investment and operating cost in € per people equivalent. 39

Figure 6: Time location of costs of action and avoided benefits for no action. 43

Figure 7: Wastewater, health and human well-being: Investing in water supply and sanitation. 52

TABLES:

Table 1 Examples of potential negative impacts of wastewater on human health, the environment and productive activities 15

Table 2 Reference price of water treated (€/m3) and shadow prices for undesirable outputs (€/kg) 21

Table 3 Estimated shadow prices for undesirable outputs (€/kg) 21

Table 4 Net present value and benefit-cost ratio for CV and SP methodologies 22

Table 5 Costs and benefits associated with wastewater reuse 28

Table 6 Average investment costs (€/m) for sewerage and collector networks in the Walloon Region of Belgium 30

Table 7 Estimated construction costs for pipes, work shafts and manholes for open cut techniques in Taiwan 31