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Development of a Knowledge Based Decision Support System for Private Sector Participation in Water and Sanitation Utilities

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Forschungs- und Entwicklungsinstitut für Industrie- und Siedlungswasserwirtschaft sowie Abfallwirtschaft e.V. Stuttgart (FEI).

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ABSTRACT

This research's message is simple: Governments can turn to the private sector for help in developing and delivering water and sanitation services. Different approaches can be adapted to varying degrees and, when well designed, these arrangements can bring improvements in the quality, availability, and cost-effectiveness of services. These principles apply across time and geography. This research explains the core principles, and demonstrates the practical way to select an option for private sector participation.

The knowledge based decision support system (KB-DSS) is designed for utility managers to use as they begin to look for a private partner. The model will point out which kind of private sector alternative best meets their objectives. It will help them make the critical decision about which type of private sector arrangement to pursue. The model is original and can be used in industrialized countries as well as in developing countries.

This report provides an overview of today's water problems around the world, develops a picture of the international water sector structure and explores the challenges to the public and private sectors. It then describes in detail the impact of private sector participation in all the continents of the world, provides the development of the KB-DSS step-by-step and applies the model to the special cases of a Western European country (Portugal) and an African archipelago (Cape Verde).

ZUSAMMENFASUNG

ABSTRACT

Die Botschaft dieser der vorliegenden Arbeit ist einfach: Regierungen können sich an die Privatwirtschaft wenden, um Hilfe bei der Entwicklung und Bereitstellung von Wasser- und Abwasserdiensten in Anspruch zu nehmen. Verschiedene Vorgehensweisen können in variablen Stufen angewendet werden und diese Regelungen können Verbesserungen bezüglich Qualität, Verfügbarkeit und Kosteneffizienz der Dienste bringen, sofern sie gut ausgearbeitet sind. Diese Prinzipien sind sowohl im Bezug auf Zeit als auch auf die geographische Lage gültig. Diese Arbeit erläutert die wesentlichen Prinzipien and zeigt einen gangbaren Weg zur Auswahl einer Alternative für private sector participation auf.

Das wissensbasierte Entscheidungsunterstützungssystem (KB-DSS) ist für Manager von Versorgungsbetrieben ausgelegt, um von Beginn an Anwendung zu finden, wenn sie nach Partnern in der Privatwirtschaft suchen. Das Modell zeigt auf, welche Alternative im Privatsektor am besten mit ihren Geschäftszielen übereinstimmt. Es wird ihnen helfen, kritische Entscheidungen über die Form der Zusammenarbeit zu fällen. Das Modell ist in seiner Form einzigartig und kann sowohl in Industrienationen als auch in Entwicklungsländer angewendet werden.

Der Bericht gibt einen Überblick über die aktuellen Probleme im Wassersektor weltweit, entwickelt daraus ein Gesamtbild der Struktur des internationalen Wassersektors und untersucht die Herausforderungen für den öffentlichen und privaten Sektor. Er beschreibt dann detailliert die Auswirkung auf die private sector participation auf allen Kontinenten, entwickelt daraus Schritt für Schritt das KB-DSS und wendet das Modell auf ausgewählte Fallbeispiele in Westeuropa (Portugal) und Afrika (Kapverdische Inseln) an.

KAPITEL 1: ÜBER DIESE ARBEIT

Warum diese Forschungsarbeit?

In dieser Arbeit werden die Themen im Zusammenhang mit public sector participation im Wasser- und Abwassersektor weltweit aus dem Blickwinkel eines Ingenieurs betrachtet. Obwohl sie auf akademischen Überlegungen basiert, ist sie für die Anwendung in der Praxis konzipiert. Sie hat zum Ziel, die Privatisierung zu entmystifizieren und die Abhängigkeiten zwischen technischen, finanziellen und Management-Elementen eines Wasser-/Abwasser-Versorgers deutlich zu machen.

Eine klare Gedankenstruktur zur Privatisierung und Fähigkeiten in der Anwendung der Methode des „composite programming" als Richtlinie für private sector participation Entscheidungen sind die Voraussetzungen zum Erfolg. Regierungen, Manager von Versorgungsbetrieben und Ingenieure verstehen private-public partnership nicht immer gut genug. Auf der anderen Seite müssen sie es verstehen, wenn sie ihre Arbeit gut machen und ihre Verantwortung wahrnehmen sollen.

Diese Arbeit erklärt das "knowledge based decision support system" (KB-DSS) Schritt für Schritt. Am wichtigsten dabei ist, dass die bei der Erarbeitung und Anwendung des KB-DSS benutzten key performance indicators detailliert erörtert werden.

Dieses Dokument wird dem geneigten Leser ein besseres Verständnis darüber erschließen, warum:

- die Armen der Welt immer noch ohne sichere Trinkwasser- oder adäquate Abwasser-Versorgung sind;
- Entwicklung, Betrieb und Wartung von Wasserversorgungssystemen traditionell zentral verwaltet wurde
- die meisten Länder Wasser nicht als ein Wirtschaftsgut behandeln;
- Wasser zu billig in den meisten Ländern der Welt ist;
- Wasserversorgungsbetriebe weltweit stark von Subventionen abhängig sind;
- die Wasserindustrie wenige global player hat;
- die großen Wasserkonzerne sich auf ihr Kerngeschäft konzentrieren;
- der Aufbau von public-private partnerships (PPP) komplex und zeitaufwändig ist;
- PPP ÜBergangskosten hoch sind;
- die PPP-Welle nachlässt;
- das französische Modell konkurrenzfähiger ist als das englische;
- Kreativität notwendig ist, um neuen Formen der Zusammenarbeit zwischen öffentlichem und privatem Sektor zu finden;
- Privatisierung in einigen Ländern nicht gewünscht wird;
- es erfolgreiche und erfolglose Fälle von private sector partnership gibt;
- einige Experten glauben, dass Privatisierung den armen Städtern helfen kann und andere absolut widersprechen;
- einige eine globale Wasserkrise befürchten;
- Privatisierung eine sehr polarisierende Wirkung auf Menschen hat;

Es ist erwähnenswert, dass diese Arbeit nicht darauf abzielt, diese polarisierenden Debatten zu unterstützen.

Struktur

Der Bericht ist in 8 Kapitel aufgeteilt. Kapitel 1 stellt die Motivation zur Erstellung der Arbeit dar, beschreibt die Struktur und zeigt auf, wie sich mit dem den interaktiven knowledge based decision support system (KB-DSS Modell) die interaktiven Tabellen erschließen.

Kapitel 2 bis 4 betrachtet analytisch den globalen Wasser- und Abwassersektor und die Herausforderungen für private Beteiligung. Kapitel 2 beginnt mit der Beschreibung der aktuellen weltweiten Wasserproblematik, indem die charakteristischen Eigenschaften des Wassersektors zusammengefasst und die grundlegenden Prinzipien des Wassermanagements untersucht werden. Im Kapitel 3 wird die aktuelle und zukünftige Rolle von private sector participation diskutiert. Es wird dann deutlich, dass Investitionsbedarf der Haupttreiber für Privatisierung ist und es wird aufgezeigt, wie dieWasserindustrie und ihr Markt aufgebaut sind. Kapitel 4 stellt ein Konzept für die public-private partnership vor, erklärt das Vermächtnis des öffentlichen Sektors und die zunehmend wichtigere Rolle des privaten Sektors. Die gesamte Bandbreite der Privatisierungsalternativen wird betrachtet, von Service- und Lease-Verträgen bis hin zum Verkauf von Anlagen. Die Rollen und Verantwortlichkeiten der beteiligten Parteien werden genauso kritisch betrachtet wir das Risikomanagement, Regulierung und Wettbewerb im Markt.

Kapitel 5 hält eine Weltreise zu den Auswirkungen von privatwirtschaftlicher Beteiligung bereit und die Kapitel 6 bis 8 führen den geneigten Leser durch die Konzeption des KB-DSS und seine Anwendung. Kapitel 5 ist geographisch nach sieben Regionen aufgebaut und untersucht deren jeweilige Charakteristik. Kapitel 6 ist der schrittweisen Erklärung gewidmet, mit welcher Methode das KB-DSS entwickelt wurde und es stellt einen Rahmen für seine Anwendung dar.

Kapitel 7 betrachtet zwei Fallstudien detailliert, indem der Hintergrund und die Entwicklung beschrieben wird: es wendet das KB-DSS auf einen städtischen Versorger in Portugal an sowie auf die Privatisierung von Electra, des Energie- und Wasserversorgers der Kapverdischen Inseln. Kapitel 8 beschließt die Arbeit mit Vorschlägen zur Weiterentwicklung des KB-DSS Modells.

Tabellen und Bilder wie z.B. Diagramme und Karten stellen die teilweise komplexen Informationen einfach verständlich dar.

Es ist erwähnenswert, dass diese Arbeit nicht darauf abzielt, die polarisierenden Debatten bezüglich der Privatisierung von Versorgungsbetrieben zu unterstützen.

Interaktives Tabellenblatt

Ein Excel Tabellenblatt mit dem knowledge based decision support system (KB-DSS Modell) stellt der Autor gerne auf Anfrage per E-Mail zur Verfügung: carla.boehl@gmx.de. Das Modell ist anwenderfreundlich und kann in verschiedenen Situationen sowie unterschiedlichen geographischen Orten angewendet werden.
Der Autor übernimmt keine Verantwortung für jedwede Entscheidung, die auf Basis eigener Daten mit Hilfe des Modells getroffen wird.

KAPITEL 2: ÜBERSICHT DER AKTUELLEN PROBLEME IM WASSERMARKT

Der Weltbank zufolge ist das Versagen im erfolgreichen Managen von Wasserressourcen ein weltweites Phänomen (25). Trotz größter Anstrengungen, Wasser- und Abwasserversorgung in den Entwicklungsländern auszubreiten, ist die Mehrheit der Armen der Welt immer noch ohne sichere Trinkwasserversorgung oder angemessene Abwasserentsorgung (25). Einer Milliarde Menschen fehlt der gesicherte Zugang zu Wasser. Über zwei Milliarden Menschen haben keine angemessene Abwasserentsorgung.

KAPITEL 3: DIE STRUKTUR DES INTERNATIONALEN WASSERSEKTORS

Die Rolle des privaten Sektors wird den Erwartungen zufolge wachsen

Wasser- und Abwasseraktivitäten werden typischerweise von staatlichen oder städtischen Unternehmen in fast allen Ländern der Welt kontrolliert. 2005 wurden nur 9% der Weltbevölkerung zu einem gewissen Grad durch private Unternehmen versorgt. Die Schätzungen zeigen, dass der Anteil der privaten Unternehmen weiter wachsen wird und im Jahre 2015 15% der Weltbevölkerung versorgt.

Der weltweite Investitionsbedarf ist ein Treiber der Privatisierung

Die fehlenden Möglichkeiten zu Investitionen -bedingt durch die leeren Kassen vieler Stadtverwaltungen in aller Welt- sind der Hauptgrund für die zunehmende Aktivität von privaten Unternehmen. Die Weltbank schätzt, dass der Mittelbedarf für die grundlegende Wasser- und Abwasserversorgung weltweit im kommenden Jahrzehnt 600-830 Mrd. US-$ betragen wird. Dabei wird ein Wert von 700 Mrd. US-$ als am wahrscheinlichsten angenommen. Ca. 300 Mrd. US-$ müssen dabei von privaten Investoren aufgebracht werden.

Eine Handvoll Player dominiert den privaten Markt

Die Weltwasserindustrie besteht im Grunde genommen aus einer Handvoll großer Firmen oder Konzerne. Diese beziehen einen Teil ihrer Leistungen von einer Reihe von technischen Firmen und Ausrüstungsfirmen. Im wesentlichen dominieren aber sechs Wasserfirmen den privaten Markt.

KAPITEL 4: DIE HERAUSFORDERUNG FÜR DEN ÖFFENTLICHEN UND PRIVATEN SEKTOR

Vorgehensweisen bei der Privatisierung

Verschiedene Herangehensweisen zur Privatisierung wurden entwickelt als Antwort auf die Notwendigkeiten und Rahmenbedingungen von Regierungen, die nach privatwirtschaftlichen Partnern suchen. Die unterschiedlichen Ausgestaltungen stellen eine unterschiedliche Gewichtung der Risikoverteilung und Verantwortlichkeiten zwischen öffentlicher Hand und privatem Investor dar. Dies zeigt sich bezüglich Anlagenbesitz, Rechnungsstellung beim Endkunden, Betrieb und Wartung (O&M) und Kapitalinvest. Im gleichen Maße wie die gewerbliche und finanzielle Verantwortung privater Firmen zunimmt, geschieht dies auch im Bezug auf höhere Regulierungsrisiken; Erfolg erfodert daher ein höheres Commitment von öffentlicher und privater Seite.

Risikomanagement

Interne und externe Risiken sind mit Wasser- und Abwasserprojekten verbunden. Wie diese Risiken verteilt und entschärft werden können, wird den finanziellen Erfolg eines Projektes entscheidend beeinflussen.

Regulierung und Wettbewerb

Eine der größten Herausforderungen, um privates Kapital und Initiative anzuziehen und zu halten, ist es, ein ausgewogenes vertragliches und regulatives Umfeld zur Reduktion von Risiken zu schaffen.

KAPITEL 5: WELTREISE DER AUSWIRKUNGEN VON PRIVATER BETEILIGUNG

Westeuropa

In der Mitte der 70er Jahre begann die Europäische Gemeinschaft (EG, die heutige EU) eine Reihe von Direktiven zur Wasserqualität zu erlassen. In diesem Zusammenhang wurden auch entsprechende Zieldaten zur Erfüllung vorgegeben (54). Durch fehlende Regulierung und Sanktionen jedoch war der Fortschritt in der Erreichung der Umweltziele schwer zu überprüfen (54).

Die Mitgliedsstaaten der Europäischen Union werden noch viele Millionen von Euros ausgeben müssen, um diese EG-Direktiven zu erfüllen.

In Westeuropa unterscheidet sich der Anteil privatisierter Wasser- und Abwasserunternehmen signifikant von Land zu Land.

Zentral- und Osteuropa

Die osteuropäische Wasser- und Abwasserindustrie ist stark fragmentiert mit vielen örtlichen und kleinen regionalen Wasserversorgern, die unabhängig voneinander arbeiten (22). Daher werden die meisten O&M Verträge in großen städtischen Gebieten vergeben (22).

Sub-Sahara Afrika

Die mittelfristige Beurteilung der WHO/UNICEF zum Fortschritt der Wasser- und Abwasserversorgung in Entwicklungsländern (123) zeigt, dass die Sub-Sahara Region Afrikas 2002 die geringste Versorgungsrate aufwies:Im Durchschnitt haben nur 58% der Menschen Zugang zur Frischwasserversorgung. Bei der Abwasserentsorgung sind es gerade noch 36%.

Mittlerer Osten und Nordafrica

Fallende Preise und eine anhaltend starke Nachfrage sind interessante Faktoren für private Beteiligung an der Entsalzungsindustrie am Arabischen Golf. Der technologische Trend ist die „Reverse Osmosis" (RO), da sie durch technischen Fortschritt signifikante Kostensenkungspotenziale aufweist.

Lateinamerika

In Lateinamerika ist es ein Ringen zwischen dem Anliegen der Regierung, teure Wasser und Abwasser Provisionen abzustoßen und der Stärke der Gewerkschaften

(54). Die Wirtschaftskrise in Argentinien hatte Auswirkungen auf die Zahlungsfähigkeit der Verbraucher (54). Brasilien hat niederschlagende Ergebnisse mit seiner politischen „stop-go“ Einstellung zur Privatisierung (54). In Rio de Janeiro gab es Anklagen wegen Korruption und darüber hinaus starke Gegenwehr der Gewerkschaften. Internationale Unternehmen warten auf die Einrichtung eines klaren Regulierungssystems (54). Chiles gutes Regulierungssystem ermöglichte es verschiedenen internationalen Unternehmen, erfolgreich in den Markt einzutreten (54).

Nordamerika

Die USA stellen den größten Markt der Welt für Wasser und Abwasserbehandlung dar (22). Es ist ein dynamischer und schnell wachsender Markt, der die derzeitige Stärke der amerikanischen Wirtschaft widerspiegelt und der durch Regulierungsbehörden und technologischen Wandel vorangetrieben wird (22).

Asien und Pazifik

In der gesamten Region, von Indien bis zu den Philippinen, treiben rasche Industrialisierung und steigende Bevölkerungszahlen das Wachstum großer Städte voran (22). Die daraus resultierende Verschmutzung des Oberflächenwassers und zu starke Nutzung von Grundwasserquellen schaffen schwerwiegende Probleme in der Wasserversorgung in der Region (22).

KAPITEL 6: ENTWICKLUNG DES DEVELOPMENT OF THE KNOWLEDGE BASED DECISION SUPPORT SYSTEM (KB-DSS)

Dieses Kapitel ist wie folgt aufgeteilt: Zunächst stellt es einen Überblick über die Grundlagen der Entscheidungsfindung und Problemlösungdar. Dann werden vorhandene Methoden zur Entscheidungsfindung erörtert und das Konzept eines „decision support systems“ (DSS) und „multiobjective programming“ vorgestellt. Die ausgewählte Methode –composite program-ming– wird dann beschrieben. Es wird erklärt, wie das composite programming benutzt werden kann, um eine Alternative zur private sector participation (PSP) für Wasser- und Abwasserversorger zu bestimmen. Dies schließt die Auswahl von Alternativen – sieben unterschiedliche Herangehensweisen an die PSP– und dieAuswahl der Ziele – ebenfalls sieben, Gründe warum Regierungen private Investoren für den Wassersektor zu gewinnen suchen.

Es wird eine Übersicht über die verfügbaren Indikatoren zur Messung der Leistungsfähigkeit von Wasser- und Abwasserversorgern und zum Benchmark dargestellt. Daraufhin wird die Vorgehensweise zur Auswahl der 36 „key

performance indicators“ (KPIs) diskutiert und der Einfluss, den effizientes Wissensmanagement im Prozess der Entwicklung eines „knowledge based decision support system“ (KB-DSS) haben kann. Schließlich erfolgt die Überführung undGruppierung der KPIs zu den ausgewählten Zielen –getrennt jeweils für Industrienationen und Entwicklungsländer.

Bárdossy (14) hat „compromise programming“ zum „composite programming“ hin weiterentwickelt –eine Methode, die sich mit Problemen hierarchischer Natur beschäftigt (z.B. im Falle, dass gewisse Kriterien eine Anzahl von Unterkriterien haben) (88).

Anwendung des „composite programming” auf die Auswahl einer PSP Herangehensweise

Die Anwendung der Methode des „composite programming” zur Konzeption des „knowledge base decision support system“ (KB-DSS) wird schrittweise erklärt:

Auswahl der Alternativen

Es existieren mehrere Optionen, um private Initiative und Kapital im Wassersektor einzubinden. Weltweite Erfahrungen mit der Beteilgung des privaten Sektors zeigen, dass es nicht das eine Modell gibt, das eindeutig das beste ist; die Eignung einer speziellen Einigung hängt von den Institutionen des Gastgeberlandes und den projektspezifischen Faktoren ab (55). Die im Rahmen dieses KB-DSS betrachteten Alternativen sind sieben der grundlegenden Mechanismen, die zurAbsicherung von PSP angewendet werden:

- Dienstleistungsverträge
- Managementverträge
- Managementverträge mit fixem Entgelt
- Pacht
- “Build-Operate-Transfer” (BOT)
- Konzession
- Anlagenverkauf

Jede dieser unterschiedlichen vertraglichen Formen und deren Eigenheiten werden im Kapitel 4 erläutert.

Auswahl der Zielkriterien

Die Weltbank (124) erklärt, dass Regierungen, die den privaten Sektor in Wasser und Abwasser involvieren wollen, generell eine oder mehrere Zielsetzungen damit verfolgen:

- um technische Expertise, Managementerfahrung und neue Technologien in den Sektor einzubringen;
- zur Verbesserung der wirtschaftlichen Effizienz im Sektor –sowohl in der operativen Leistungsfähigkeit als auch beim Kapitalinvestment;
- um Investitionsgelder im großen Stil in den Sektor zu pumpen oder Zugang zum privaten Kapitalmarkt zu erhalten;
- um die öffentlichen Subventionen für den Wassersektor zu reduzieren oder um die Subventionen auf die heute nicht oder nur schwach unterstützten Gruppen umzulenken;
- um den Wassersektor von kurzfristiger politischer Intervention abzuschirmen und die Möglichkeiten mächtiger Interessengruppen zu limitieren;
- um die Wasserversorgung starker auf die Bedürfnisse und Präferenzen der Verbraucher auszurichten.

Obwohl diese üblichen Ziele notwendigerweise vereinfacht sind und viele komplexe Themen komprimieren, wird für das KB-DSS folgende Auswahl getroffen:

- O1. Technische Expertise
- O2. Betriebseffizienz
- O3. Kundenorientierung
- O4. Wirtschaftliche Effizienz
- O5. Investition
- O6. Managementerfahrung
- O7. Abschirmung von politischer Einmischung

Jedes dieser Ziele wird durch mehrere KPIs definiert.

Auswahl der key performance indicators (KPIs)

Für dieses KB-DSS wurde ein top-down Ansatz zur Auswahl der KPIs für jedes Zielkriterium verwendet.

Dieser Abschnitt beinhaltet die Rechtferigung und den potenziellen Einfluss auf die sieben ausgewählten Zielkriterien. Anschließend folgt eine Erklärung der verwendeten KPIs, die zur Bewertung jedes Zielkriteriums herangezogen wurden. Jedes der Zielkriterien wird auf Basis einer Bandbreite von drei (Minimum) bis acht (Maximum) KPIs bewertet. Insgesamt handelt es sich um 36 KPIs.

Wissensmanagement

Das Zusammentragen des internen und externen KnowHows (Daten, Informationen), das für die Berechnung der KPIs notwendig ist, ist sehr aufwendig.

Jeder Wasser- und Abwasserversorger hat seine eigenen Wissensmanagement Mechanismen und deren Effizienz schlägt sich direkt in der Qualität der Daten und der benötigten Zeit für deren Suche und Auswertung nieder. Der größte Vorteil eines effizienten Wissensmanagements ist, dass es zu einem umfassenden Verständnis über die Praktiken eines Versorgers führt. Es erlaubt eine rasche Identifikation der Prozesse (und konsequenterweise eine stetige Verbesserung) und ist die Basis für herausragende Benchmarkergebnisse. Für dieses KB-DSS wurden vier Hauptwissensgebiete identifiziert: Wasser- und Abwasserservice (physikalisch), Personal, Geschäftsumfeld und Finanzen.

Gruppierung, Gewichtung und Kompensationsfaktoren

Die hierarchische Struktur in den kaskadierten Ebenen der Gruppen ist in der weiter unten folgenden Tabelle dargestellt, deren Struktur, Gewichtungen (α) und Kompensationsfaktoren (p) in den Leveln 4 bis 1 zunächst erklärt wird. Dabei ist zu berücksichtigen, dass Werte von p>1 eine abnehmende Kompensierbarkeit dieses Kriteriums darstellen.

Level 4

Der Kompensationsfaktor (p) für die Gesamtbewertung –Level 4– der drei kapazitiven Elemente –Technik, Finanzen und Management- ist 3, weil sie sich nur teilweise gegenseitig kompensieren können.

Level 3

Die technische Kapazität beschreibt die physikalische und operationale Fähigkeit eines Wasser- und Abwassersystems, die industrieüblichen und regulatorischen KPIs zu erreichen. Dies beinhaltet die Angemessenheit der physikalischen Infrastruktur und den technischen Wissensstand.

Der Gewichtungsfaktor der technischen Kapazität auf Level 4 ist 35%, weil in diesem KB-DSS die Managementfähigkeiten als eine eher sich entwickelnde Zielgröße verstanden werden.

Diese Gruppe berücksichtigt die Indikatoren der folgenden drei Zielkriterien:

- Technische Expertise
- Betriebseffizienz
- Kundenorientierung

Die Gewichtungen liegen entsprechend bei 20%, 30% und 50%. Dieses KB-DSS versucht den Fokus auf die Kundenorientierung der Wasser- und Abwasserversorger zu legen. Der Kompensationsfaktor ist 2, weil die Gruppenziele gegenseitig teilweise kompensiert werden können, Beispielsweise kann gute technische Expertise bis zu einem gewissen Grad schlechte Betriebseffizienz kompensieren und umgekehrt.

Finanzielle Kapazität ist die Fähigkeit eines Wasser- und Abwasserversorgers, finanzielle Mittel zu akquirieren und damit zu haushalten, so dass die industrieüblichen und regulatorischen KPIs erreicht werden können.

Der Gewichtungsfaktor auf Ebene 4 ist 25%, weil für dieses KB-DSS das Finanzmanagement direkt nach den Management- und technischen Fähigkeiten folgt.

Die Gruppe der finanziellen Möglichkeiten berücksichtigt die Indikatoren der folgenden beiden Zielkriterien:

- Wirtschaftliche Effizienz
- Investition

Die Gewichtungen sind 40% bzw. 60%, da Investitionen regelmäßig der Hauptgrund für eine mögliche Beteiligung des privaten Sektors sind. Der Kompensationsfaktor ist 1, weil die Indikatoren sich gegenseitig kompensieren können, d.h. gute wirtschaftliche Effizienz kann zu einem guten Teil fehlende Investitionen kompensieren und umgekehrt.

Managementfähigkeit ist die Fähigkeit eines Wasser- und Abwasserversorgers, seine Aktivitäten so fortzuführen, dass das System dazu befähigt wird, industrieweite und regulatorische KPIs zu erreichen und diesen Stand zu erhalten.

Der Gewichtungsfaktor auf Ebene 4 ist 40%, weil für dieses KB-DSS die Managementfähigkeit als das zentrale Element für nachhaltige Wasserwirtschaft gesehen wird.

Die Managementfähigkeiten berücksichtigen die Indikatoren der folgenden beiden Zielkriterien:

- Managementerfahrung
- Abschirmung von politischer Intervention

Die Gewichtung ist in beiden Fällen 50%. Der Kompensationsfaktor beträgt 4, weil eine Kompensation nicht zu erwarten ist. D.h. gute Managementerfahrung kann nur sehr begrenzt politische Interventionen kompensieren. Andererseits kann positiver politischer Einfluss nur teilweise schlechtes Management kompensieren, welches häufig darin endet, dass die Gemeinde durch Subventionen den Verlust trägt. Dies mag auf die kurze Frist gesehen helfen, löst aber nicht das Problem.

Level 2 und Level 1

O1. Technische Expertise

Das Zielkriterium technische Expertise berücksichtigt auf Level 2 eine Untermenge von 2 Indikatoren und einen weiteren separaten Indikator:

- Nachfrage Management
    - Verluste zwischen Quelle und Verteilung
    - Verluste zwischen Verteilung und Konsument
- Abwasserbehandlung

Die Gewichtungen sind 70% bzw. 30%, weil der Erhalt und Ausbau des Netzwerks regelmäßig Anlass für mögliche Privatinvestitionen geben. Abwasserbehandlung ist bereits ein Gebiet, auf dem die Privatwirtschaft verstärkt aktiv ist. Dies geschieht aus verschiedenen Gründen, vor allem aber weil der Risikofaktor relativ gering ist. Der Kompensationsfaktor beträgt 3, weil die Indikatoren sich nur teilweise gegenseitig kompensieren können.

Die Untermenge des Nachfrage Management hat einen Kompensationsfaktor von 1, weil die Indikatoren sich vollständig gegenseitig kompensieren können. Der erste Indikator hat dabei eine Gewichtung von 40%, der zweite von 60%.

O2. Betriebseffizienz

Das Zielkriterium Betriebseffizienz berücksichtigt eine Untermenge von zwei Indikatoren und zwei separate Indikatoren:

- Wasserverluste ("Unaccounted-for-Water")
- Performance
    - Wasser Beschwerden
    - Abwasser Beschwerden
- Wasserqualität

Die Gewichtungsfaktoren betragen 50% für die berühmten Wasserverluste, 30% für die Performance und ihre Untermenge sowie 20% für die Wasserqualität. Der Kompensationsfaktor für dieses Zielkriterium beträgt 4, wie die Kompensation der Untermenge durch die beiden separaten Indikatoren nicht sehr wahrscheinlich ist und umgekehrt.

Die Untermenge zur Performance des Wasser- und Abwasserversorgers hat einen Kompensationsfaktor von 1, weil die Kundenbeschwerden häufig miteinander zusammenhängen. Die Gewichtung beträgt 50% für beide Beschwerdearten.

O3. Kundenorientierung

Das Zielkriterium Kundenorientierung berücksichtigt zwei Untermengen of je 2 bzw. 3 Indikatoren:

- Versorgung
    - Wasserversorgung
    - Kanalisation
- Servicequalität
    - Stetigkeit des Services
    - Ausfälle
    - Verbindungsverzögerungen

Die Gewichtungen der Untermengen sind 40% bzw. 60%. Eine verbesserte Versorgung ist ebenfalls häufig der Hauptgrund für eine mögliche Beteiligung des privaten Sektors. Dieses KB-DSS legt trotzdem ein höheres Gewicht auf die Servicequalität. Der Kompensationsfaktor dieses Zielkriteriums ist 1, weil die Indikatoren sich gegenseitig kompensieren können.

Die Indikatoren der Untermenge Versorgung sind mit je 50% gleich gewichtet. Der Kompensationsfaktor beträgt 2, weil die Kanalisation normalerweise nicht existieren würde, wäre nicht die Wasserversorgung zuerst existent.

Die Indikatoren der Untermenge Servicequalität sind mit 70%, 20% und 10% gewichtet. Die Verbindungsverzögerungen haben das geringste Gewicht, da trotz seiner Tauglichkeit als Indikator die beiden anderen im Alltag die bedeutendere Rolle spielen. Der Kompensationsfaktor ist 3, weil die Indikatoren sich nur bis zu einem gewissen Grad gegenseitig kompensieren können.

O4. Wirtschaftliche Effizienz

Das Zielkriterium wirtschaftliche Effizienz berücksichtigt zwei Untermengen mit jeweils zwei Indikatoren:

- Rechnungsstellung und Inkasso
    - Tarife
    - Umsätze
    - Abrechnungszeitraum
- Finanzielle Kennzahlen
    - Kosten-Umsatz-Verhältnis
    - Schuldendienstquote

Beide Untermengen sind mit 50% gleichgewichtet, weil die beteiligten Indikatoren eine gute ökonomische Aussagekraft besitzen. Der Kompensationsfaktor für dieses Zielkriterium beträgt 3, weil sie sich nur teilweise gegenseitig kompensieren können.

Die Indikatoren der Untermenge Rechnunsstellung und Inkasso sind mit 40%, 30% und 30% gewichtet. Der Kompensationsfaktor ist 3.

Die Indikatoren der Untermenge finanzeller Kennzahlen haben eine Gewichtung von 60% bzw. 40%. Der Kompensationsfaktor beträgt 1.

O5. Investition

Das Zielkriterium Investition betrachtet drei Indikatoren, ohne dafür Untermengen zu bilden:

- Investitionen
- Anlagevermögen
- Finanzierung

Die Gewichtung beträgt 50%, 40% und 10%, weil Investitionen der Schlüssel zu guter Performance sind. Die Finanzierung repräsentiert die Solvenzkennzahl, die in diesem KB-DSS keine größere Rolle spielt.

Der Kompensationsfaktor beträgt 2, weil die Indikatoren sich teilweise gegenseitig kompensieren können, z.B. kann ein hohes Anlagevermögen ein niedrigeres Niveau von Investitionen kompensieren.

O6. Managementerfahrung

Das Zielkriterium Managementerfahrung berücksichtigt einen unabhängigen Indikator und zwei Untermengen von drei bzw. vier Indikatoren:

- Messbarkeit
- Mitarbeiter & Kosten
    - Betriebskosten
    - Mitarbeiter/Einwohner
    - Arbeitskosten
- Personalmanagement
    - Qualifikation und Ausbildung
    - Arbeitsregulierung
    - Abwesenheit von der Arbeit
    - Schulung

Die Gewichtung des unabhängigen Indikators ist 20%. Die Gewichtung der Untermengen ist 30% bzw. 50%. Dieses KB-DSS legt also einen höheren Wert auf das Personalmanagement. Der Kompensationsfaktor für dieses Zielkriterium ist 6, weil die Kompensation des unabhängigen Indikators durch eine oder beide Untermengen äußerst unwahrscheinlich ist. Als Beispiel kann angeführt werden, dass schwache Qualifikation und ein geringer Ausbildungsstand nicht zu einer guten Ablesepraxis führen.

Die Indikatoren der Untermenge Mitarbeiter und Kosten werden mit 40%, 30% und 30% gewichtet. Der Kompensationsfaktor beträgt 6, aus den oben genannten Gründen.

Die Indikatoren der Untermenge Personalmanagement haben die Gewichtungen 30%, 10%, 25% und 35%. Der Indikator zur Arbeitsregulierung ist am schwächsten gewichtet, weil er den Managern keine Wahlfreiheit zulässt; er ist durch die Region oder den Staat determiniert. Der Kompensationsfaktor beträgt 7, weil die Indikatoren sich nicht gegenseitig kompensieren können. Als Beispiel sei angeführt, dass geringe Fehlzeiten nicht fehlende Schulung kompensieren können, genauso wenig wie eine hohe Teilnahme an Schulungen die Abwesenheiten von der Arbeit nicht aufzufangen vermögen.

O7. Abschirmung von politischer Einmischung

Das Zielkriterium Abschirmung von politischer Einflussnahme berücksichtigt vier unabhängige Indikatoren und zwei Untermengen von jeweils zwei Indikatoren:

- Bekleidung politischer Ämter
- Korruption
- Bürokratie
    - Regulierungsanforderungen
    - Lizenzen und Genehmigungen
- Rankings
    - Wettbewerbsfähigkeit
    - Wirtschaftliche Freiheit
- Kriminalität
- Capacity building

Die Gewichtung der Untermenge Rankings beträgt 20% und die Gewichtung des capacity building beträgt 40%. Alle anderen sind mit 10% gleich gewichtet. Capacity building ist ein höchst modischer Begriff und wird im Rahmen dieses KB-DSS so hoch bewertet, weil es seinen Wert bewiesen hat. Der Kompensationsfaktor für dieses Zielkriterium beträgt 3, weil schlechte Performance eines oder mehrerer Indikatoren nicht auf eine generell schlechte Performance schließen lässt. Es gibt Beispiele in Entwicklungsländern, in denen trotz hoher Kriminalität, Bürokratie und Korruption mit Hilfe von capacity building die Performance der Wasser- und Abwasserversorger besser wurde.

Die Indikatoren der Untermenge Bürokratie sind mit 50% gleich gewichtet. Der Kompensationsfaktor beträgt 1, weil sie sich theoretisch gegenseitig kompensieren können.

Die Indikatoren der Untermenge Rankings sind mit 30% bzw. 70% gewichtet. Der Kompensationsfaktor beträgt 2, weil Wettbewerbsfähigkeit teilweise die wirtschaftliche Freiheit kompensieren kann und umgekehrt.

Gruppierung, Gewichtung und Kompensationsfaktoren

KPI	α	p	Ebene 1	α	p	Ebene 2	α	p	Ebene 3	α	p	Level 4
1	0,40	1	Nachfrage	0,70	3	Technische Expertise	0,20	2	Tech-nische Kapazität	0,35	3	Gesamt-bewertung
2	0,60											
3				0,30								
4				0,50	4	Betriebs-effizienz	0,30					
5	0,50	1	Performance	0,30								
6	0,50											
7				0,20								
8	0,50	2	Versorgung	0,40	1	Kunden-orientierung	0,5					
9	0,50											
10	0,70	3	Service-qualität	0,60								
11	0,20											
12	0,10											
13	0,40	3	Rechnungs-stellung und Inkasso	0,50	3	Wirtschaftliche Effizienz	0,40	1	Finanzielle Kapazität	0,25		
14	0,30											
15	0,30											
16	0,60	1	Finanzielle Kennzahlen	0,50								
17	0,40											
18				0,50	2	Investition	0,60					
19				0,40								
20				0,10								
21				0,20	6	Management-erfahrung	0,50	4	Manage-ment Kapazität	0,4		
22	0,40	6	Mitarbeiter & Kosten	0,30								
23	0,30											
24	0,30											
25	0,30	7	Personal-management	0,50								
26	0,10											
27	0,25											
28	0,35											
29				0,10	3	Abschirmung von politischer Einmischung	0,50					
30				0,10								
31	0,50	1	Bürokratie	0,10								
32	0,50											
33	0,30	2	Rankings	0,20								
34	0,70											
35				0,10								
36				0,40								

KAPITEL 7: ANWENDUNG DES KB-DSS AUF FALLSTUDIEN

Dieses Kapitel beschreibt die Anwendung des vorgestellten KB-DSS auf eine Industrienation und ein Entwicklungsland. In beiden Fällen wird das KB-DSS vor und nach dem Markteintritt von privaten Investoren simuliert:

- Die ausgewählte Industrienation ist Portugal als ein westeuropäisches Land und seit 1986 Mitglied der Europäischen Union. Der Wasserver- und Abwasserentsorger, der als Gegenstand der Untersuchung dient ist ein städtisches Unternehmen und heißt *Serviços Municipalizados de Saneamento Básico de Viana do Castelo* (SMSBVC). Das KB-DSS Modell wird angewendet vor und nach Abschluss der 30-Jahres Konzession, die zur Gründung des regionalen Unternehmens *Águas do Minho e Lima* (ADML) führte. ADML ist eine Tochtergesellschaft der *Águas de Portugal* (AdP) und arbeitet „*em alta*" – bis zur Distribution an den Endverbraucher, die weiterhin von den Gemeinden selbst durchgeführt wird– in der Region Minho-Lima und schließt die Stadt Viana do Castelo ein, in der auch der Firmensitz ist.
- Die Kapverdischen Inseln, 450km vor der afrikanischen Küste mitten im Atlantischen Ozean gelegene zehn Inseln und fünf kleine Inseln sind das Land der Fallstudie zu Entwicklungsländern. Das KB-DSS wird vor und nach Abschluss einer 36-Jahres Konzession an Electra –einem lokalen Wasser- und Energieversorger– angewendet. Electra ist heute eine internationale Tochter von *Energias de Portugal* und *Águas de Portugal* (EDP/AdP).

Wenn man die Minho-Lima Konzession und die Konzession auf den Kapverdischen Inseln im Vergleich nebeneinander stellt, ist es aufschlussreich zu sehen, wie die beiden Fälle sehr unterschiedliche Vorgehensweisen bei der Beteiligung des privaten Sektors durch ein und dieselbe Firma wiederspiegeln.

Zur Darstellung der Themen der städtischen Wasser- und Abwasserversorgung von Viana do Castelo ist dieser Abschnitt wie folgt aufgeteilt: Es beginnt mit einem Rückblick auf die Hauptströmungen im portugiesischen Wassersektor und mit der Betrachtung des derzeit den portugiesischen Wassermarkt dominierenden öffentlichen Unternehmens Águas de Portugal (AdP) SGPS, SA. Die Region Minho-Lima und ihre wirtschaftliche und institutionelle Charakteristik werden dargestellt. Die Konzession, die die Basis für die Gründung der in der Region operierenden Tochtergesellschaft der ADP (die ADML) darstellt, und deren Zielsetzungen werden kritisch betrachtet. Das staatliche Unternehmen als Gegenstand dieser Fallstudie, die Municipalized Services of Viana do Castelo (SMSBVC) wird untersucht und das KB-DSS Modell wird für die Jahre 1998 und 2003 angewendet. Alle verwendeten Daten und Ergebnisse werden im Rahmen der Arbeit vorgestellt und wurden eingehend analysiert. Abschließend wird die Leistungsfähigkeit von SMSBVC unter Berücksichtigung des Einflusses durch das Investment von ADML untersucht.

Der folgende Abschnitt dient einem Überblick über die Kapverdischen Inseln und ihrer wirtschaftlichen und institutionellen Charakteristik in der Wasser- und Abwasserversorgung. Der Prozess der Privatisierung von Electra –des Energie- und Wasserunternehmens– wird eingehend betrachtet. Das KB-DSS Modell findet Anwendung für die Jahre 1998 und 2003 –vor und nach Electras Übernahme. Obwohl die Schlussfolgerungen in einer noch jungen Konzession noch unreif sein mögen, können einige Lehren für die erfolgreiche Beteiligung privater Firmen aus der Fallstudie der Kapverdischen Inseln gezogen werden.

Zusammenfassend lässt sich sagen, dass sich die Situation in Viana do Castelo im Jahre 2003 verbessert hat –nach der Gründung einer regionalen Firma ADML und den entsprechenden riesigen Investitionen in der Region. Die SMSBVC wurde verantwortlich für die *„em baixa“* Services –die Distribution von Wasser an die Haushalte– und ADML für die *„em alta“* Services –der Aufbau und die Verfügbarkeit von Infrastruktur für den Wassertransport und die Errichtung und den Betrieb von Abwasserreinigungsanlagen.

Die Hauplehre aus den Erfahrungen der Kapverdischen Inseln ist schließlich, dass trotz der Anstrengungen der Regierung zur Erhöhung der Preise vor der Privatisierung, weiterhin noch keine Bereitschaft existiert, für die Wasser- und Abwasserversorgung zu bezahlen. Dies ist ein Haupthinderungsgrund für den Erfolg von Privatbeteiligungen auf den Kapverden. Öffentliche Einrichtungen selbst –Staat, institutionalisierte Services und Gemeinden– häufen offene Rechnungen bei Electra an. Die privaten Haushalte sind nicht bereit, höhere Preise zu bezahlen und stehen für 46% der offenen Forderungen.

KAPITEL 8: AUSBLICK

Das vorgestellte wissensbasierte Entscheidungsunterstützungssystem (KB-DSS) zeigt auf, welche Form der Zusammenarbeit ausgewählt werden sollte, um den lokalen Bedürfnissen in Industrienationen und Entwicklungsländern zu entsprechen. Jedoch können die Ergebnisse stets nur so gut sein wie Qualität der in die Wissensbasis übertragenen Daten. Je umfassender die Informationen über einen Wasser- und Abwasserversorger und sein wirtschaftliches Umfeld sind, desto genauer und aussagekräftiger werden auch die Resultate sein. Die Stärken des KB-DSS liegen in der Analyse der Zielkriterien und der Identifikation der Bedeutung von Problemen anhand der gewählten „key performance indicators“ KPIs zu den jeweiligen Zielkriterien sowie schlussendlich zu den drei Kapazitäten –Management, Technik und Finanzen. Die Auswahl eines konkreten vertraglichen Ausgestaltung für eine „public private partnership“ ist zweitrangig gegenüber dem Verständnis der kritischen Themen eines Wasser- und Abwasserversorgers.

Die für dieses KB-DSS verwendeten KPIs können quantifizierbar sein oder auch nicht. Der Vorteil des „composite programming“ liegt darin, dass durch die Transformation alle KPIs mit einem Wert zwischen 0 und 1 belegt werden. Der Zielwert eines nicht-quantifizierbaren KPI wird mit 1 bezeichnet und der am wenigsten akzeptable Wert mit 0. Dies ist zum Beispiel mit dem letzten ausgewählten KPI des vorliegenden KB-DSS geschehen, dem Kapazitätsaufbau.

Das KB-DSS stellt ein hilfreiches Tool für Manager von Versorgungsbetrieben dar, um ihre aktuelle Situation zu analysieren, ihre Probleme zu identifizieren und –durch Benchmarking– einen Hinweis auf die Bedeutung dieser Probleme zu erhalten.

Ein weiterer Vorteil dieses KB-DSS ist, dass die Gruppierung, Gewichtung und die Auswahl von Kompensationsfaktoren zusammen von verschiedenen Interessensvertretern durchgeführt werden. Diese dadurch in einer frühen Phase getroffene Vereinbarung bzw. Kompromiss über die Prioritäten kann viele Probleme nach der Privatisierung vermeiden helfen.

Weiterer Forschungsbedarf und
Empfehlungen für die Verbesserung des erarbeiteten KB-DSS

- Die Auswahl der „key performance indicators” könnte auf eine detailliertere Ebene ausgedehnt werden, um detailliertere Betrachtungen zu ermöglichen –die International Water Association listet über 200 performance indicators auf– obwohl dadurch die Arbeit mit den interaktiven Tabellenblättern komplex werden und eine spezielle Software notwendig werden könnte. Auf der anderen Seite könnte die Liste der KPIs auch kürzer gestaltet werden, um den Informationsbeschaffungsprozess weniger aufwendig zu gestalten. Auch muss man feststellen, dass Versorgungsbetriebe generell kein zeitgemäßes Wissensmanagement betreiben und Anfragen häufig von einer Person zur nächsten und von einer Abteilung zur nächsten gegeben werden, ohne je beantwortet zu werden.
- Der Benchmarking Prozess und die Wahl von Ziel- und Mindestakzeptanzwerten könnte noch exakter verlaufen oder noch beschränkender. Dies würde erfordern, dass weiterhin intensiv in speziellen technischen, finanziellen oder Management-Publikationen geforscht würde.
- Die Auswahl der Alternativen könnte erweitert werden (oder einfach eine andere Auswahl sein), da die Anzahl an Optionen für den privaten Sektor auf sieben beschränkt ist. Hier gibt es eine große Bandbreite an Forschungsbedarf. Zum Beispiel die sogenannten Dreier-Partnerschaften zwischen dem privaten Sektor, der öffentlichen Hand und Nicht-Regierungsorganisationen (NGO) oder Spender

oder Investor scheinen immer attraktivere Optionen in Entwicklungsländern zu werden. Dies ist noch nicht ausreichend dokumentiert.

- Die sieben Zielkriterien, die diesem KB-DSS zugrunde liegen folgen einem Muster der Weltbank. Forschung zu diesem speziellen Thema könnte sehr wertvoll sein.
- Die Transformationsmatrix, die zur Quantifizierung der Kundenorientierung des ausgewählten Arrangements dient, basiert ebenfalls auf einer Struktur der Weltbank. Tiefergehende Forschung ob der Möglichkeiten des privaten Sektors die Wasser- und Abwasserversorger zu treffen, stellt einen herausragenden Mehrwert dar.
- Ein System zur einfachen Aktualisierung der Datenbasis des KB-DSS und zur vereinfachten Berechnung der nächsten Jahre wäre hervorragend.
- Die Entwicklung eines KB-DSS auf Basis der „fuzzy composite programming"-Methode könnte noch genauerer Ergebnisse liefern.
- Dieses KB-DSS wurde für die Anwendung bezüglich einer Regierung konzipiert (national oder regional, je nach Bedarf). Es könnte für die Verwendung in der Privatwirtschaft adaptiert werden –die Zielkriterien wäre dann allerdings unterschiedlich.

In der Zusammenfassung stellt das in dieser Arbeit entwickelte wissenbasierte Entscheidungsunterstützungssystem (KB-DSS) eine standardisierte Vorgehensweise dar, um Probleme von Wasser- und Abwasserversorgern zu analysieren. Seine Einfachheit in der Anwendung macht es attraktiv und erlaubt es dem Anwender, ein breites Verständnis der tatsächlichen Situation eines betrachteten Versorgungsbetriebs zu gewinnen –aus einem technischen, einem finanziellen und einem Management-Blickwinkel.

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ADML	*Águas do Minho e Lima*
AdP	*Águas de Portugal*
AfDB	African Development Bank
BOO	Build-Own-Operate
BOOT	Build-Own-Operate-Transfer
BOT	Build-Operate-Transfer
CPI	Corruption Perceptions Index
DBFO	Design-Build-Finance-Operate
DSS	Decision Support System
EBIT	Earnings before Interest and Tax
EBRD	European Bank for Reconstruction and Development
EDP	*Energias de Portugal*
EIB	European Investment Bank
EU	European Union
EUR	Euros
FDI	Foreign Direct Investment
FTE	Full time employees
GCI	Growth Competitiveness Index
GDP	Gross Domestic Product
IADB	Inter-American Development Bank
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFC	International Finance Corporation
IFI	International Financial Institutions
ISPA	Instrument for Structural Policies for Pre-Accession
IWRM	Integrated Water Resources Management
KB-DSS	Knowledge based decision support system
KPI	Key Performance Indicator
MDG	Millennium Development Goals
MENA	Middle East and North Africa
MIGA	Multilateral Investment Guarantee Agency
NGO	Non-Governmental Organization
ODA	Overseas Development Assistance
O&M	Operation and maintenance
PPP	Public-private partnerships
PSP	Public sector participation
REI	Rigidity of Employment Index
RO	Reverse Osmosis

ROE	Return on equity
SMSBVC	Municipalized Services of Viana do Castelo
UFW	Unaccounted for water
USD	United States Dollar
UWWT	Urban Wastewater Treatment Directive
WB	World Bank
WFD	Water Framework Directive

LIST OF SYMBOLS

A_i	Alternative
J_i	Indicator
$n_{I,j}$	Normalized value
$z_{I,j}$	Indicator value
w_j	Worse value
b_j	Best value
α_j	Weighting factor
p_i	Compensation factor within groups

CHAPTER 1

ABOUT THIS DOCUMENT

1.1 Why this research

In this research, the issues related to public sector participation in the water and sanitation sector across the world are seen through the lens of a professional engineer. This is reflected in the nature of the research. While it draws on academic thinking, its purpose is practical application. It aims to demystify privatization and to clarify the linkages between the technical, financial and managerial elements of a water and sanitation utility.

Clear thinking about privatization and skill in using the method of composite programming to guide private sector participation decisions are prerequisites for success. Governments, utility managers and engineers alike do not always understand private-public partnerships well enough. But they must understand it if they are to do their job well and fulfill their responsibilities.

In this research, the knowledge based decision support system (KB-DSS) is explained step-by-step. Most important, the key performance indicators involved in developing and using the KB-DSS are discussed in detail.

This document will help its readers better understand why:

- The world's poor are still without safe drinking water or adequate sanitation services;
- Centralized administration has traditionally developed, operated and maintained water systems;
- Most countries do not treat water as an economic good;
- Water is under-priced in most countries of the world;
- Utilities worldwide are heavily dependent on subsidies;
- The water industry has few global players;
- The water giants are concentrating on their core businesses;
- Establishing public-private partnerships (PPP) is complex and time consuming;
- PPP transaction costs are high;
- The PPP wave is breaking down;
- The asset-lite French model is more competitive than the asset heavy English model;
- Creativity is needed to find new types of arrangements between the public and the private sector;

- Privatization is not welcome in some countries;
- There are successful and unsuccessful cases of private sector partnership;
- Some experts believe privatization can help the urban poor and others absolutely disagree;
- Some fear a global water crisis;
- Some appear to strike up distinctly pro- or anti- positions around privatization.

It is worth noting that this research does not aim to support polarized debates on the wider and contentious issues around private sector participation.

1.2 Structure

This report is organized in eight chapters. Chapter 1 exposes the motivation for this research, describes the report's structure and indicates how to access the interactive spreadsheets with the knowledge based decision support system (KB-DSS model).

Chapters 2 through 4 – analytically review the global water and sanitation sector and the challenges to private participation. Chapter 2 begins by describing today's water problems around the world, summarizing the unique features of the water sector and examining the basic principles of water governance and management. In Chapter 3, the current and forecast role of private sector participation is discussed. It then makes the case that investment need is a major driver for privatization and explains how the industry and its markets are structured. Chapter 4 provides the concept of public-private partnership, explains the legacy of the public sector and the expanding role of the private sector. The full range of privatization options is examined, from service and lease contracts to sale of assets. The roles and responsibilities of the stakeholders are reviewed, as well as risk management, regulation and competition in the sector.

Chapter 5 provides a world tour on impacts of private sector participation and Chapters 6 through 8 will guide the reader through the KB-DSS design and use. Chapter 5 is arranged geographically in seven regions and examines their characteristics. Chapter 6 is devoted to explain step-by-step the methodology used to develop the KB-DSS and it provides a framework for using it.

Chapter 7 considers two case studies in depth, describing the background and evolution: it applies the KB-DSS to a municipally owned utility in Portugal and to the privatization of Electra, the power and water utility of Cape Verde. Chapter 8 concludes the report with recommendations to improve the developed KB-DSS model.

Tables and figures such as diagrams and maps present the sometimes complex information in an easy to understand format.

1.3 Interactive spreadsheet

An Excel spreadsheet with the knowledge based decision support system (KB-DSS model) is available upon request to the author by e-mail: carla.boehl@gmx.de

The model is user-friendly and can be used in a variety of situations and geographical locations.

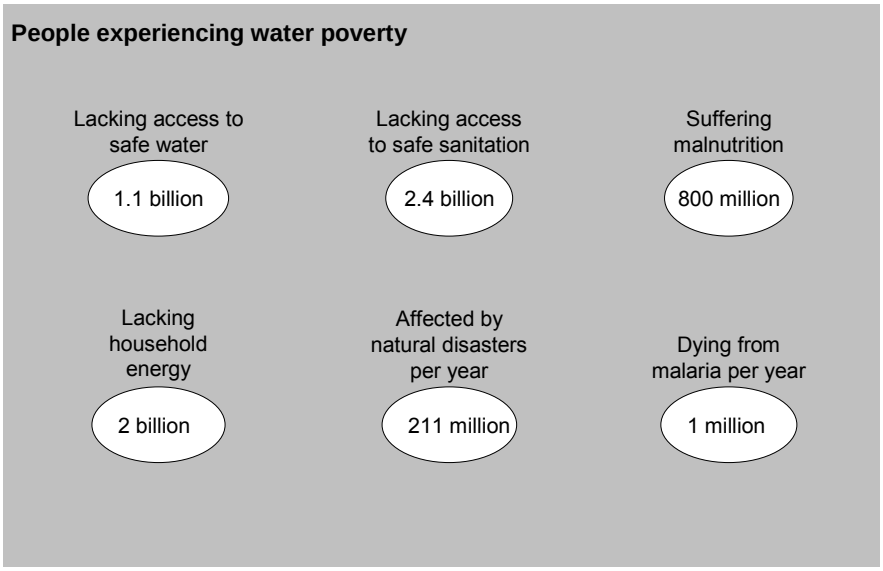
The author accepts no responsibility for any decisions based on your inputs to the model.

CHAPTER 2

OVERVIEW OF TODAY'S WATER PROBLEMS

2.1 Multiple burdens of water poverty

According to the World Bank, there is a worldwide failure to manage water resources properly (25). Despite major efforts to extend water and sanitation throughout developing countries, the majority of the world's poor are still without safe drinking water or adequate sanitation services (25). One billion people lack access to safe water. Over two billion do not have adequate sanitation (see Figure 2.1).



Source: WWAP (2003)

Figure 2.1 Multiple burdens of water poverty

2.2 Progress in water and sanitation coverage

In 1980 The United Nations launched its Water Supply and Sanitation Decade, and during that time a 100 billion dollar was spent on infrastructure projects worldwide (22). At the end of the decade, though, these projects were little more than a drop in the ocean (22).

In 2002, only 58 percent of the Sub-Saharan African households had access to water (123) and 36 percent to sanitation services (see Figures 2.2 and 2.3). In South Asia, the

figures for water coverage are 80 percent, but only 37 percent in terms of sanitation coverage (123).

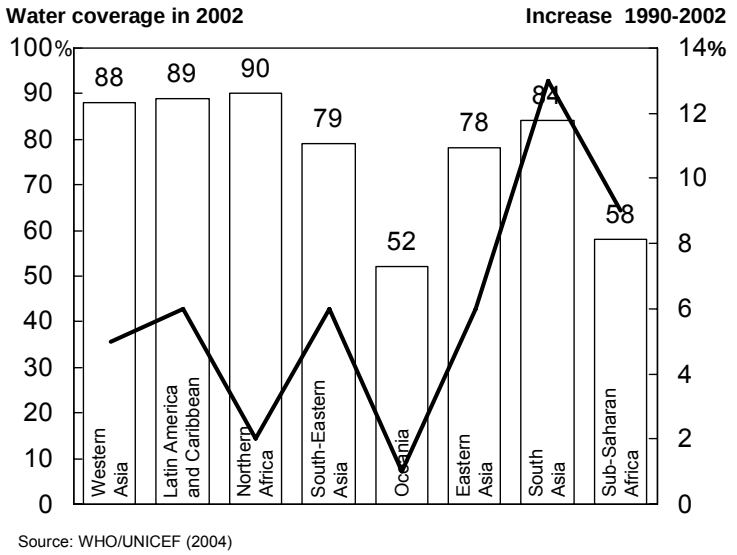


Figure 2.2 Progress in water supply coverage in the developing world

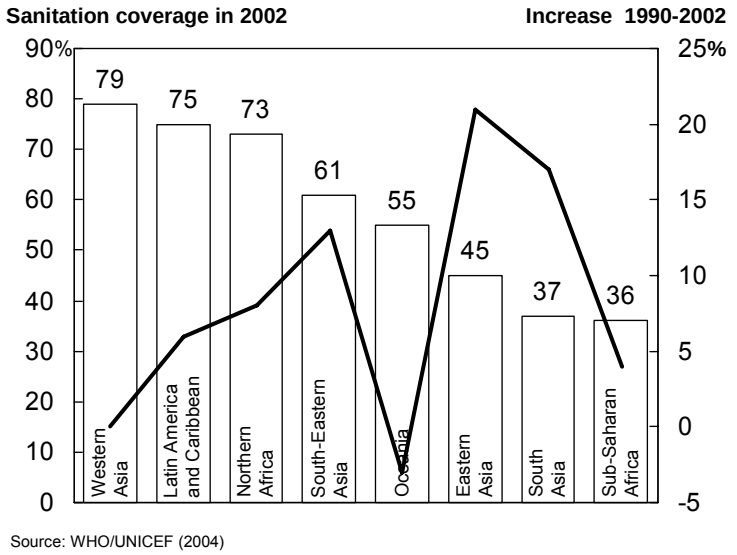


Figure 2.3 Progress in sanitation coverage in the developing world

2.3 Industrial use of water increases with country income

Water serves three primary functions: domestic use, agriculture, and industry. The water industry developed as a result of the requirements of domestic and industrial use. Industrial use of water increases with the country's income (see Figure 2.4). In high-income countries, also called the developed or industrialized countries, the industrial use of water accounts for 59 percent of the global water use. Agriculture accounts for 30 percent and domestic use for 11 percent (134). In low and middle-income countries, agriculture accounts for 82 percent of the global water use (134). Industry and domestic use account for 10 and 8 percent respectively (134).

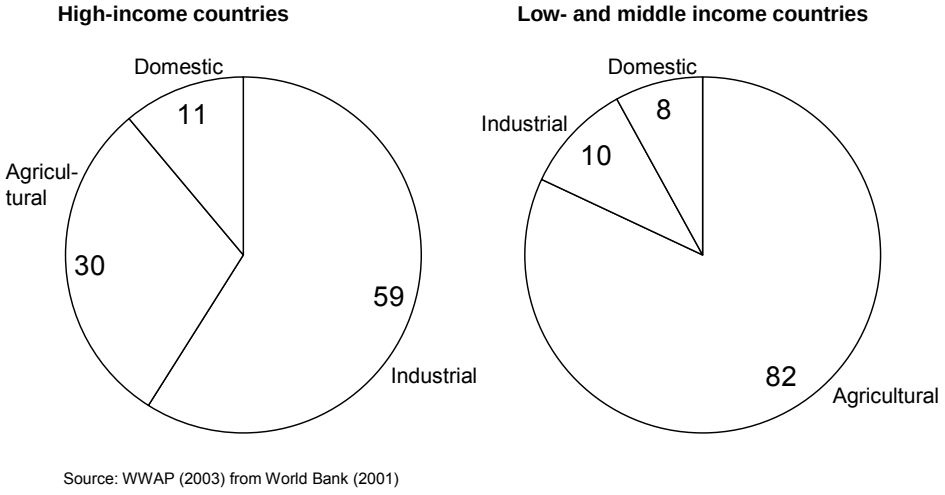
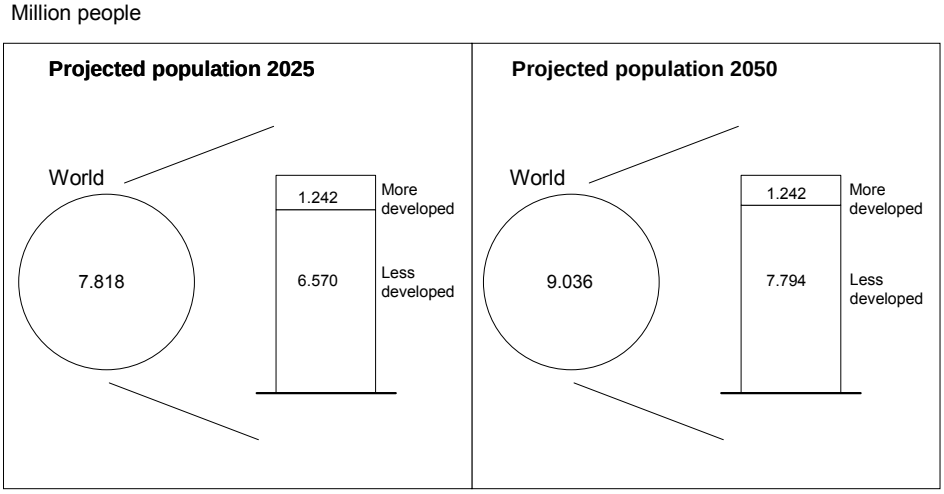


Figure 2.4 Industrial use of water increases with country income

2.4 Population and water availability

Population growth not only leads to greater demand of water for domestic supply but also impacts on the majority of other uses for water (134). The demand for food increases with population, and hence does the water required for agricultural production (134). The United Nations estimate that the population in more developed countries will stabilize (see Figure 2.5). These facts lead to the conclusion that water demand will mostly increase in less developed countries and for agricultural purposes.

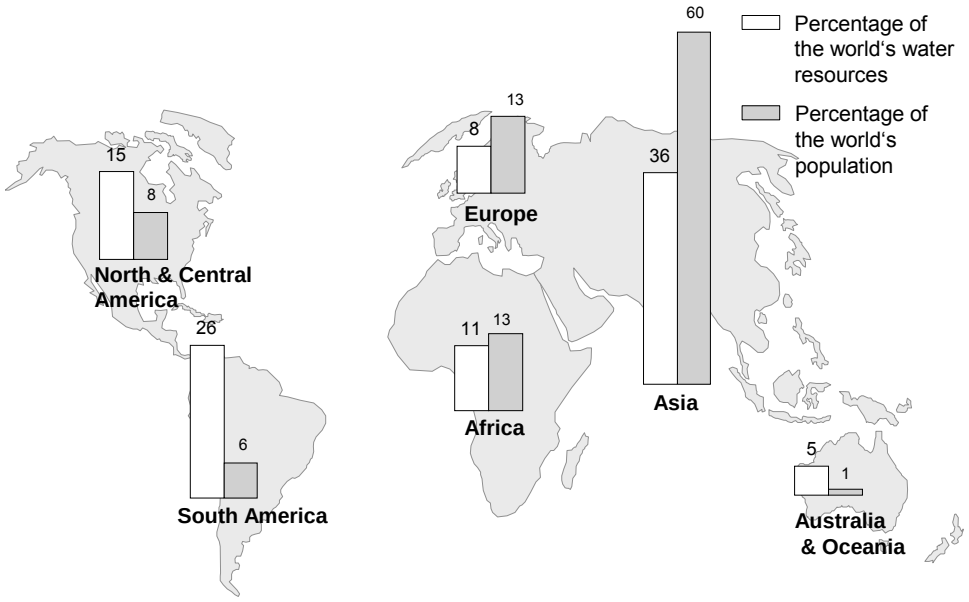


Note: Future projections of worldwide population have been revised downward in recent years; result of significant decline in birth rates

Source: WWAP (2003) from UN (2002)

Figure 2.5 Increasing worldwide population is a major drive for water resources management

Wide variations in the distribution of water and of population across the globe pose problems of water resources management. Experts generally agree that there is no water crisis; there is a problem of water resources management. In fact, there are enough water resources around the world, but these are not equally distributed. The global overview of water availability versus the population (134) stresses the continental disparities, and in particular the pressure on the Asian continent, which supports more than half of the world's population with only 36 percent of the world's water resources (see Figure 2.6). In contrast, South America supports only 6 percent of the world's population with 26 percent of the world's water resources. North & Central America support 8 percent of the population with 15 percent of the world's water resources. Figures for Europe are of 8 percent of the world's water resources to 13 percent of the world's population. Africa has more water resources than Australia, 11 percent and 5 percent respectively, but is where 13 percent of the world's population live while in Australia live only 1 percent of the world's population.

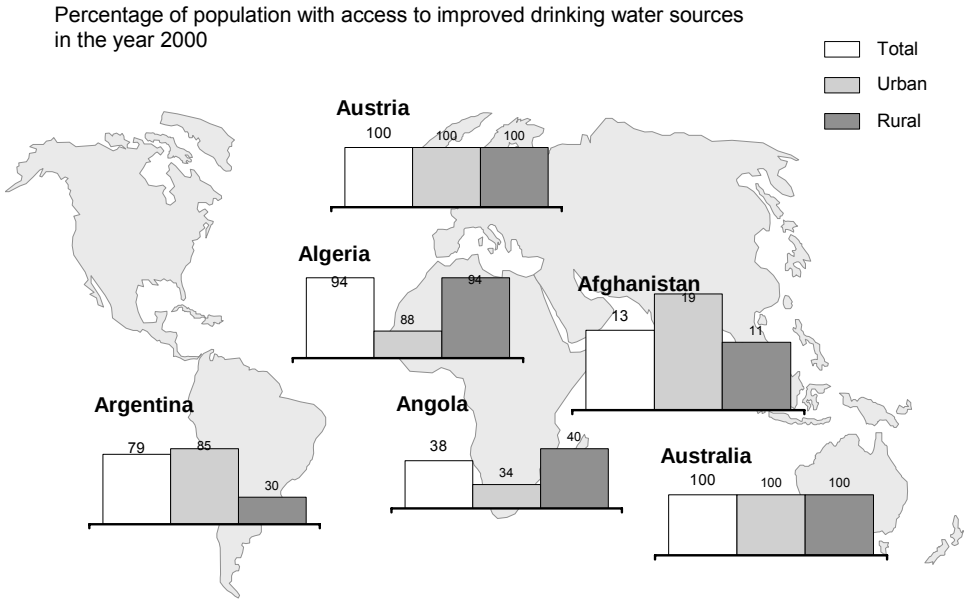


Source: WWAP (2003) from the web site of the UNESCO/HIP Regional Office of Latin American and the Caribbean (2001)

Figure 2.6 Continental disparities of water availability versus population

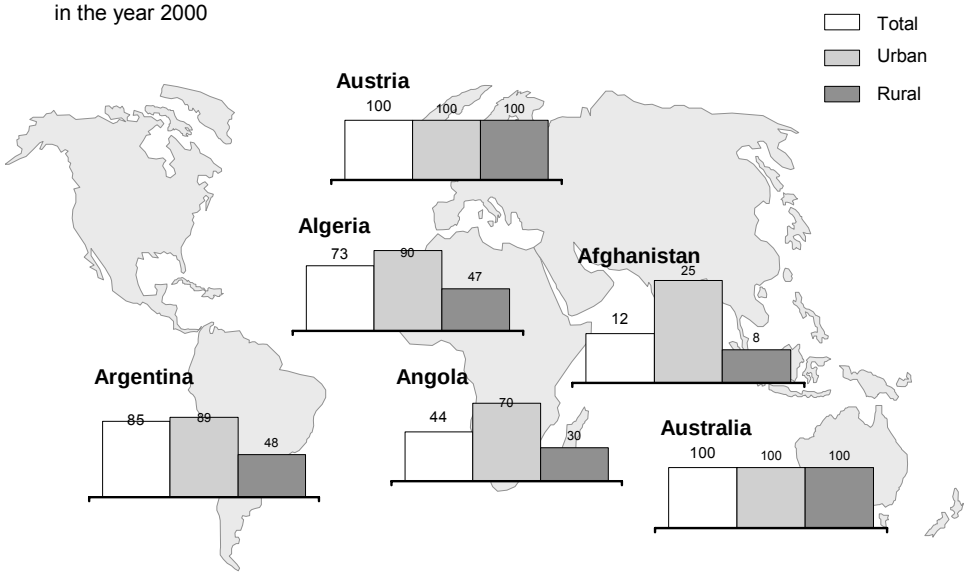
2.5 Disparities in water supply and sanitation coverage

Access to improved drinking water resources and access to improved sanitation facilities vary at national level and at regional level. The regional data can only be aggregated to a national indicator value if the indicators and data collection are the same between the different regions of a country (134). Disparities between countries and between types of regions (urban or rural) in terms of access to water supply (see Figure 2.7) and sanitation (see Figure 2.8) pose problems to the national governments and local authorities.



Source: WWAP (2003) from WHO/UNICEF (2000)

Figure 2.7 Disparities on water supply coverage



Source: WWAP (2003) from WHO/UNICEF (2000)

Figure 2.8 Disparities on sanitation coverage

2.6 Unique features of the water sector

The technical, economic and institutional attributes of the water and sanitation sector are considered unique because they differ from other infrastructure sectors, such as power, telecommunications and transportation in important ways. Haarmeyer & Mody (55) explain that these distinctive features are the source of many risks that private contracts are faced with and consequently justify the lower levels of private

investment in the water sector relative to the other infrastructure sectors (see Figure 2.9):

Source: Adapted from Haarmeyer, D. and Mody, A. (1998)

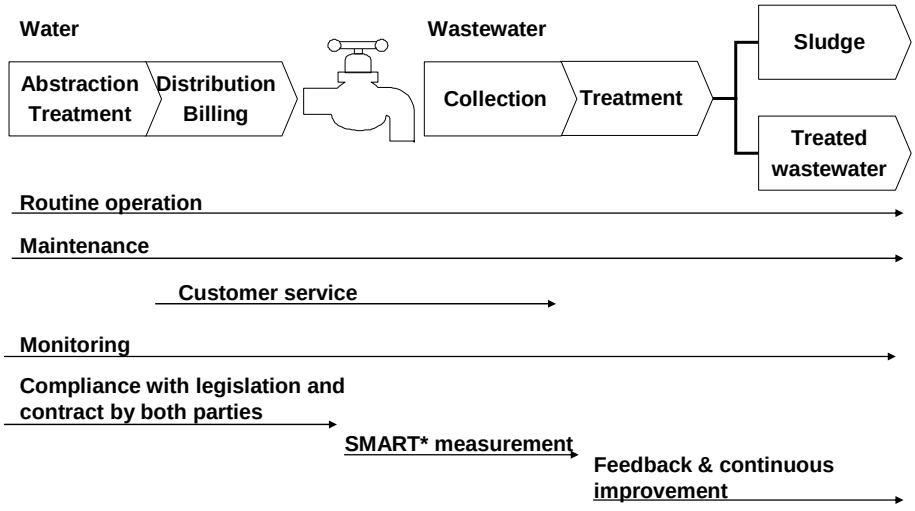
Figure 2.9 Unique features of the water sector

- Economic characteristics, such as high capital intensity and large sunk costs, limit the scope of direct competition, creating the need for a credible regulatory framework to protect consumers from excessive charges and investors from 'creeping expropriation'.
- Multiple public policy objectives (economic efficiency, environmental enhancement, the protection of health and the affordability of tariffs as well as the broader fiscal and political goals) accentuate political and regulatory uncertainty.
- The fragmentation of delivery systems under financially and institutionally weak provincial and municipal governments reduces the attractiveness to investors. Regulation by provincial and municipal governments is especially vulnerable to political expropriation and contact erosion.
- The legacy of institutional neglect –and sometimes abuse – has led to depreciated assets of uncertain value. Uncertainty about the condition and value of these underground assets translates to uncertainty about the investment requirements and, hence, tariff levels.

Thus, while the experience of private participation in other sectors will provide lessons for water and sanitation, the special features of this sector will drive the long-term development of private initiative and capital.

2.6.1 Value chain of a water and sanitation utility

The delivery of clean water to households (and perhaps ultra-clean water to industry) and proper sewerage and treatment services for wastewater and sewage basically compose the main end-products of a water utility. The routine operation processes required, or the value chain, is represented in Figure 2.10. In broad terms, water is abstracted from natural sources (surface water like rivers or groundwater; can also be the sea or the ocean in case of desalination) and after proper treatment (there aren't any more pure water sources, so water always needs to be purified; a process that is becoming more expensive as global pollution increases) is distributed to consumers (or stored). Once water is used, it turns into wastewater. Usually, the water consumed is metered, and consumers receive a bill according to their respective consumption. Wastewater is collected and directed to treatment, which can be primary and/or secondary and/or tertiary. Treated wastewater may be reused for irrigation or other purposes. Sludge has to be disposed.



* SMART: Specific, Measurable, Attainable and Relevant
Source: Adapted from Partnerships for Water (2005)

Figure 2.10 Value chain of a water utility

2.6.2 Concept of social service

The concept that water is free is still ingrained amongst many water consumers, notably in cities in developing countries, expanding rapidly as a result of the migration from the countryside (54).

Haarmeyer & Mody (55) explain that the tradition and perception of water as a predominantly social service led to neglect of the sector's long-term economic viability and to massive undercapitalization. They add that the principal cause of

undercapitalization is that most governments have taken a short-term view of water and sanitation assets.

In Europe and North America, a relatively long history of urban water supply has made it easier to convey the concept that the provision of water should carry a price, although, in some quarters there is still considerable resistance to the concept that it is a commodity like any other, to be bought and sold (54).

In developing countries, most notably in the large conurbations of Africa and South Asia, urban water systems – developed in colonial times for what were then much smaller communities - have come under great strain as populations have soared (54). The issues of utility performance in these markets are often very different than those of industrialized countries (see Table 2.1).

Table 2.1 Utility Performance in developing countries

Indicator	Currently recorded	Attainable levels	Mean value in industrialized countries
Unaccounted for Water	> 45%	> 25%	16%
Staff/ 1000 connections	> 20	< 6	2,10
Staff/ 1000 people served	n.a.	< 0,94	0,78
Bill Collection Period	> 18 months	<3 months	1,80
Working ratio	> 1	<0,7	0,68
Connection charges (%GDP/capita)	5-60%	< 20%	n.a.
Service continuity	< 12 hours/day	24 hours/day	24 hours/day
Labor costs as % of operating costs	n.a.	< 39%	29%
Water coverage	18% to 100%	n.a.	99%
Sanitation coverage	n.a.	n.a.	n.a.
Price (% of annual per capita GDP for 20 liters of water per day)	> 0,2%	n.a.	0,036% to 0,12%

Source: Elshort, H. and O'Leary, D. (2005) from Jenssens (2005)

2.7 Governance and management

Governance and management are interdependent (134). Effective governance systems should enable the more practical management tools to be applied correctly (134). Public-private partnerships, public participation, economic regulatory or other instruments will not be effective unless the political will exists and broader administrative systems are in place (134).

2.7.1 Millennium Development Goals

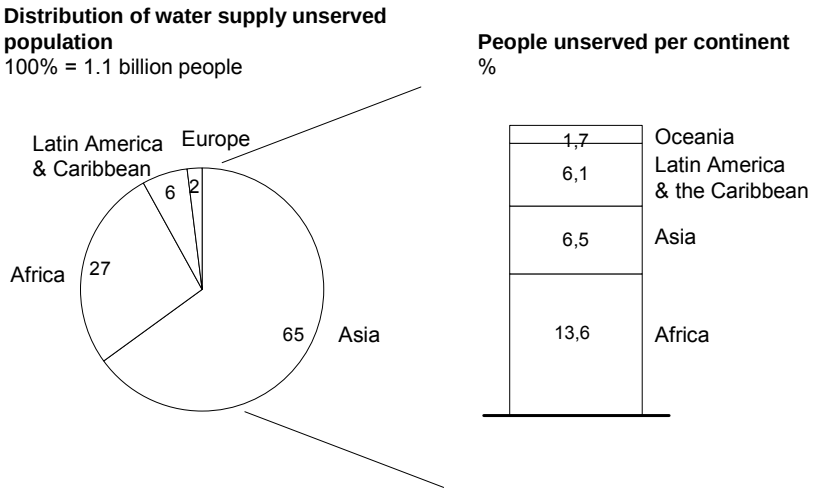
The United Nations General Assembly Millennium meeting in the year 2000 established a number of Millennium Development Goals that have become the key international development targets of the modern era (134). Only one directly relates to water - the Millennium Development Goal on environmental sustainability – but improved water management can make a significant contribution to achieving all of the goals (134). The relationships, both direct and indirect, between the Millennium Development Goals and water are listed at Table 2.2. The Millennium Development Goals provide a context within which wider issues linking water, sustainable development and poverty reduction can be understood (134). It illustrates the importance of thinking about water in relation to a wider context: the ways in which it can contribute to the overall reduction of poverty and the development of people and nations (134).

Table 2.2 Vision 21 - Water supply and sanitation targets

- To reduce by 2015 by one-half the proportion of people without access to hygienic sanitation facilities.
- To reduce by 2015 by one-half the proportion of people without sustainable access to adequate quantities of affordable and safe water; this was also endorsed by the United Nations Millennium Declaration.
- To provide water, sanitation and hygiene for all by 2025.

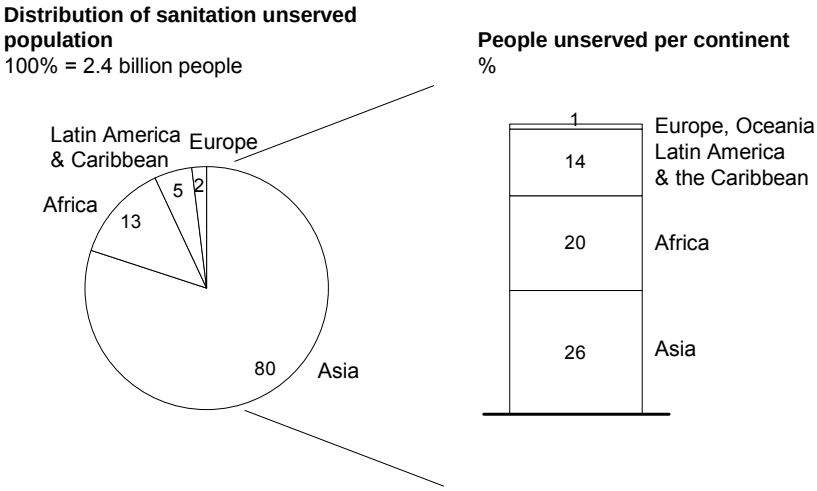
Source: WWAP (2003) from WSSCC (2000)

As discussed above, and according to data on water and sanitation coverage provided by the WHO/UNICEF Mid-term assessment of progress (see Figures 2.11 and 2.12) doubts and criticism concerning the ability to achieve the Millennium Development Goals are being raised. In fact, as over-ambitious as the MDG may seem, they stimulated more progress for water and sanitation.



Note that in terms of total number of people the highest unserved group is Asia
Source: WWAP (2003) from WHO/UNICEF Joint Monitoring Programme (2002)

Figure 2.11 Proportionally to population Africa is the most unserved by water supply



Source: WWAP (2003) from WHO/UNICEF Joint Monitoring Programme (2002)

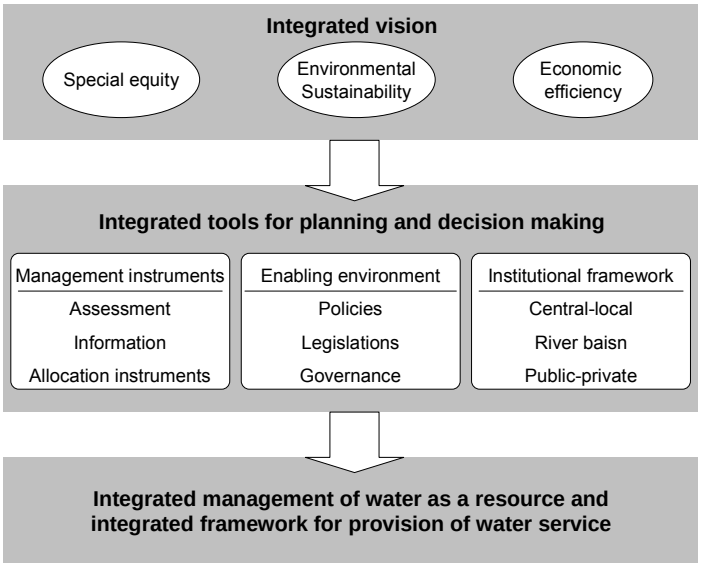
Figure 2.12 Asia shows the highest number of people unserved by sanitation

2.7.2 Integrated Water Resources Management

There is a wide acceptance that integrated water resources management (IWRM) is the appropriate management tool for sustainable use of water resources and improved delivery of water services (134). IWRM promote participatory approaches, demand and catchment-area management, partnerships, subsidiarity and decentralization, the need to strike a gender balance, the environmental, economic

and social value of water; and basin or catchment management (134). It replaces the traditional fragmented sectoral approach to water management that has led to poor services and unsustainable water use (134).

Figure 2.13 provides the framework for moving towards IWRM. It is a social, environmental and economic integrated vision providing integrated tools for planning and decision making through: management instruments, an enabling environment and a proper institutional framework; consequently leading to integrated management of water as a resource and an integrated framework for provision of water service.



Source: WWAP (2003) from GWP (2002)

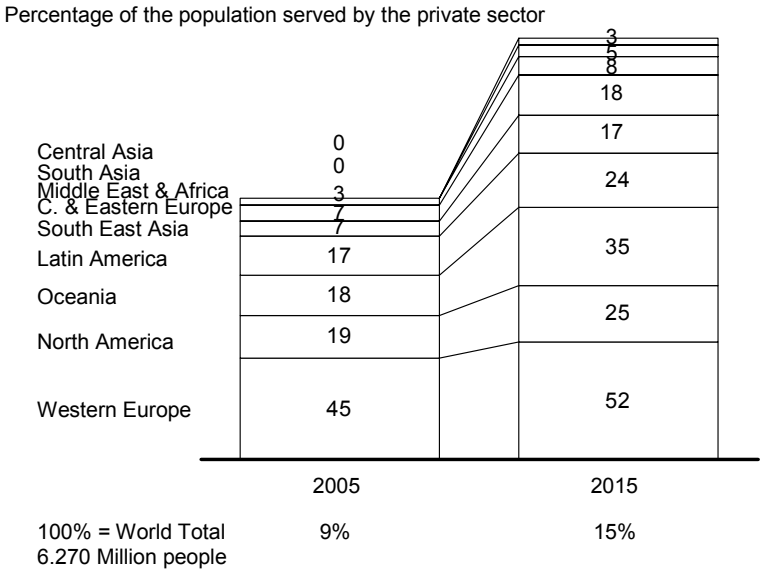
Figure 2.13 Framework for moving towards integrated water resources management

CHAPTER 3

THE INTERNATIONAL WATER SECTOR STRUCTURE

3.1 Private sector's role is expected to grow

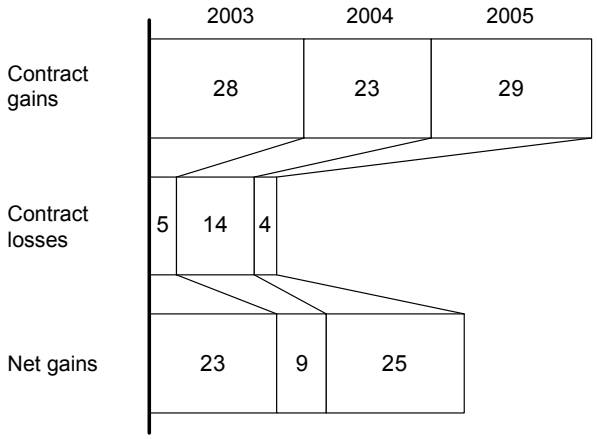
Water and sanitation activities are usually controlled by state or municipally owned companies in almost all countries of the world. In 2005 only 9 percent of the total world population was served to some extent by the private sector but estimates show that the role of the private sector will continue to grow, reaching 15 percent of the world's population in 2015 (see Figure 3.1). The continent where the private sector has a higher presence is Western Europe with 45 percent of its population being served by private companies, followed by North America with 19 percent, Oceania with 18 percent and Latin America with 17 percent.



Source: Global Water Intelligence (2005)

Figure 3.1 Private sector's role is expected to grow

Recent contract activity for providing water and sanitation services by the private sector suffered a decline in 2004, that was recovered in 2005 (see Figure 3.2). In 2003 there were 28 major contract gains and 5 contract losses, which represented net gains of 23 contracts in that year. The same did not happen in 2004, due to a relatively high number of contract losses of 14 and a small decrease of contract gains which totaled 23. The net gains in 2004 were of only 9 contracts. In 2005 the contract gains increased to 29 and the contract losses went down to 4, which represent net gains of 25 contracts in that year.



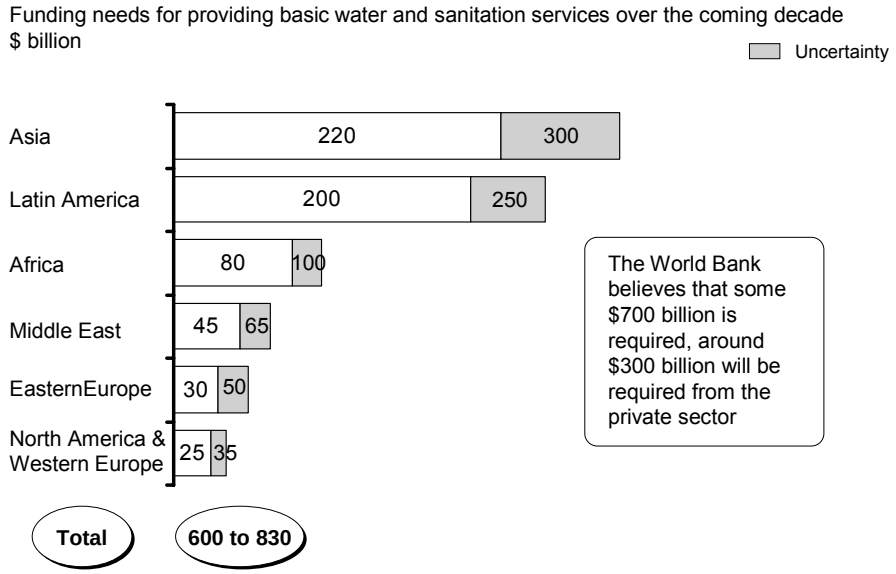
Source: Global Water Intelligence (2005)

Figure 3.2 Recent private sector participation contracts per year

3.2 The global need for investment is a driver for privatization

The municipalities' lack of funds for investment faced almost everywhere in the world is the major driver for increasing activity by private entities. The World Bank estimates that funding needs for providing basic water and sanitation services worldwide over the coming decade totalize a value of 600 to 830 billion dollars, being the value of 700 billion dollars the most frequently presented. Around 300 billion will be required from the private sector (see Figure 3.3).

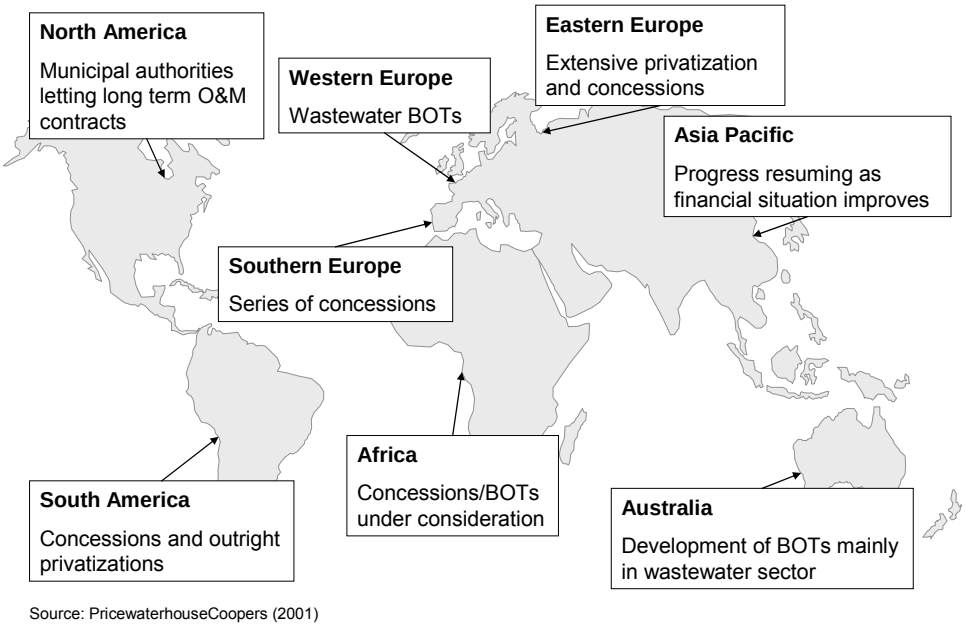
The continent with the highest need for investment is Asia, mainly due its high population density. It is estimated that 220 to 300 billion dollars will be needed to meet the basic services of water and sanitation in this continent. Latin America needs 200 to 250 billion dollars, followed by Africa with 80 to 100 billion, which will have to be pro-active looking for donors. The Middle East and Eastern Europe need to gather 45 to 65 billion dollars and 30 to 50 billion dollars respectively to cope with the demands of the next decade. In a better situation, but also looking for investors are maybe North America and Western Europe with funding needs reaching 25 to 35 billion dollars.



Source: Global Water Intelligence (2005), Lane M. (2003) and World Bank web site

Figure 3.3 The global need for investment is a driver for privatization

The geographic trends of the water industry vary according to funding style. Figure 3.4 summarizes these trends.

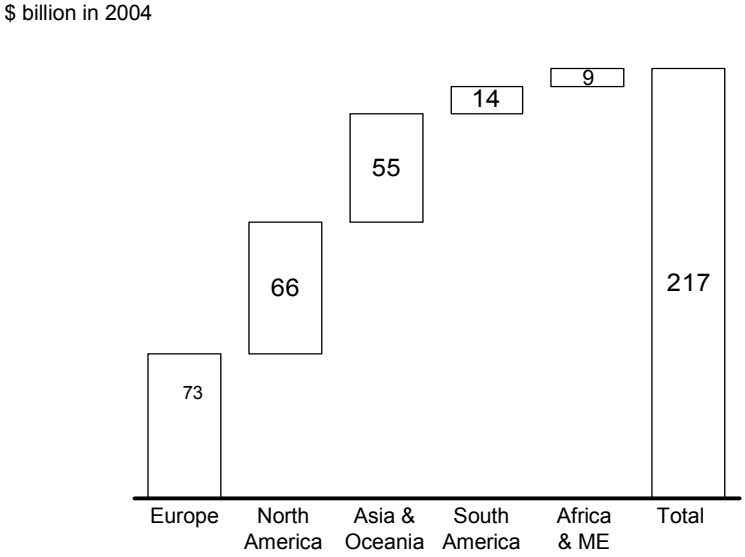


Source: PricewaterhouseCoopers (2001)

Figure 3.4 The geographic privatization trends vary according to funding

The total worldwide revenues of municipal water and water services reached in 2004 the amount of 217 billion dollars (see Figure 3.5). The municipalities cumulating the highest revenues are located in Europe, totalizing the amount of 73 billion dollars, followed by North American municipalities who gathered 66 billion dollars and

Oceania reaching the amount of 55 billion dollars. Municipalities in Latin America did not perform as well and reached the amount of only 14 billion dollars. This is the same for African municipalities, who presented in 2004 total revenues of 9 billion dollars.



Source: Global Water Intelligence (2005)

Figure 3.5 Revenues of municipal water and wastewater services

These numbers lead to the conclusion that where high investment is needed the most is also where municipalities have the least revenues. The reasons for the lack of revenues vary enormously between countries and even between municipalities, but often the causes are related to the municipality's lack of efficiency and the under-pricing of water. Another conclusion is that the private sector is more active where municipalities are more efficient and consumers are willing to pay the water tariffs, i.e, where revenues exist. Inefficient municipalities (frequently over-staffed), under-pricing water, where consumers are not willing (or can not) afford water tariffs, in need of funding try to attract investment by the private sector. The private sector can help by bringing in the investment needed, but will in exchange look to improve efficiency frequently by decreasing the number of staff (and other cost-cutting measures) and increasing the low water tariffs.

The international financial institutions active in the water and sanitation sector support in different ways the operation and/or expansion of water infrastructure particularly in developing countries (see Table 3.1).

Table 3.1 International Financial Institutions

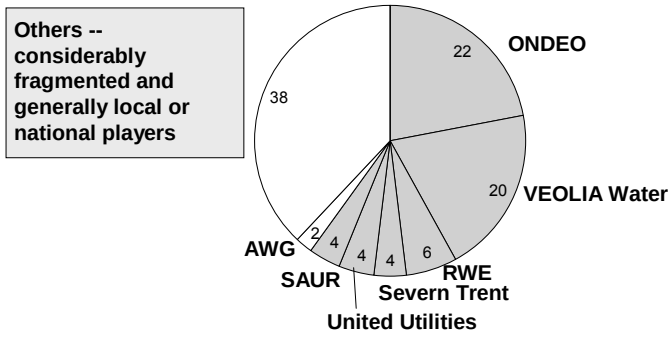
Abbreviation	Name
AfDB	African Development Bank
ADB	Asian Development Bank
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
IADB	Inter-American Development Bank
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFC	International Finance Corporation
MIGA	Multilateral Investment Guarantee Agency
WB	World Bank

Source: IFI web sites

In pursuit of this aim they are in part seeking to emulate the start of a major era of water infrastructure regeneration begun in Europe in the 1980s (54). This has involved the overhaul of water operations and structures in such countries such as the United Kingdom, France and Germany, subsequently extended to Spain, Portugal and Italy (54). Water reform has also been carried out in Belgium and the Netherlands, and is a significant item on the political and financial agendas of the new EU Member States in Central and Eastern Europe (54). The reform of the water and sanitation sectors has yet to affect much of the former Soviet Union (the Baltic States are an exception), and in much of the developing world progress towards reform has been patchy (54).

3.3 A handful of water players dominate the private market

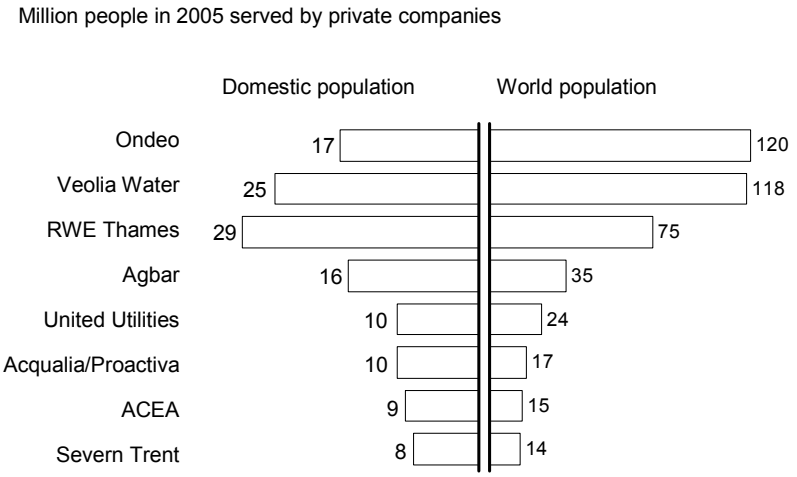
The world water industry consists, generally speaking, of a handful of major companies or groups, and of the various technical and equipment companies that serve them. Basically, six water players dominate the private market (see Figure 3.6). The total water industry market is estimated to value 66 billion dollars. The market shares are of 22 percent to Ondeo (Suez, France), 20 percent to Veolia Water (France), 6 percent to RWE Thames (Germany), 4 percent to Severn Trent (U.K.), 4 percent to United Utilities (U.K.), 4 percent to SAUR (France), 2 percent to AWG (U.K.) and 38 percent to others, generally local or national players.



Source: Company Annual Reports and web sites (various years)

Figure 3.6 A handful of water players dominate the private market

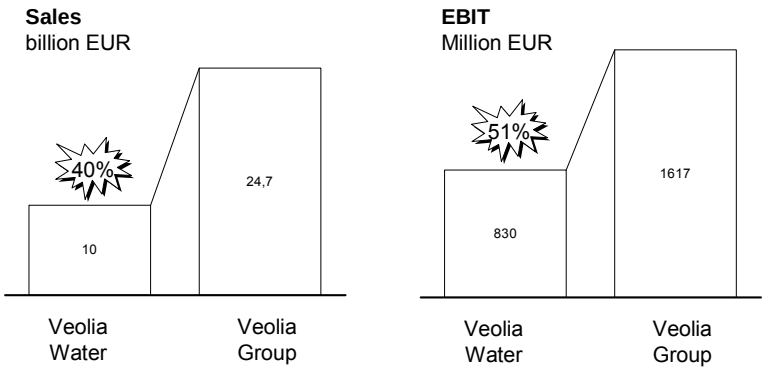
The strong presence of the few big water players in their own home countries was the basis for their growth in global markets (see Figure 3.7). The French Ondeo and Veolia Water, leaders of the private water market in terms of population served around the world (respectively 120 and 118 million people) are also the leaders in terms of domestic population served: Ondeo's activities reach 17 million people in France and Veolia Water 25 million. The German RWE, that acquired the British Thames is the next big company, serving 75 million people worldwide. A handful of U.K. companies and a few firms from Germany complete the picture as far as cross-border activities are concerned. The Spanish Agbar is active in Latin America but generally in partnership with, or as subsidiaries of the French giants. These few water players dominate the international market and currently serve more customers overseas than in their own home countries.



Correlation factor: 0,76
Source: Company Annual Reports and web sites (various years)

Figure 3.7 The few players in the private water market grew global based on their strong domestic markets

Veolia Water, for example, subsidiary of the Veolia Group, represented in 2004, 40 percent of the Group's sales and 51 percent of the EBIT - Earnings Before Interest and Tax - with their water and sanitation activities (see Figure 3.8).



Source: Company Annual Report and web site (2004)

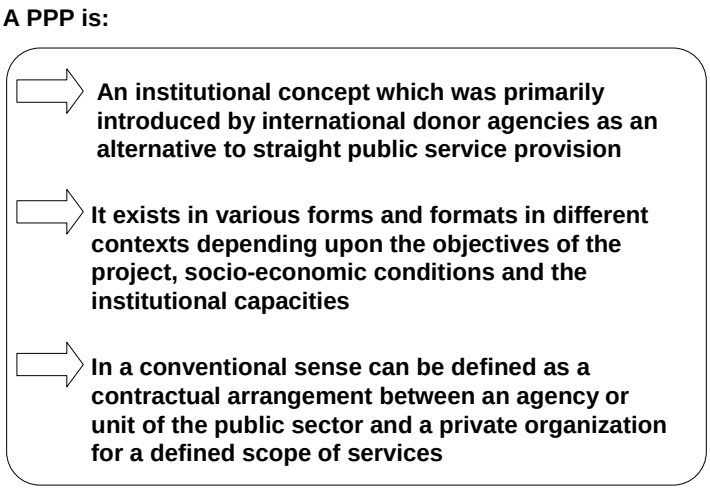
Figure 3.8 Veolia Environment in numbers

CHAPTER 4

THE CHALLENGE TO PUBLIC AND PRIVATE SECTORS

4.1 The concept of public private partnership (PPP)

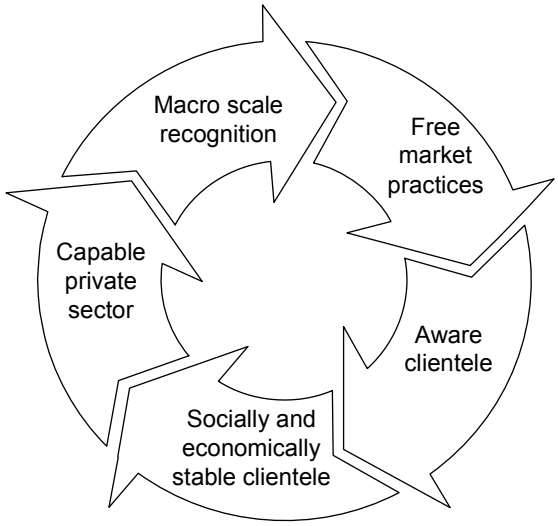
Sohail, M. (109) explains that a public private partnership is an institutional concept which was primarily introduced by international donor agencies as an alternative to straight public service provision (see Figure 4.1).



Source: Adapted from Sohail, M. (2003)

Figure 4.1 What is a public private partnership?

There are several pre-conditions that can lead to the public private partnership as a choice for water and sanitation services delivery (see Figure 4.2). One, it requires recognition at the macro scale for it to be useful in service delivery. Two, it is normally effective in contexts where free market practices have a reasonable background. Three, it requires an aware clientele that considers the provision of an urban service to be a chargeable product depending upon the nature of production. Four, it needs a clientele that is socially and economically stable enough to pay for the services. And five, it needs a capable private sector that has the capacity to efficiently provide and sustain the contracted part of the service to the identified clientele.



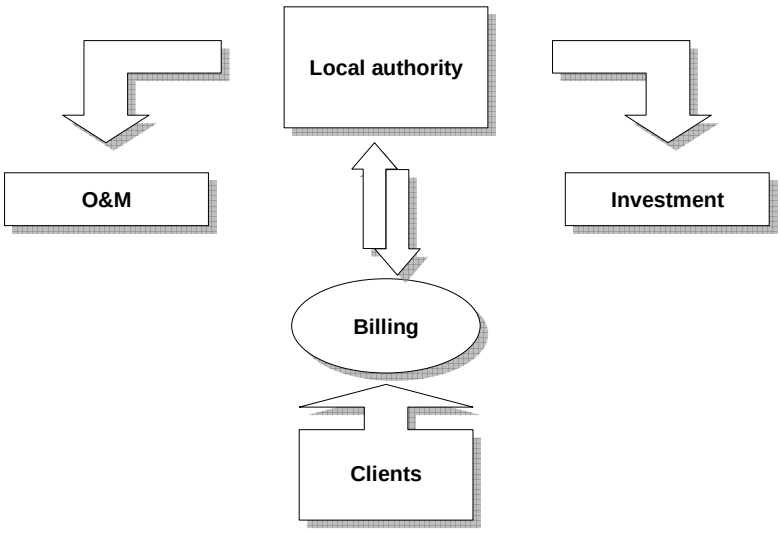
Source: Adapted from Sohail, M. (2003)

Figure 4.2 Pre-conditions for public private partnerships

In addition, public private partnership has been applied in situations where conventional public sector modes of service delivery have lost efficiency and where efficiency in operational and financial terms is needed (109).

4.2 Delivery of services by the public sector

A water and sanitation provider controlled by the state or by the local municipality is responsible for all the activities comprehended in a water utility's value chain and it is also responsible for investment (see Figure 4.3).



Source: Adapted from Finger, M. and Allouche, J. (2002)

Figure 4.3 Water utility controlled by the state or a municipality

4.3 Expanding private sector role

Under the pressure of the huge capital investment needs (outlined in Chapter 3), governments around the world are moving to involve the private sector in what had once been the exclusive public domain of providing water and sanitation services.

Private companies have the ability to offer a deal to their public sector counterparts (54). First, the sheer size of the global water industry firms enables them to achieve economies of scale for many operational and management tasks when compared with state run local water utilities (54). The private sector has the means to develop and implement new technologies as a result of its investor base and access to capital, an important fact considering the rising environmental standards around the world (54). Finally, because of their professional management, private companies often have lower staffing costs and require relatively fewer staff than the public sector (54).

The water industry supplies technology and services to both industrial and municipal clients (54). However, the industry's relationship to these two client populations differs significantly (54). In general, industrial clients purchase equipment or sub-contract services which they finance as capital and operational expenses (54). By contrast, the private sector provision of water and wastewater technology and services to national and municipal governments is much more complex.

The provision of private sector services in the municipal water and sanitation sector takes place across a variety of social, economic and political environments that may condition the manner and degree of such participation (54). Governments may wish to limit private sector control over their national waterworks, or they may face opposition by labor unions concerned with privatization related job losses (54). Furthermore, governments seeking to privatize their water and sanitation sectors are generally driven to take this action by financial constraints (54). These governments are not only unable to afford to maintain their systems, but are desperately in need of the investment capital and fees that privatization can bring (54). Consequently, private sector companies must often finance the capital investment needed to build or upgrade municipal systems (54). Thus, both the approaches to privatization and the methods of financing are essential components of private sector participation in municipal and water and sewerage services (54).

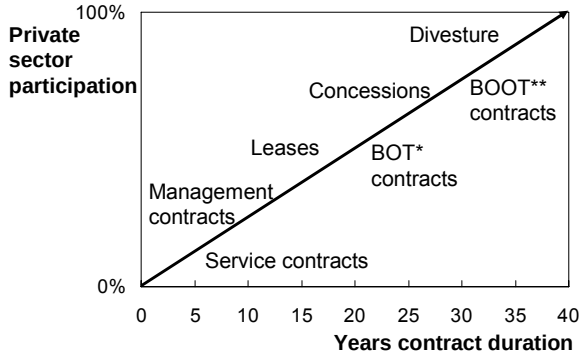
4.4 Approaches to privatization

In both developed and developing nations the role of government is being redefined away from that of service provider to one of service regulator and facilitator. A trend towards governments privatizing their previously state run assets and services has transformed the energy and telecommunications sectors over the last decade, and most recently has involved the water and sanitation sector as well. As the privatization of the water sector has traditionally been more political sensitive than, say, telephones or electric utilities, a greater variety of approaches is associated with the privatization of water and sewerage infrastructure.

Privatization is a general term encompassing a variety of arrangements that shift to the private sector selected responsibilities for, and sometimes ownership of, public sector assets. Varying approaches to privatization have developed in response to the needs and constraints of governments seeking to partner with the private sector. In general privatization in this sector has overwhelmingly focused on transferring to the private operators the responsibility for operating and maintaining existing systems and building new capacity, rather than transferring the ownership of system assets themselves, which is more prevalent in other utility sectors.

These various approaches can be visualized in a scheme reflecting varying degrees of private sector intervention in the provision of water and sanitation utilities according to the number of years of normal contract duration (see Figure 4.4). It can run from service contracts, management contracts, leases, BOT contracts, concessions, BOOT contracts to divesture or asset sale. These different forms of private sector participation, which are no more than contractual arrangements, are not fixed and can be combined between them, say, in fact there are no single models. A range of options exist and new mechanisms are appearing in different countries and regions

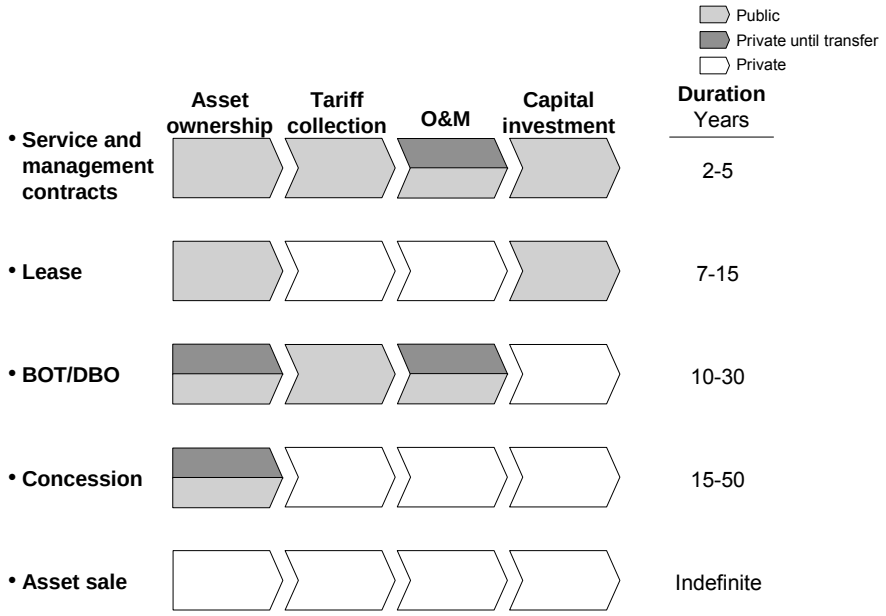
of the world, in a call for creativity to meet the growing water and sanitation demands and solve common or project-specific problems. Figure 4.5 identifies the five basic approaches used for private sector participation. The different arrangements represent a continuum of allocation of risks and responsibilities between the public and the private sector in terms of asset ownership, tariff collection, operation and maintenance (O&M), and capital investment. As the private sector's commercial and financial responsibility increase, so does the extent of greater regulatory risk; success, therefore requires greater government and private commitment.



Increasing level of delegation, risk and irreversibility

* BOT: Build, Operate, Transfer
** BOOT: Build, Own, Operate, Transfer
Source: Adapted from World Bank (1997), Toolkit 1

Figure 4.4 Various approaches exist for private sector participation



BOT = Build-operate-transfer; DBO = Design-build-operate, *General management is public but services are done by private
Source: Adapted from Water & Wastewater International (2003)

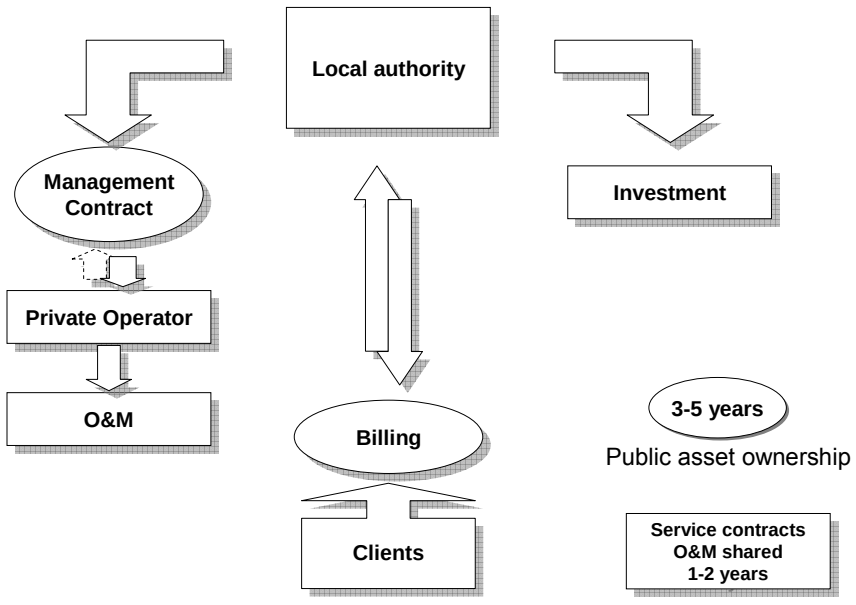
Figure 4.5 Options for private participation

As each of the different contractual arrangements is discussed below, caution is advised in comparing them since the scope of work can vary greatly across the contract types. In particular, water sourcing and treatment under BOT or BOO contracts imply a higher private capital commitment than for service, management or lease contracts but a more restricted domain of operation.

4.4.1 Service and management contracts

A contract for a discrete service, such as repairing a water main, detecting leaks or reading meters, is the simplest form of private participation. Such service contracts are generally competitively bid, set for short periods (one to three years), based on fixed fees and involve no private investment. Because of its ease in arranging, this form of contract is widely used.

Haarmeyer & Mody (55) explain that management contracts give the private sector full responsibility for operations and maintenance (O&M) services for a specific facility (such as wastewater treatment plant) or an entire system (see Figure 4.6). The private O&M contractor typically accepts performance-based fees, which are generally based on physical parameters, such as volume of water treated and achievement of environmental quality standards. The contractor may also bear the risk of legal liability for failure to meet environmental standards. The O&M contractor does not take on the investment and financing risks. The duration of management contracts is generally less than ten years.



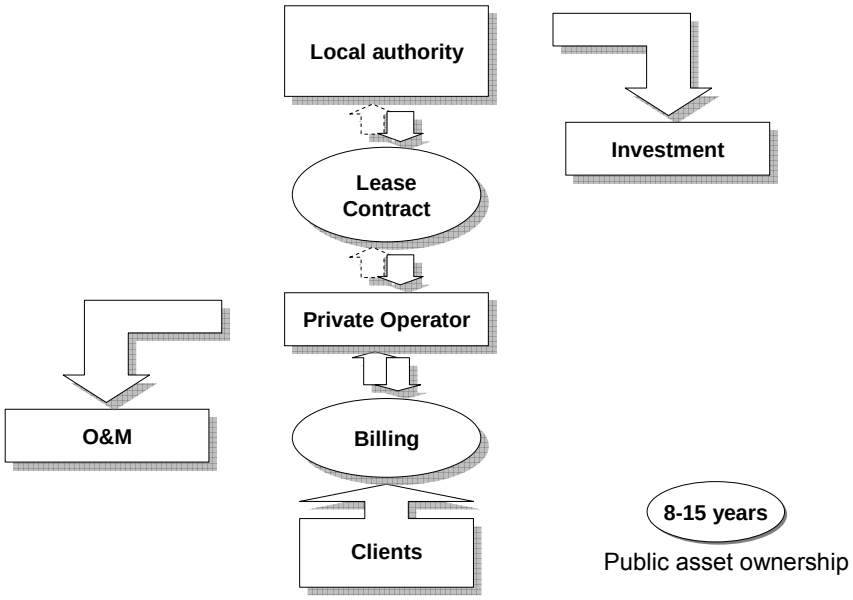
Source: Adapted from Finger, M. and Allouche, J. (2002)

Figure 4.6 Management contract

Because service and management contracts may not require tariff increases or significant downsizing of staff, short-term management contracts may be politically more acceptable than forms of private participation such as concession contracts, which require cost recovery. Like corporatisation, which involves transforming a utility into a financially and institutionally independent entity, management contracts offer a way to improve operational and service performance and thus prepare a utility for fuller privatization options. However, under this approach, the degree of private involvement is fairly limited and hence private initiative and capital are harnessed only to a limited extent.

4.4.2 Lease contracts

Under a leasing arrangement, according to Haarmeyer & Mody (55), a government-owned system is rented to a private company, whose remuneration comes directly from tariffs. In addition to operations and maintenance functions, the private company is responsible for billing, collection and financing working capital (see Figure 4.7). The leasing company thus bears performance risk and demand risk. The private company receives a part of the tariff to cover operations and maintenance costs, capital improvements with short economic life and profits; the government receives the rest of the tariff as a rental fee or municipal surcharge, which may be used to finance fixed capital assets. Lease contracts generally do not exceed 12 years.

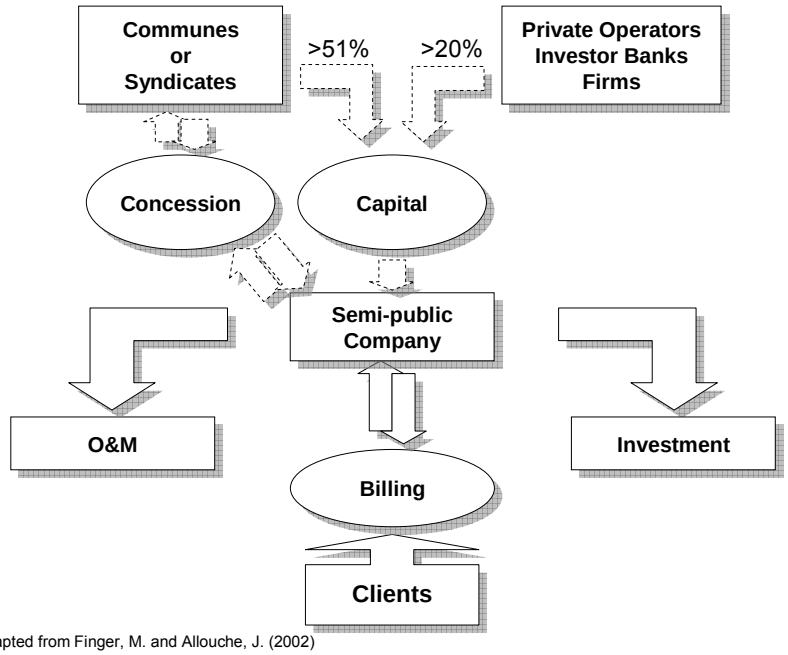


Source: Adapted from Finger, M. and Allouche, J. (2002)

Figure 4.7 Lease contract

The company which is awarded the operation lease may sometimes be jointly owned by the by the private and public sectors (see Figure 4.8). Haarmeyer & Mody (55) raise two questions concerning such mixed operating companies. First, can the

incentive problems – or conflicts of interest – that arise when the government owns the assets, has a stake in the operations company, and is responsible for regulating the conduct of each of these entities be minimized? Problems of commercial accountability (lack of clear corporate governance structures) and regulatory accountability (lack of informed and independent regulation) can be severe when these risks are shared by or overlap two distinct entities with different interests. Second, as with management contracts, are these companies capable of evolving into arrangements that allow fuller private participation, particularly capital participation? Anticipating the risk sharing problems and the specific threat of political interference, potential investors may be discouraged from investing in joint ownership project.



Source: Adapted from Finger, M. and Allouche, J. (2002)

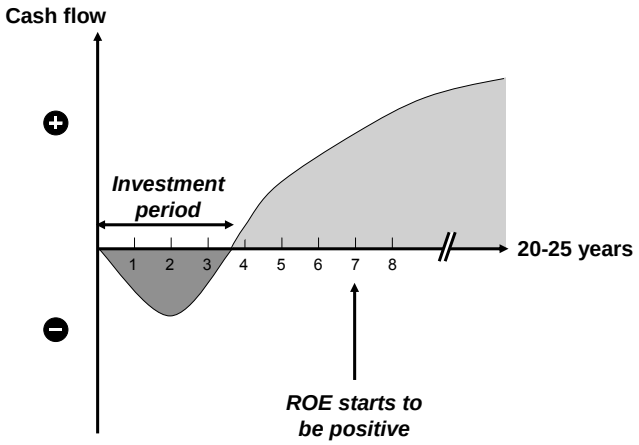
Figure 4.8 Semi-public company

4.4.3 BOO/BOT

BOO (Build-Own-Operate) and BOT (Build-Operate-Transfer) contracts represent an approach to securing new discrete investments for water sourcing and treatment (55). In countries with limited financial resources and urgent needs for specific facilities, such as water or wastewater treatment plants, BOO/BOT contracts can be an efficient way to channel private investment and initiative to new facilities.

Under the contract, the government-owned utility pays a private company to source water or treat a certain volume of raw water or sewage (55). To provide the basis for project financing, the revenue stream is secured through a take-or-pay arrangement – fixed payments are made irrespective of whether the service is used or not. The contract length is negotiated to allow for retirement of debt and provide a return on

equity (ROE) to investors (see Figure 4.9). At the end of the BOT contract, which generally lasts 15 to 25 years, the private company transfers the facility back to the government. In contrast, the private company owns and operates the facility for perpetuity under a BOO contract.



BOT = Build-operate-transfer; ROE = Return-on-equity
Source: Adapted from Water & Wastewater International (2003)

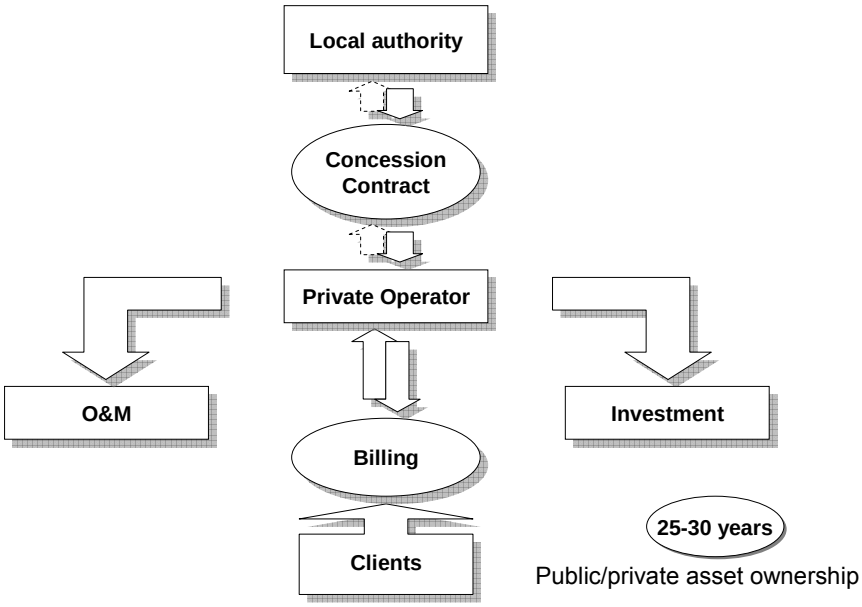
Figure 4.9 The BOT contract length is negotiated to provide a return on equity to investors

In contrast to a full utility concession, a BOO/BOT contract does not typically grant the private company access to assets that are already generating revenue, and the private firm thus face more stringent credit issues. A concern exists that the single client – the municipal utility – may be unable to honor its obligations.

While placing greater capital at risk in service, management or lease contracts, the BOO/BOT arrangements do not deal with the inefficiencies of the distribution sector – the water losses, lack of metering and inefficient tariff setting. Indeed, Haarmeyer & Mody (55) discuss that often these arrangements are perceived as a short-term mechanism for avoiding dealing with the long-term and less tractable problems. In this respect, they follow the same philosophy that led to independent power generators under long-term take-or-pay contracts in the power sector. The danger exists under such arrangements in both the power and water sectors that the supply sources thus created will be inefficient because they supply a service that is not needed (in the worst situation the extra supply will be wasted where distribution losses are not stemmed). Greater coordination of supply and distribution investments is therefore required. Also, where independent water services providers exist, less dependence on take-or-pay contracts and greater competition among alternative suppliers is likely to improve system efficiency.

4.4.4 Concession

In a full utility concession, a contract allocates to the private sector all of the responsibilities of the leasing contract plus capital investment for rehabilitation and expansion (see Figure 4.10). Because it bears the consequences of both operations and investment decisions, a concession holder faces stronger incentives to integrate and perform both of these tasks efficiently (55). Greater shouldering of operational responsibilities and stronger incentives means that such a concession offers a much broader scope for productivity improvements through, for example, water loss reduction, lower overheads and more efficient billing and collection. As in a lease, a concession fee must often be paid by the concessionaire for the use of the existing capital assets.



Source: Adapted from Finger, M. and Allouche, J. (2002)

Figure 4.10 Concession contract

The concessionaire is remunerated according to a contractually established tariff (often the bid price in competitively awarded concessions) collected directly from consumers. At the end of the concession, which generally last 20 to 30 years, or long enough to recoup capital costs, the fixed assets are returned to the government and the private company is compensated for the residual value of the facilities it has financed. Although the contract represents the main instrument for governing the concession, a regulatory process is typically developed in parallel to deal with evolving policy concerns and renegotiation of the contract to adjust tariffs and assess the performance of the investment programme. Thus, because of its impact on a concession's financial viability, regulatory risk must be adequately identified and minimized.

4.4.5 Full privatization - divesture or asset sales

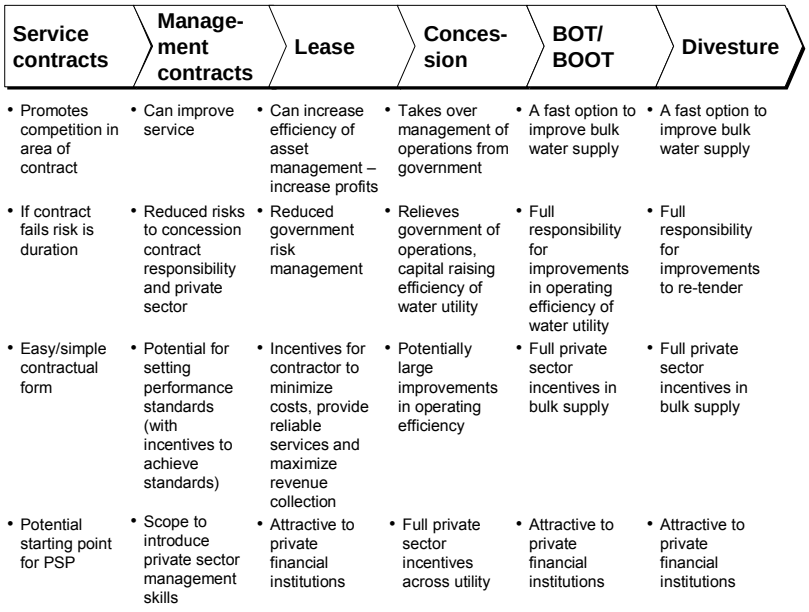
Haarmeyer & Mody (55) discuss that assigning the private sector full commercial risk and transferring water and sanitation assets to private ownership offers the greatest scope for efficiency improvements and the longest time horizon for investors. Under full privatization, all assets, operations and future capital investment are turned over to the private sector for perpetuity. Assets sales have been used only rarely - to date full privatization has only happened in England and Wales (explained at Chapter 5) and partially in Chile.

To protect consumers from monopolistic behavior, a private owner of a water company generally operates under a license from the government that sets certain service levels and tariff rates. This licensing function may be supplemented by a regulatory agency to monitor and enforce service and tariffs (for example, OFWAT in the United Kingdom). To protect investors and operators, a predictable regulatory structure is crucial.

Unlike the other contractual arrangements examined, private asset ownership provides the opportunity for capital market monitoring. Especially for listed water and sanitation companies, an important mechanism for disciplining management is the information provided in security prices. Low stock prices can lead to corporate takeovers of poorly performing companies. Also, where a credible regulatory framework exists, asset ownership provides security and collateral for long-term investment.

4.5 Advantages and opposition

The potential benefits of the different approaches of private sector intervention are summarized in Figure 4.11.



Source: ADB (2003)

Figure 4.11 Potential benefits of various PSP options

Despite advantages of private sector partnership, many countries have explicit laws or constitutional causes prohibiting ownership of water assets and in some cases, it goes as far as prohibiting any type of involvement by private companies (see Table 4.1). Concern is often voiced about the loss of competitive discipline. Higher tariff levels may also be of concern as new owners of water infrastructure assets attempt to recover their investment.

Table 4.1 Many countries have explicit laws or constitutional clauses prohibiting private ownership of water assets

	City and/or country
Privatization is illegal	Uruguay and Netherlands
No profit allowed	Denmark
Water for free	South Africa
No charging without investing	Barrio El Alto (Bolivia)
Providing good services	Argentina
No drop in quality of services	Atlanta (USA)
No increase in water prices	Manila (Philippines)
Respect for the environment	Stockton (California, USA)
Returning to public sector	Neufchateau, Castres, Châtellerault and Cherbourg (France)
Anti-water-privatization campaigns	Cochabamba (Bolivia)

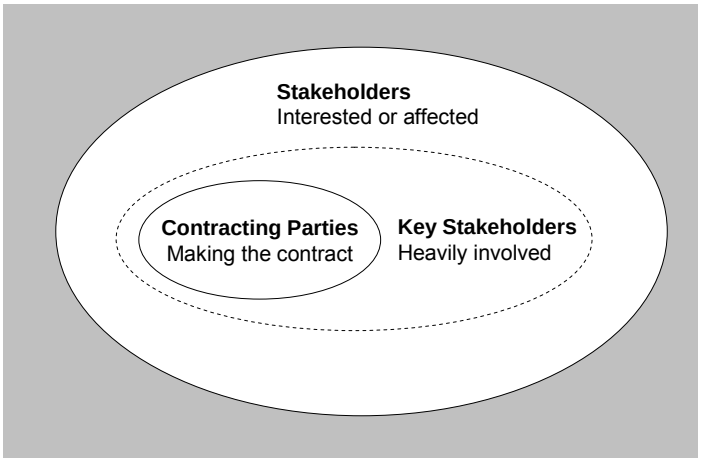
Source: Adapted from Lassere, F. and Rekacewicz, Ph. (2005)

4.6 Roles and responsibilities

Partnerships for Water (85) provide the nomenclature of actors in a given public private partnership (PPP) and explain the importance of role definition and institutional separation (see Figure 4.12).

The roles in complex partnerships such as PPP for water and sanitation services need to be clearly defined and institutionally separated. Partnerships for Water (85) identify the following key roles and actors:

- The national government sets the policy and legal framework for water and sanitation, public private partnerships, and represents the interests of all citizens.
- The local government (regional, municipal, as appropriate) ensures access to basic services, has authority over user charges, and concludes service delivery contracts.
- The consumer becomes a legitimate customer of the service provider and is responsible for paying the bills on the basis of an agreed tariff.
- The regulator(s) monitor the performance of all parties, provide information on the execution of the contract, and act to balance the interests of governments, service providers and consumers.
- The service provider(s) are responsible for executing the contractual agreements and for delivering services.



Example: Contracting Parties: local authority, service operator; Key Stakeholders: Both contracting parties and national and municipal governments, investors, regulator, donors, trade union(s), consumer NGOs; Stakeholders: All and gender & community groups, beneficiaries, households, etc
Source: Partnerships for Water (2005)

Figure 4.12 Stakeholders in public private partnerships

4.7 Managing risks

Internal and external types of risks are associated to water and sanitation projects. How these risks are allocated and mitigated will determine the financial performance of a project.

- Market or customer risks in the water and sanitation sector take the form of demand – ability and willingness to pay – risk and payment or credit risk. Possible mitigation mechanisms are: independent tariff and demand studies, right to cut-off service, utility combinations or regionalization (project bundling) and/or loan convenants (debt service coverage ratios).
- Take-or-pay contracts with two-part tariff and/or credit support (guarantees) can work as mitigation mechanisms for off-take or non-payment risk.
- Construction or completion risks refer to the risk that lenders and investors may face if the contractor fails to complete a project on time, within budget and per contract design specifications. Possible mitigation mechanisms are: Turnkey contracts with performance bonds, liquidated damages and insurance, selection of reputable firms and/or recourse of sponsors' balance sheet during construction.
- Performance/operating risk. After construction and project start-up, risk exposure to lenders declines as cash flow generation allows loans to be repaid. The main operational risk in water and wastewater facilities is that they fail to meet the specific performance parameters set out in BOT contracts, full utility concessions and assets sales (operating licenses). Managing these risks can go through performance-based operation, maintenance contracts, long-term ownership interest and selection of reputable operators.
- Currency risk. A fundamental concern for foreign sponsors, lenders and equity investors is the ability of a local project to generate revenue in a currency that maintains value and can be converted to foreign exchange. Because water and sanitation projects generate revenue in local currency, the convertibility of the local currency is essential to obtaining financing. Indexed tariffs and/or debt service payment escrow accounts can work as mitigation mechanisms.
- Regulatory and political risks include the risk of expropriation, regulatory interference (such as unilateral changes in contracts), early termination and change of law. The special attributes of water and wastewater projects – their local nature, the need for tariff and environmental regulation, the difficulty of determining the asset value of underground pipes –accentuate these risks. Municipalities with little, if any, regulatory experience often becomes responsible for significant regulatory functions. Mitigation mechanisms are: credible concession agreement, independent regulatory authority, fair arbitration procedures, potential risk guarantees and political risk insurance.
- *Force majeure* risks are those that are beyond the control of the private or the government parties to a contract. Under *force majeure*, either party has the right to suspend obligations under the contract. F*orce majeure* events include domestic

political events, such as war, riot, general strikes and changes in laws, and 'acts of God', such as natural disasters, fires and epidemics.

4.8 Regulation and competition

Establishing a favorable contractual and regulatory environment to reduce risk is one of the major challenges to attract and secure private capital and initiative. According to Haarmeyer & Mody (55), regulation is needed to balance the dual objective of:

- Ensuring that customers pay a fair price for services at the appropriate level of quality; and
- Enabling efficient operators to earn a risk-adjusted rate of return that will attract private investment.

As powers, responsibilities and ownership are transferred to the private sector, a case for regulation can be made. Table 4.2 provides a comparison of the oversight models - public ownership, economic regulation and competition-in terms of ensuring utility performance.

Table 4.2 Alternative models of oversight for ensuring utility performance

Model	Public ownership	Economic regulation	Competition
Guiding performance principle	Service	Prudence	Efficiency
Focus of effort	Controlling prices	Meeting standards	Controlling costs
Motivation	Political support	Compliance with standards	Profits
Mechanism of accountability	Voters	Ratepayers	Customers
Mechanism for consumer protection	Complains to public officials	Complains to regulators	Consumer choice
Mechanism for controlling behavior	Elections and other political processes	Rules and regulations	Markets, contestability and competition

Source: Beecher, J. (1997)

The rationale for regulation is consistent not only with the economic theory of market failure and monopoly power but also with principal-agent theory, which suggests that safeguards are needed because the private sector will not always act in the best interest of the state (16).

CHAPTER 5

WORLD TOUR ON IMPACTS OF PRIVATE SECTOR PARTICIPATION

5.1 Western Europe

Most of the major cities of Western Europe began to lay down water and sewerage networks following public health scares in the late 19th century (54). By the mid-20th century these networks were crumbling (54). In municipal hands, services had been overmanned and inefficiently run, with leakage rates often running at around 40 percent (54).

By the mid-1970s, the European Community (currently European Union) was beginning to draw up a series of water quality directives, together with the setting of target dates for compliance (54). However, the lack of a sound regulatory regime meant that progress in attaining environmental objectives was difficult to monitor (54).

5.1.1 Investment

The members of the European Union will have to spend millions of euros to comply with the European Commission directives (see Table 5.1). Estimates published by GWI reveal that about 196 billion euros will be needed to extend/rehabilitate the water infrastructure in 17 Western European countries (the former EU 15 and Norway and Switzerland) and 124 million euros in wastewater infrastructure. Notably, Germany, France and U.K. will have to spend several millions.

Table 5.1 Forecast capital investment in Western Europe 2006-15

Country	Capital expenditure in EUR million	
	Water infrastructure	Wastewater infrastructure
Belgium	6,500	2,500
Denmark	1,600	1,200
Finland	1,800	1,500
France	33,500	17,800
Germany	52,000	23,000
Greece	2,196	1,072
Ireland	2,355	1,345

(table cont. next page)

Table 5.1 (cont.)

Country	Capital expenditure in EUR million	
	Water infrastructure	Wastewater infrastructure
Italy	20,000	16,000
Luxembourg	200	300
Netherlands	8,000	3,125
Norway	2,500	2,000
Portugal	4,500	3,200
Spain	14,000	12,000
Sweden	2,750	1,900
Switzerland	4,000	3,200
UK	36,000	31,500
Total	**195,801**	**123,912**

Source: Global Water Intelligence (2005)

5.1.2 Urban Wastewater Directive

Particularly the Urban Wastewater Directive (see Table 5.2), and its high fines for non-compliance, injects significant pressure to the member states to appropriately treat their used waters.

Table 5.2 Types of treatment required under the UWWT Directive

Type of area	Size of agglomeration in thousands population equivalent			
	Between 2 and 10	Between 10 and 15	Between 15 and 150	More than 150
Sensitive area	Secondary	Stringent	Stringent	Stringent
Normal area	Secondary	Secondary	Secondary	Secondary

Source: European Commission web site (2003)

According to data published by GWI, currently only a handful of EU member states turned to tertiary treatment to clean their wastewater (see Table 5.3). Sweden and Germany use tertiary treatment techniques to clean 95 and 92 percent respectively of the produced wastewater. Other countries, like U.K., Spain and France turn to biological treatment. In contrast, in Greece, wastewater treatment consists mainly of primary treatment.

Table 5.3 Status of EU wastewater services (in percentage)

Country	Primary	Biological & Advanced	Tertiary
Sweden	0	0	95
Germany	1	6	92
Austria	0	0	86
Denmark	2	4	84
Switzerland	0	14	82
Finland	0	0	80
Netherlands	0	20	78
Norway	12	1	67
UK	4	60	36
Italy	3	36	24
Belgium	0	29	16
France	13	62	13
Greece	32	14	9
Spain	21	58	4
Ireland	8	51	2
Portugal	13	47	0

Source: Global Water Intelligence (2005)

5.1.3 Water Framework Directive

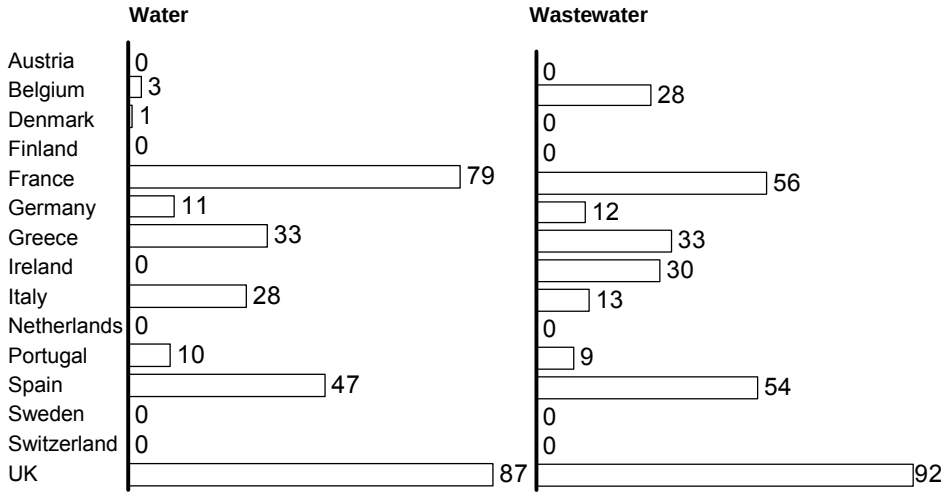
On 23 October 2000, the "Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy" or short the EU Water Framework Directive (or even shorter the WFD) was finally adopted (82). The Water Framework Directive objectives are:

- Ensuring protection of all our waters, with the objective of good quality (good status), as a rule, at the latest by 2015.
- Covering all impacts on water, regardless of their origin, and to provide a single coherent management frame based on river basins and the integration of all water-related legislation.
- Getting citizens and stakeholders involved by broad public participation.
- Using economic instruments in support of environmental objectives.
- Providing a sound long-term basis for political, technical and financial decisions at all levels.

- Achievement of "good status" for all European waters by 2015. The definition of the good water status encompasses the chemical composition of water and the ecological elements. The ecological status is defined as an expression of the condition of water bodies with regard to their capacity to support natural life, biodiversity and legitimate water uses.
- Another important objective is to develop water pricing policies that provide adequate incentives to recover the costs of water services for households, industry and agriculture.

5.1.4 Degree of privatization

In Western Europe, the rate of privatization in water and wastewater services varies considerably from country to country (see Figure 5.1). In France, which has a century old tradition of public private partnerships (see Chapter 4), the rate of water privatization is 79 percent and the rate of wastewater privatization is 56 percent, while in Spain roughly 47 percent of the country's water supply has been privatized and about 54 percent of the wastewater services has been privatized. In countries such as Austria, Ireland, The Netherlands, Switzerland and the Scandinavian countries (Denmark, Finland, Sweden and Norway) municipal residents do not receive water supply and wastewater services from private sector providers.



Source: European Investment Bank (2004)

Figure 5.1 Degree of privatization in the European Union

5.1.5 Methods of financing

Diversity is the applicable word when trying to identify the financing trends for water and wastewater services in Western Europe (see Table 5.4).

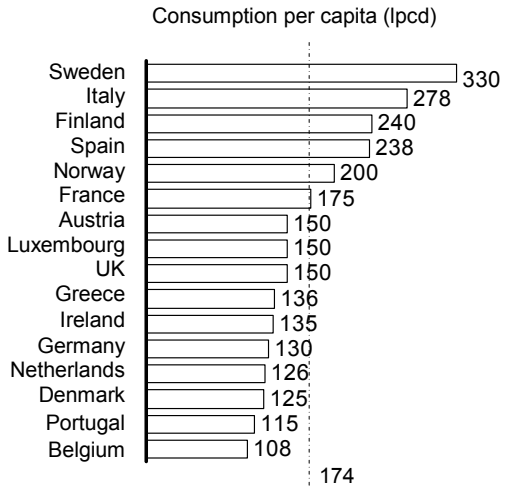
Table 5.4 Diversity of financing trends in Western Europe

Country	Financing trend
Netherlands	Increased debt for publicly owned companies; First DBFO (Scottish model) for WWTP
England & Wales	Increased gearing for privatized water companies; Restructuring (100% debt financed)
Scotland	DBFO all bond financed
France	Traditional municipal companies; Leases & concessions
Portugal	Public holding company (bulk supplier) & Cohesion Fund grants; Private concessions with Cohesion Fund grants
Italy	Partial flotation (51% municipal shareholding); Private concessions (limited to date)

Source: European Investment Bank (2003)

5.1.6 Water consumption

Europe is diverse geographically, topographically, politically and economically. From the water-rich north to the poor south, and with ageing infrastructure throughout, the water consumption per capita varies considerably (see Figure 5.2). In average, the water consumption is of 174 liters per capita per day. Sweden and Italy have the highest consumption levels, of 330 and 278 liters per capita per day respectively. In contrast, Portugal and Belgium consume much less than the average.



Source: Global Water Intelligence (2005)

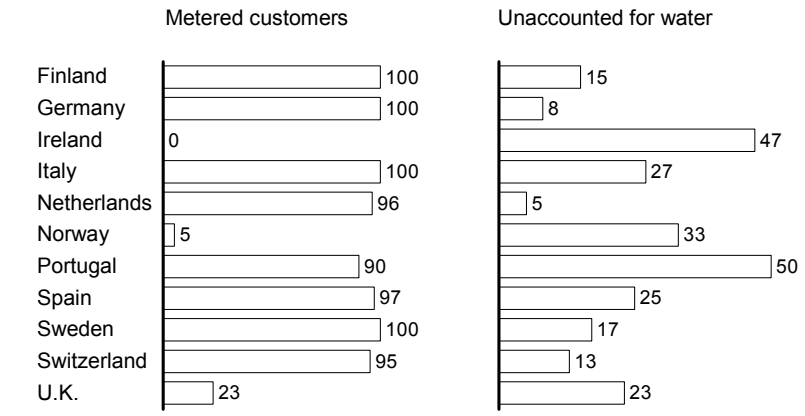
Figure 5.2 Water consumption in Western European countries

5.1.7 Metering and water losses

Generally in Western Europe to benefit from water supply services the use of a meter is mandatory, with the exception of countries like Ireland, Norway and U.K. where such a rule does not apply (see Figure 5.3).

In fact, in U.K. it will soon change with new legislation entering into force. In Ireland the decision is political, as water is free in this country. In terms of efficiency in control of water losses, the figures of the most common indicator to measure this, the unaccounted for water (UFW), shows considerable variation between countries (see Figure 5.3).

Performing countries have UFW values below 15 percent, such as The Netherlands, Germany and U.K. In contrast, Portugal and Ireland present very high values of UFW, 50 and 47 percent respectively, indicating inefficiencies.

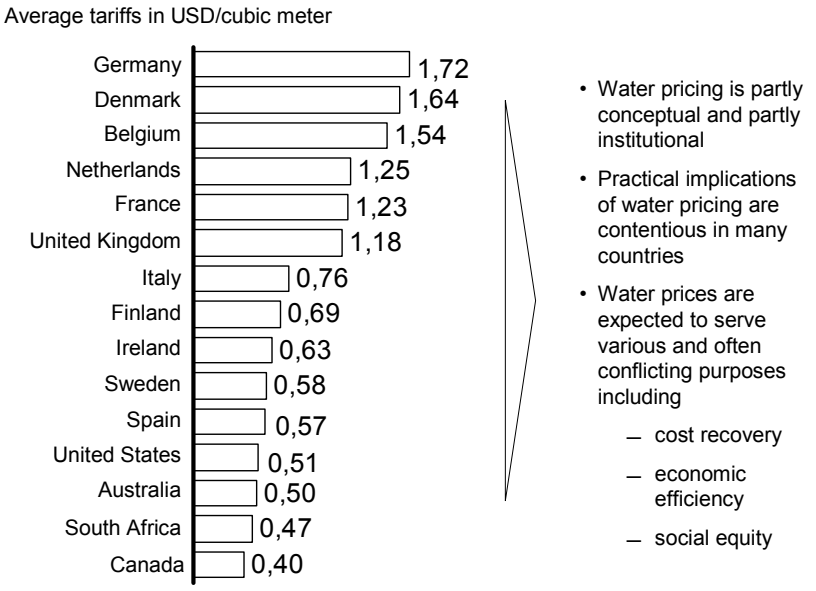


Source: Global Water Intelligence (2005)

Figure 5.3 Metering level and unaccounted for water in European Union

5.1.8 Tariffs

The price of water delivered in Western Europe is considered high when compared to other industrialized countries such as Australia, Canada and the United States (see Figure 5.4). The country charging the highest water tariffs is Germany, followed by Denmark, billing their customers with 1,72 and 1,54 euro per cubic meter of water delivered.



Source: Watertech Online (2001)

Figure 5.4 Industrialized countries show a wide range of variation in water pricing

Adding the wastewater tariffs to the water tariffs, according to data published by the GWI, Denmark emerges as the country charging the highest amount to consumers (see Figure 5.5). Denmark charges 4,8 euros per cubic meter, followed by Belgium charging 3,82 euros per cubic meter and Germany 3,75 euros per cubic meter. In contrast, in Italy the total tariff for water and wastewater services is on average 0,92 euros per cubic meter, as a result of companies being heavily subsidized. In Ireland both water and wastewater activities cost nothing to consumers.

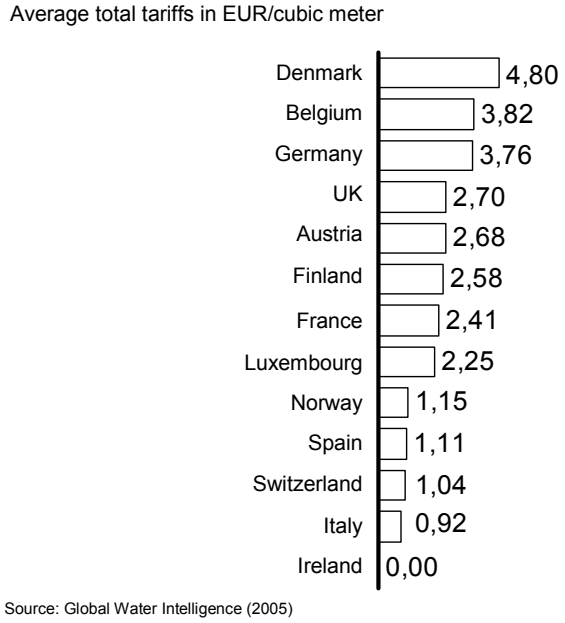


Figure 5.5 Total water and wastewater tariffs vary considerably in Western Europe

5.1.9 French model

The European giants have had plenty of experience in public private partnerships: France's Compagnie Générale des Eaux was founded in 1853, and Suez Lyonnaise des Eaux in 1880; and PPP has been the traditional way of involving private operators. Given this long tradition for a strong involvement of the private sector in water services management – the so called "French model" – private operators hold a very strong position in the water market (as discussed in Chapter 3).

In Aqualibrium (80) two main categories of public-private partnerships that may be developed in France are described:

- Delegation contracts, according to which a private operator is given the management if a service by a municipality;
- Joint stock companies between one or more municipalities and the private operator (s). The joint stock company is in charge of the management of the service. This solution, mainly applied in large cities, is unusual. It seems that

neither private operators nor local communities appreciate this organization very much (unlike in Spain for instance) because of its hybrid status: when applied, it often follows a request from the municipality.

According to information from the same source, two types of delegation contracts are generally developed:

- Lease (*affermage*): the contract covers only the running of the service as the plant already exists. It includes partial renewal;
- Concession: the concessionaire builds and operates the plant and finances some of the renewing of the equipment. However, the plant belongs to the municipality from the very beginning.

In both cases, the operator bears the financial risk as its remuneration comes directly from consumers. It may be noted that both types of contracts are more and more frequently combined (80). For example, the service is operated under a lease contract, and a concession contract is passed to finance and operate an extension of a treatment plant (80).

The public sector is split among thousands of *régies*: around 10,200 for water supply and 13,400 for wastewater treatment (80). As far as water supply is concerned, the public sector's share is decreasing: *régies* serve about only 21 percent of the inhabitants (80). The private sector is very much concentrated with three major operators: Générale des eaux, Lyonnaise des eaux and SAUR. Together they serve 98 percent of all consumers supplied by the private sector (80).

Also in Aqualibrium (80) the characteristics that ensure the three main French operators significant strengths are discussed:

- They gather complementary activities: R&D in water treatment, conception of water disinfecting and wastewater treatment plants, building of plants, water services management;
- They propose a full range of activities in the environment sector: water, waste and energy;
- They have acquired know-how in water services management in industrialized as well as developing countries.

5.1.10 German model

Access to water supply is guaranteed by the German constitution. Although water companies are mostly public, they generally operate under private corporation law – the so called "German model". One of the most common structures is the multi-utility municipal company, usually known as *Stadtwerke*. The average water charges vary enormously between local states (see Figure 5.6). Local states such as Thuringia

and Saxony charge 2,34 and 2,33 euros per cubic meter, a much higher amount than the average tariff of 1,72 euro per cubic charged on average around the country (as discussed in section 5.1.8).

There are more than 5,000 public water companies in Germany which in general operate independently from each other (see Figure 5.6). In this fragmented market, Bavaria alone counts 2,060 water companies, followed by the local state of Baden – Württemberg with 975 companies.

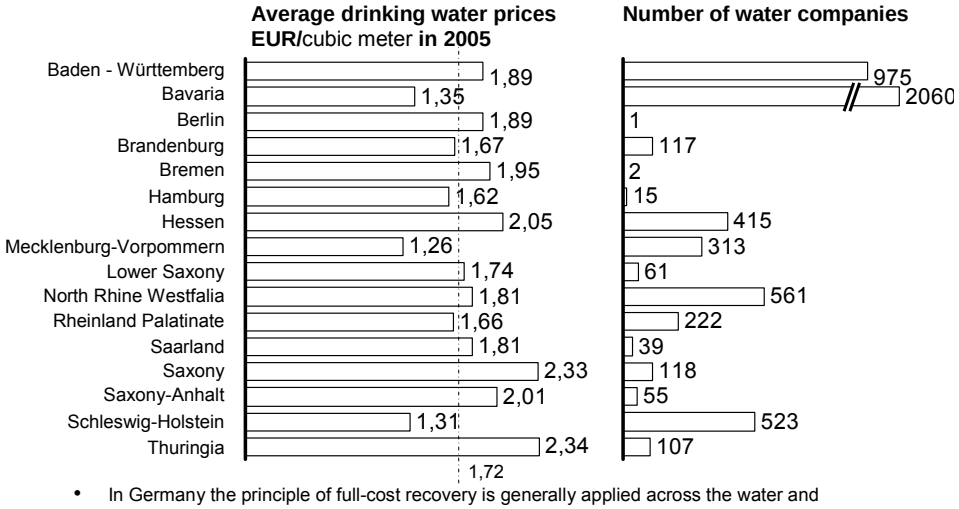


Figure 5.6 German average water charges and number of water companies vary considerably between states

In response to European Union directives Germany has started to embrace public private partnerships as a means to finance and manage its water utilities, notably wastewater activities (see Table 5.5).

Table 5.5 Recent German wastewater transactions according to size

Target company	City (million inhabitants)	Investor	Date
Berliner Wasserbetriebe	Berlin (3,39)	RWE Umwelt, Vivendi	June-99
Hansewasser	Bremen (0,54)	Gelsenwasser, E.on	Nov-98

(table cont. next page)

Table 5.5 (cont.)

Target company	City (million inhabitants)	Investor	Date
Stadtentwäasserung Dresden	Dresden (0,48)	Gelsenwasser	Nov-03
Entwässerungsbetriebe Krefeld	Krefeld (0,25)	Trienekens	Sep-89
Abwasserbetriebe Rostock	Rostock (0,20)	Eurawasser	1993
Lausitzer Wassergesellschaft	Cottbus (0,11)	Eurawasser	Jan-04
Stadwerke Schwerin	Schwerin (0,10)	Eurawasser	May-01
Entwässerungsgesellschaft Viersen	Viersen (0,08)	RWE Umwelt	2002
Entwässerungsgesellschaft Cuxhaven	Cuxhaven (0,05)	EWE	Dec-02
Stadtwerke Weisswasser	Weiss-wasser (0,02)	Veolia	Jan-03

Source: Various

Full cost recovery water tariffs are calculated in Germany (49). According to information from the German Federal Environmental Agency, the water customer ensures through the payments that not only the operational costs but also the capital costs (amortization and interest of the investments) are completely covered. This does not mean that public subsidies are not paid. In particular for the reconstruction of infrastructure in the new states in former GDR substantial special funding by the federal government and the EU was made available (49). In addition to this, there are varying funds available according to the individual states and regions to overcome "disparities" - in order to minimize the difference in the price for water even in areas with low population density in comparison to cities (49). The water supply utilities are subject to taxation, in particular corporate tax and VAT and therefore contribute to the federal and state budgets (49). In addition, some states levy further taxes and fees, such as the groundwater extraction fee in particular (49, 94).

In the wastewater management sector, the situation is even more complex (49). Municipal waste water utilities are tax-exempt, in comparison to private waste water

utilities, even if these perform identical tasks (49). Additionally, wastewater investments may be subsidized on an individual basis (49). On the other hand, wastewater charges have an influence on wastewater fees (49). On a practical level, there are various subsidies and steering instruments which may in part have a counterproductive effect (49).

5.1.11 British model

In 1973 in England and Wales, responsibility for water supply was placed in the hands of ten Regional Water Authorities who took over the work previously carried out by 157 water undertakings, 29 river authorities, and 1,393 sanitary authorities, whose jurisdiction was based on river catchment areas (22).

Underinvestment and the expensive system upgrades required by various environmental directives from the European Union led the government to privatize the water and sewerage services in England and Wales in 1989 – the only full privatization in the world, the so called "British model", in which the assets of the water companies moved completely from the public to the private sector (see Table 5.6). Tax allowances were granted to the companies, which were then floated to the stock exchange; these companies joined major European players in competing for contract business worldwide (discussed in Chapter 3).

Table 5.6 England and Wales experience in water privatization

Government	Unitary
Impetus for privatization	Ideological but increasingly commercial and pragmatic
Implementing privatization	Top-down
Water systems	Ten regional water systems formed according to river basins
Utility ownership	All privatized (1989)
Regulatory structure	Single administrator for water only (OFWAT); other administrators for other sectors
Regulatory authority	Administrative; independence
Regulatory method	Regulatory determination of price caps and indexed changes with adjustments for quality and efficiency
Regulatory review	Performance

Source: Beecher, J. (1997)

The French model is asset-light (53). The source of competitive advantage is the ability to operate water systems efficiently across the world (53). The English

regulated utility model is asset heavy to the extent that finance rather than operations have become the key source of competitive advantage (53).

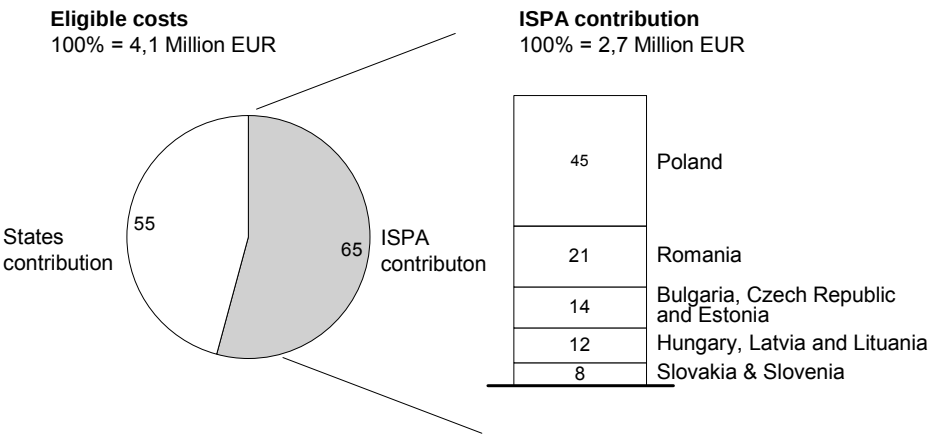
5.2 Central and Eastern Europe

In the early 1990s wide-scale privatization was seen as the antidote to years of massive centralization and bureaucracy throughout the communist world (22). It was thought that these transition economies would adapt rapidly to western-style democracy and markets (22). A decade later, the scorecard on privatization has been mixed, although the extent of privatization increases every year in the water and sewerage sectors (22). These transitional economies simply do not have the extensive capital necessary for large-scale maintenance and development of water and sewerage infrastructure (22).

The Eastern European water and wastewater industry is highly fragmented with many local and small regional water companies operating independently from one another (22). As such, the bulk of O&M contracts are being awarded in large urban areas (22).

5.2.1 Financing

Lending institutions and funds such as the World Bank, the EU Phare Programme and ISPA (Instrument for Structural Policies for Pre-Accession - EU Fund), the EIB and the EBRD, all provide low interest and long term financing for infrastructure projects. ISPA alone contributed with 65 percent of the eligible costs in water and wastewater sectors (total of about 4 million euros) for the period of 2000-03 to countries such as Poland, Romania, Bulgaria, Czech Republic and Estonia (see Figure 5.7).



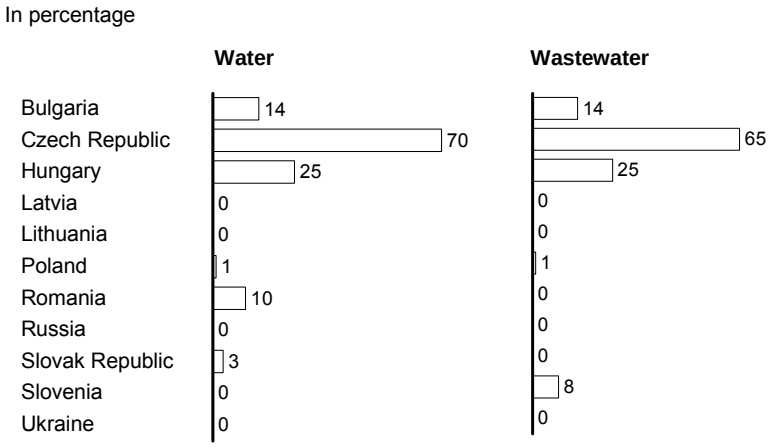
ISPA - Instrument for Structural Policies for Pre-Accession (EU Fund)
Source: Web site of the European Commission (2005)

Figure 5.7 ISPA grants in the water and wastewater sectors in 2000-03 to Eastern European countries

The interest of these lending institutions is to develop Central and Eastern Europe while stressing the conservation of ecological and water resources. As a condition of financing water and wastewater companies, lending institutions often require some form of privatization. Because of the highly fragmented, localized water systems, the EBRD has developed a system under which water projects can be pooled, called the multi-project financial facility. This system makes funds available to private companies which make equity investments in and loans to pooled groups of small water and wastewater projects.

A common strategy used by the public sector in Central and Eastern Europe is to introduce privatization in order to increase efficiency while retaining control over both assets and operations – the mixed operating company approach (described in Chapter 4). Under this system, the municipality or regional public authority splits a water works into two companies: one that owns the assets and another to manage the operations. Retaining ownership of the assets, a controlling stake in the public authority is then sold to the private sector. Concession projects are then granted to that company.

The EIB published data on the degree of privatization in Central and Eastern European countries, showing a low intervention by the private sector in these countries, with the exception of Czech Republic where the PSP level reached about 70 percent in the water sector and 65 percent in wastewater activities (see Figure 5.8).



Source: European Investment Bank (1999)

Figure 5.8 Degree of privatization in Central and Eastern Europe

Forecast capital investment in Eastern Europe for the period of 2006-15 indicates more activity in the wastewater sector, notably in Poland, Romania and Czech Republic (see Table 5.7). Bulgaria also joins the club concerning capital expenditure in water infrastructure. A total expenditure of 10 million dollars is estimated for water infrastructure and twice that amount for wastewater infrastructure.

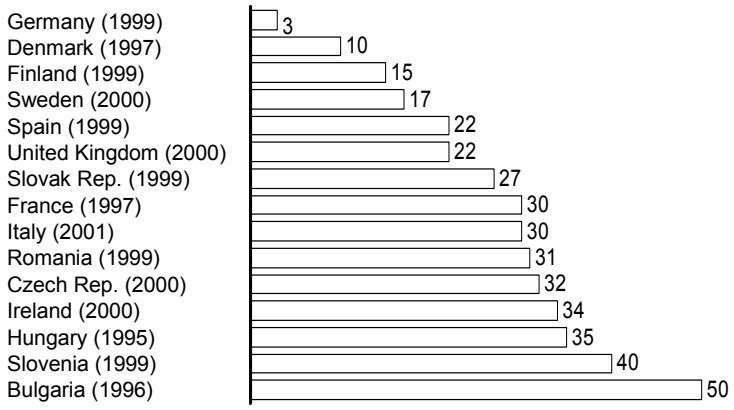
Table 5.7 Forecast capital investment in Eastern Europe 2006-15

Country	Capital expenditure in USD million	
	Water infrastructure	**Wastewater infrastructure**
Bulgaria	1.500	1.860
Czech Republic	1.100	3.200
Estonia	204	265
Hungary	700	2.300
Latvia	100	900
Lithuania	100	1.300
Poland	2.200	5.300
Romania	1.620	3.700
Russia	875	900
Slovakia	740	670
Slovenia	300	1.000
Ukraine	600	400
Total	**10.039**	**21.795**

Source: Global Water Intelligence (2005)

5.2.2 Unaccounted for water

The unaccounted for water (UFW), according to data provided by the European Environmental Agency, reveals huge water losses and/or inefficiencies in countries like Bulgaria, Slovenia and Hungary (see Figure 5.9). Bulgarian water systems have UFW of about 50 percent, Slovenia 40 percent and Hungary 35 percent. Probably these values are currently much lower, but that is still the available data. The UFW comparison between Eastern and Western European countries puts in evidence the gap in quality of water systems between the countries.



Source: EEA (2003)

Figure 5.9 High unaccounted for water in Eastern Europe compared with Western Europe

Bulgarian water systems have UFW of about 50 percent, Slovenia 40 percent and Hungary 35 percent. Probably these values are currently much lower, but that is still the available data. The UFW comparison between Eastern and Western European countries puts in evidence the gap in quality of water systems between the countries.

5.2.3 Tariffs

The Global Water Tariff Survey published by the Global Water Intelligence in 2005 (53) reveals the diversity in domestic tariffs charged by the water and wastewater service providers to the customers of the major Eastern European cities (see Table 5.8). The highest tariffs happen in Prague and Tallinn, 1,8 and 1,67 dollar per cubic meter. Ukrainian urban customers pay in average for the delivery of water and wastewater services only about 20 dollar cents per cubic meter. This survey also

includes the average annual expenditure on water as a percentage of the country's gross domestic product per year. In some of countries this percentage of the annual expenditure is relatively high, indicating that the water tariffs charged are very high to local pockets, for example in Armenia. In other countries, this indicator is quite low, meaning that the tariffs are probably under priced, as for example in Slovakia.

Table 5.8 Water and wastewater tariffs - Eastern Europe in USD/m3

City	Country	Total domestic tariff	Average annual expenditure on water as % of GDP per head
Prague	Czech Republic	1,80	0,94
Tallinn	Estonia	1,67	0,76
Budapest	Hungary	1,72	0,53
Vilnius	Lithuania	2,17	0,68
Warsaw	Poland	1,32	0,58
Zagreb	Croatia	1,18	0,00
Riga	Latvia	0,74	0,52
Bucharest	Romania	0,59	1,10
Bratislava	Slovakia	0,61	0,20
Sofia	Bulgaria	0,54	0,42
Belgrade	Serbia	0,40	0,94
Chrisinau	Moldova	0,21	1,74
Yerevan	Armenia	0,28	4,90
Khardiv	Ukraine	0,25	1,26
Odessa	Ukraine	0,23	0,86
Kiev	Ukraine	0,16	0,68
Minsk	Ukraine	0,11	0,40

Source: Water Tariff Survey Global Water Intelligence (2005)

5.3 Sub-Saharan Africa

Sub-Saharan Africa has to deal with severe problems, including political instability, weak public administration, high mortality from water-borne diseases, lack of credible regulation to facilitate privatization, high levels of debt and strong dependence on international development agencies to provide the basic services offered elsewhere in the world by municipalities (22). On the whole, the region is considered one of the largest challenges in the world for development (22).

The WHO/UNICEF mid-term assessment of progress in water and sanitation coverage (123) in developing countries reveals that in 2002 the lowest coverage rates are in Sub-Saharan Africa: on average, only 58 percent of the people have water supply. The figure for sanitation is 36 percent (see Chapter 2, Figures 2.2 and 2.3).

5.3.1 Privatization contracts

Bayliss (13) explains that over the last two decades, the focus of development policy in Sub-Saharan countries has shifted from the state to the private sector. Water privatization has been carried out to some degree in at least fourteen countries in the region, and many other governments are at various stages in the privatization process (see Table 5.9). In some cases privatization has been difficult to achieve.

Table 5.9 Selected water privatization contracts in Sub-Saharan Africa

Date	Country	Contract duration and type	Lead company
2002	Congo (Brazzaville)	Short-term management contract prior to award of 25 year management contract	Biwater
2002	Uganda	2 year management contract	Suez-Ondeo
2001	Burkina Faso	5 year management contract	Veolia
2001	Niger	10 year renewable contract for water and electricity supply	Veolia
2000	South Africa	5 year management contract	Suez-Ondeo
2000	Chad	30 year concession	Veolia
1999	Mali	20 year lease	Saur
1999	Cape Verde	36 year lease	Águas de Portugal/EdP
1999	Mozambique	Maputo and Motola: 15 years	Águas de Portugal
1999	South Africa (Nelspruit)	30 year lease	Biwater/NUON
1999	South Africa (Dolphin Coast)	30 year lease	Saur

Source: Bayliss, K., (2003)

Bayliss (13) discusses that the performance of privatized utilities has not changed dramatically, but that enterprises have continued to perform well, or not so well, depending both on their state when they were privatized and on the wider economic context. The evidence points to internal improvements in terms of financial management. However, governments face considerable difficulties in attracting investors and regulating private utilities. Furthermore, according to Bayliss (13), privatization fails to address some of the fundamental constraints affecting water utilities in Sub-Saharan Africa, such as finance, the politicized nature of service

delivery, and lack of access for the poor. A preoccupation with ownership may obscure the wider goals of water and sanitation reform in these countries.

5.3.2 Performance indicators before and after privatization

Table 5.10 collects some key findings from selected Sub-Saharan countries on performance indicators, comparing the position before and after privatization where data was available. Generally, the figures indicate that in Gabon and Senegal good performance has been marginally improved, while in Guinea poor performance has continued.

Table 5.10 Selected performance indicators before and after privatization in selected Sub-Saharan countries

	Unaccounted for water (%)		Connections (%)		Collection rates (%)	
	Before	After	Before	After	Before	After
Guinea	50	47	38	47	75	60
Gabon	n.a.	14	49,3	62	n.a.	93
Senegal	31	22	80	82	91	97
C. D'Ivoire	n.a.	16	n.a.	84	n.a.	n.a.

Source: Bayliss, K. (2003)

5.3.3 Water governance and finance

Currently, the main cost for water related services in Sub-Saharan countries carried by governments through taxation and service charges and, to a lesser degree, by donor assistance. For example, the European Union Water Initiative (45) contributes to the achievement of the Millennium Development Goals for water and sanitation in these countries, within the context of an integrated approach to water resources management (see Chapter 2). Donor coordination is a key to the success of this initiative, therefore an EU member state is appointed to lead the country dialogue (see Table 5.11).

Table 5. 11 Country Dialogues of the EU Water Initiative

Country	Supported by
Cape Verde	European Commission
Central African Republic	France & European Commission
Congo Brazzaville	France & European Commission
Republic of Congo	EU donors
Egypt	to be decided
Ethiopia	to be decided
Ghana	Denmark
Mauritania	France
Mozambique	The Netherlands
Rwanda	Belgium
Zambia	Germany

Source: EUWI (2005)

The private sector is only modestly involved in water related services in Sub-Saharan countries (134).

Governments of developing countries have not been able to raise adequate funds through taxation or the application of water tariffs for enhanced cost recovery (134). A report published by the United Nations Economic Commission for Africa (UNECA) on financing water development in Africa pointed to some specific sources of for additional funding (see Table 5.12).

Most importantly, it acknowledged the interdependence between effective water governance, increased funding and efficient utilization of water resources. The challenging task of raising additional funds should also render decision-makers aware of the need to complement capital-intensive instruments with alternative low-cost technology, especially in the sanitation sector.

Table 5.12 Financing water development in Africa

• Water should be explicitly included in Poverty Reduction Strategy Papers (PRSP)	• Urban revenue could be transferred for rural water supply development and human and institutional capacity-building efforts
• In most African countries, water management is dispersed between other sectors (agriculture, health, energy, etc) and is not the responsibility of a specific ministry or authority	• Private finance and public-private partnership may be best suitable for urban areas. The role of private sector involvement in the African water sector is subject to debate
• A fixed percentage of African government budgets (for example five percent) could be devoted to water resources development and management • Bilateral and multilateral aid could be earmarked as matching funds to African governments' budgetary commitments	• No amount of financial resources can solve Africa's water challenges without firm commitment by its political leaders and decision-makers. Efficient utilization of financial resources can only be achieved when a basic system of effective governance, including transparency, accountability and subsidiarity, is in place to guide public functions

Source: WWAP (2003) from UN Economic Commission for Africa (2002)

Three main points emerge, summarized by Bayliss (13), concerning the discussion on private sector participation in Sub-Saharan countries. First, the impact of privatization depends on the initial state of the enterprise. Second, regulation has proved extremely difficult even where regulatory capacity is relatively advanced. Third, privatization has been constrained by the lack of investor interest in the water sector in the region.

Bradaart (17) has revealed high rates of failures for public private partnerships in some Sub-Saharan countries in the 1990s. The researcher argues that while some early PPPs led to improvements, these were overshadowed by a wave of contract renegotiations, allegations of collusion and corruption and courtroom battles (17).

For privatization to succeed Bradbaart recommends that governments choose short-term agreements such as service and management contracts, preferably with domestic private firms, including small-scale providers. Governments should also borrow in local currencies to avoid foreign exchange risks (17).

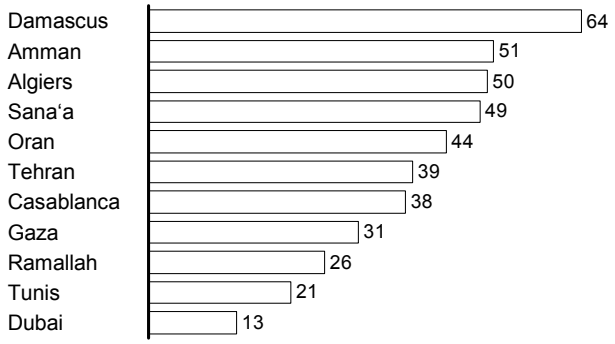
5.4 Middle East and North Africa

The Middle East is an arid region characterized by centuries-long history of conflict for a variety of reasons, among them water (22). Water sources are limited by climate, geography and hydrology; desertification is a serious issue for many of the countries of the region (22). All the flowing freshwater sources in the Middle East are shared by at least two countries that often have different political agendas, which create problems in securing a steady supply for agricultural, industrial and domestic use (22). Increasing population growth rates across the region, coupled with a rising standard of living, have correspondingly increased demand of water, despite the finite amount provided by rain, rivers and groundwater (22).

North Africa is characterized by an arid climate and water scarcity. Population is growing and the region is politically stable. According to the WHO/UNICEF mid-term assessment of progress in water and sanitation coverage (123) the rates in 2002 for North African countries are of 90 and 73 percent respectively (see Chapter 2, Figures 2.2 and 2.3).

5.4.1 Unaccounted for water

The unaccounted for water verified in some of the major cities systems', according to data published by the Global Water Intelligence (53), varies significantly in the MENA region (see Figure 5.10). On one hand, performing utilities such as in Dubai and Tunis register UFW of 13 and 21 percent, and on the other hand, very high values of UFW, such as Damascus, Amman and Algiers are over 50 percent, which indicates a high level of inefficiency and/or negligence of the water system.



Source: Global Water Intelligence (2005)

Figure 5.10 Unaccounted for water in Middle East and North Africa

5.4.2 Outlook

Table 5.13 provides an outlook for a given list of MENA countries in terms of its water sector reform, water resources and finance.

In general all the MENA countries suffer from a lack of natural water resources. Very good reforms and finance can help to cope with the problem. In the case that there is no proper reform going on and/or the country's financial situation is not doing well, the potential for the country to face water problems increases.

There are no serious water concerns in Israel, Oman, Turkey and the U.A.E. Countries like Bahrain, Morocco and/or Saudi Arabia could face some challenges. Possible difficulties in the water sector may emerge in Algeria, Libya or Tunisia. Unless measures are taken by Jordan, Palestine, Egypt, Syria and Yemen to tackle with the current situation, these countries may have to deal with a water "crisis".

Table 5.13 Water Outlook for the Middle East and North Africa

Country	Water sector reform	Water resources	Finance	Outlook
Israel	Very good	Poor	Good	No serious concerns (table cont. next page)
Oman	Good	Poor	Good	
Turkey	Medium	Good	Medium	
UAE	Good	Poor	Good	
Bahrain	Medium	Poor	Good	Could face some challenges
Iran	Poor	Good	Medium	
Kuwait	Medium	Poor	Good	
Lebanon	Medium	Good	Poor	
Morocco	Good	Medium	Poor	
Qatar	Medium	Poor	Good	
Saudi Arabia	Medium	Poor	Good	
Algeria	Medium	Poor	Medium	Possible difficulties
Iraq	Poor	Good	Poor	
Libya	Poor	Medium	Medium	
Tunisia	Poor	Medium	Medium	
Jordan	Medium	Poor	Poor	Probable difficulties
Palestine	Medium	Poor	Poor	
Egypt	Poor	Poor	Poor	Crisis likely
Syria	Poor	Poor	Poor	
Yemen	Poor	Poor	Poor	

Source: Global Water Intelligence (2005)

5.4.3 Recent privatization contracts

Table 5.14 provides information about the recent PSP contracts in Algeria and Morocco.

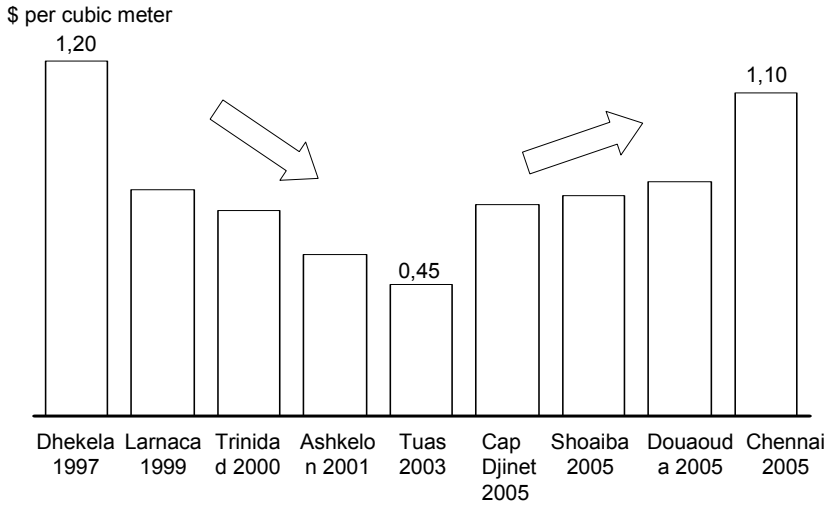
Table 5.14 Recent PSP contracts in North Africa to October 2005

Year	Country - City	Company	Water (million people)	Wastewater (million people)
2005	Algeria - Athmania	Suez	1.000	0.000
2005	Algeria - Taksebt	Suez	2.000	0.000
2005	Morocco - Marrakech	Suez	0.000	1.000

Source: Company Annual Reports and web sites

5.4.4 Desalination

Desalination techniques are becoming increasing cost effective, and the cost of a cubic meter of desalinated water decreased considerably in the last years, though it went up as well (see Figure 5.11).



Source: Global Water Intelligence (2005)

Figure 5.11 Desalinated water costs go up as well

Falling prices and strong demand are an appealing contribution for drawing the private participation sector into the Gulf's desalination industry.

The trend in technology is Reverse Osmosis (RO), since it has evolved, enabling significant cost reductions. The revolutionary concept is the addition of RO plants to new or existing thermal facilities in a hybrid system.

The Middle East's first hybrid plant was in Fujairah in the UAE. The switch to membrane systems for pre-treatment of the feed water for RO plants, rather than the traditional sand filtration techniques, not only means using less land, but also allows for greater selectivity in removing impurities (see Table 5.15).

Moreover, the improved quality of the feed water enhances the lifespan of RO plants, increasing their long-term cost effectiveness.

Table 5.15 Major water sector membrane techniques

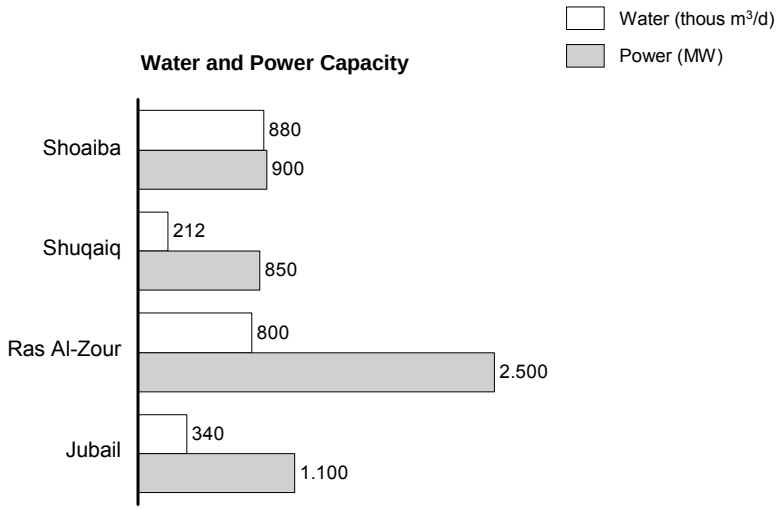
	MF	UF	NF	RO
Pore size range (micrometers)	0,01 - 1,0	0,001 - 0,01	0,0001 - 0,001	<0,0001
Operating pressure (psi)	<30	20-100	50 - 300	225 - 1,000
Microorganism removal	Protozoan cysts, algae, bacteria	Protozoan cysts, algae, bacteria	All	All
Dissolved inorganics removal	None	None	20 - 85%	95-99%
Energy use	Low	Low	Low to moderate	Moderate

MF - Microfiltration; UF- Ultrafiltration; NF - Nanofiltration
RO- Reverse Osmosis

Source: Global Water Intelligence Research (2005)

While the Gulf States use desalination to provide the bulk of their consumable water, in other areas the process is small scale and creates lower grade water that is not suitable for human consumption (22). Although there is a movement to invest more heavily in large scale desalination plants, countries, particularly Israel, have thus far chosen to improve efficiency in their current systems rather than to rely on desalination as a panacea for their water needs (22).

Desalination is a more viable option when combined with power plants, particularly when the process can be fuelled by excess heat that would be released as waste. Independent water and power projects (IWPP) are widely used in Saudi Arabia (See Figure 5.12).



Source: Global Water Intelligence (2005) from WEC (2005)

Figure 5.12 Saudi Arabia's independent water and power projects

5.5 Latin America

In Latin America there is a struggle between a government's desire to offload expensive water and sewerage provision and the strength of the labor unions (54). The economic crisis that took place in Argentina had impact on consumers ability to pay their water and sewerage bills (54). Brazil has proved frustrating with its political stop-go attitude to privatization (54). Chile's good regulatory regime has meant that several international companies have entered the market successfully (see Table 5.16).

Table 5.16 Recent PSP contracts in Chile to October 2005

Year	Company (City)	Company	Water (million people)	Wastewater (million people)
2005	ESMAG (Magallanes)	Falabella	0.147	0.147
2005	ESSAR (La Araucanía)	Falabella	0.581	0.581
2005	ESSAT (Tarapacá)	Falabella	0.409	0.409

Source: Company Annual Reports and web sites

5.5.1 Local private companies

The three countries, as previously mentioned, which have gone the farthest in the large-scale privatization of their state owned water and sanitation sectors are Argentina, Brazil and Chile. New players in these countries reflect a more localized market. Table 5.17 gives estimates of the population served by local private companies in Argentina, Brazil and Chile and their respective contract types.

Table 5.17 Local private water companies in Latin America

Company	Country	Coverage (million people)	Contract type
Antofagasta	Chile	0,50	One concession
C Financiero	Chile	1,90	Two concessions
Latin Aguas	Argentina	1,80	Three concessions
SABESP	Brazil	25,10	São Paulo
SACI Falabella	Chile	1,00	Three concessions

Source: Global Water Intelligence (2005)

5.5.2 Tariffs

Table 5.18 summarizes the diversity of total water and wastewater domestic tariffs charged in major Latin American cities. These tariffs sometimes vary considerably within the same country, as for example in Brazil. In the Brazilian city of Belo Horizonte customers receive a bill of 2,05 dollar per cubic meter while in the same country, in São Paulo or Salvador, the prices are of 0,51 and 0,59 dollar per cubic meter respectively.

In terms of the average annual expenditure on water and wastewater services as a percentage of the country's gross domestic product per year, in some of countries this percentage of the annual expenditure is relatively high, indicating that the water tariffs charged are very high to local pockets, as for example in some Brazilian cities. In other cities, this indicator is quite low, meaning that the tariffs are probably under priced, as for example in Santa Fé, Argentina.

Table 5. 18 Total domestic tariffs - Latin America in USD/m^3

City	Country	Total domestic tariff	Average annual expenditure on water as % of GDP per head
Belo Horizonte	Brazil	2,05	2,18
Fortaleza	Brazil	1,20	1,27
Brasília	Brazil	1,05	1,11
Santiago de Chile	Chile	0,94	0,77
Rio de Janeiro	Brazil	1,01	1,07
Kathmandu	Nepal	0,65	2,36
Lima	Peru	0,36	0,90
San José	Costa Rica	0,64	1,36
Buenos Aires	Argentina	0,51	0,98
Quito	Ecuador	0,27	1,95
Guayaquil	Ecuador	0,48	1,94
Assunción	Paraguay	0,40	0,42
São Paulo	Brazil	0,51	0,54
Caracas	Venezuela	0,21	0,76
Bogotá	Colombia	0,32	1,15
Salvador	Brazil	0,59	0,32
Santa Fé	Argentina	0,16	0,27

Source: Water Tariff Survey Global Water Intelligence (2005)

5.5.3 Alternative service providers - the other private sector

Solo (101) emphasizes that serving the underprivileged is a huge challenge in Latin American cities and suggests that small enterprises can and will be a part of the solution; and also that different government policies can promote or hinder the scale and quality of their response.

Independent service providers in Latin American cities can charge tariffs close to the tariffs charged by utilities and create competition for customers (see Figure 5.13). Comparisons between the average tariffs charged by private networks, community systems and truckers (or vendors) in the cities of Cordoba, Guatemala City and Lima reveals that the independent providers are important with continuing niches, even in the cities where the utility provides good coverage.

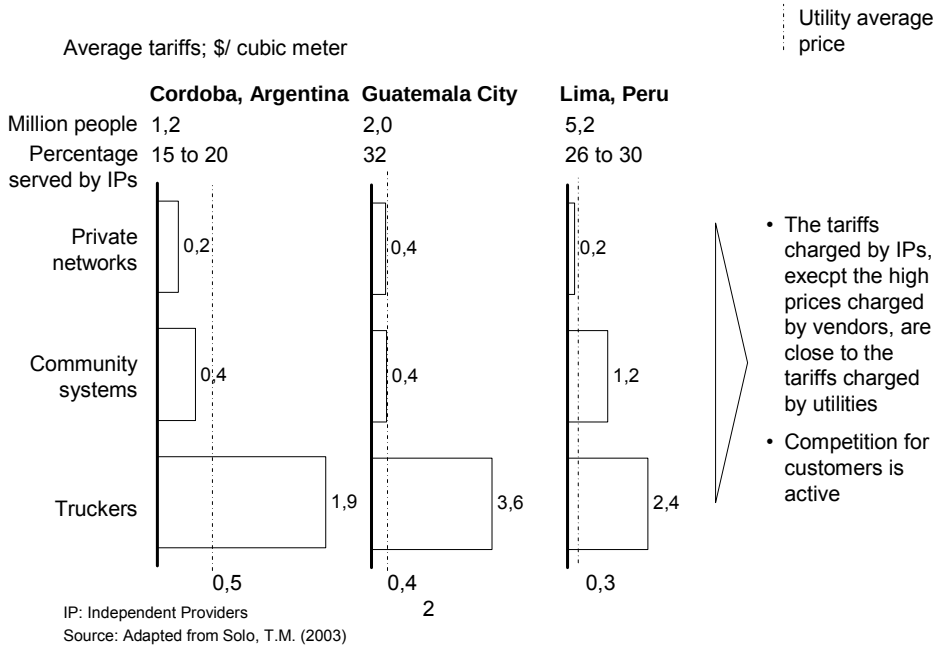


Figure 5.13 Independent water providers in Latin America

5.6 North America

The U.S. is the largest market in the world for water and wastewater treatment services and technology (22). It is a dynamic and rapidly growing market, reflecting the current strength of the country's American economy, and driven by regulatory mandates and technological change (22).

5.6.1 U.S. experience in water privatization

This U.S. is also an extremely fragmented market, with a few large regional water companies and many municipal small municipality suppliers (see Table 5.19)

The 1974 Safe Water Drinking Act required all supplied water to be treated, but most municipalities have not yet built the necessary treatment plants (54).

Table 5.19 U.S. experience in water privatization

Government	Federal
Impetus for privatization	Pragmatic but increasingly ideological and commercial
Implementing privatization	Bottom-up
Water systems	> 55,000 community water systems formed according to parochial needs
Utility ownership	80% public; 20% private
Regulatory structure	Independent, multimember state commissions with multisector jurisdiction; limited regulation of publicly owned systems
Regulatory authority	Quasi-administrative, qualilegislative, quasi-judicial
Regulatory method	Regulatory determination of revenue requirements, rate base, rate-of-return, and rate design
Regulatory review	Prudence

Source: Beecher, J. (1997)

Many of the U.S. water systems are over a hundred years old. Faced with aging infrastructure and increasing pressure to comply with regulations, public entities are turning to the private sector in order to bring in outside funding, although some municipalities have faced resistance from labor unions concerned about layoffs (54).

5.6.2 Recent contracts in the U.S.

Foreign companies, such as the French Veolia and the German RWE/Thames want to take advantage of opportunities to buy small systems in order to consolidate them, thus creating economies of scale (see Table 5.20).

Table 5.20 Recent PSP contracts in U.S.

Year	City	Company	Water (million people)	Wastewater (million people)
2005	Greshan, Oregon	Veolia Env.	0.000	0.160
2004	Virgin Islands	Veolia Env.	0.000	0.075
2004	Sioux City	RWE/Thames	0.000	0.085

Source: Company Annual Reports and web sites

There are concerns regarding the projections by the European Environmental Protection Agency (EPA) that around 300 billion dollars needs to be invested in U.S. water and wastewater infrastructure over the next two decades (54). Companies are also anxious about a new EPA requirement that water companies must send reports on water quality and contaminants to consumers along with their bills, but some see this as a business opportunity as municipalities are forced, by the regulation, to deal with any water quality problems (54).

5.7 ASIA PACIFIC

Across the Asia Pacific region, rapid industrialization and rising population are fuelling the growth of large urban centers (22). The resulting increased pollution of surface waters and overdraft of groundwater sources is creating severe problems of water supply throughout the region (22).

Industrial demand for treated process water now competes with the domestic water needs of urban populations (22). For these countries, whose economic growth is tied to expanding industrial production, assuring adequate supplies of clean water is not only a matter of social policy, but also one of economic policy (22). The need to meet this growing industrial water demand, perhaps even more than the need to meet growing domestic urban water demand is driving the increasing trend to privatize the water and wastewater sector (22).

Accordingly, those contracts either already awarded or currently contemplated for the construction and operation of water treatment facilities are predominantly for medium to large industrial centers, often state or national capitals (22).

5.7.1 Recent contracts

Table 5.21 gives a list of selected water and wastewater privatization contracts in the last years in the Asia and Pacific region. Not to miss the incredible activity in China. With a consumer population of 1.3 billion, China's newly opened water and sanitation market is becoming magnetic to private water companies.

Water scarcity has always been one of the most foreboding challenges to China's development. Though China ranks sixth in the world in terms of total fresh water resources, its per capita quantity is only one-fourth of that.

Table 5.21 Recent PSP contracts in Asia Pacific

Year	Country - City	Company	Water (million people)	Wastewater (million people)
2005	Australia -Perth	Suez	1.500	0.000
2004	Australia - Cranbourne	Tyco	0	0.050
2005	China - Bengbu	FCC	0.000	2.000
2005	China - Changle	Salcon	0.000	0.080
2005	China - ChangZhou	Veolia Env.	1.200	0.000
2005	China - Chenggong, Kunming	Salcon	0.050	0.000
2005	China - Hai Yang City	China Evergreen	0.000	0.080
2005	China - Handan	Veolia Env.	0.000	0.400
2005	China - Hanxi	Asia Water Tech.	0.000	0.600
2005	China - Harbin	Hyflux	1.000	2.000
2005	China - Hebei	China Evergreen	0.000	0.450
2004	India - Visakhapatnam	Larsen & Toubro	0.500	0.000
2005	Philippines - Baguio	Benguet	0.250	0.000
2005	Singapore - Ulu Pandan	Keppel	0.100	0.000
2004	New Zealand - Thames - C'del	Veolia Env.	0.025	0.025

Source: Company Annual Reports and web sites

5.7.2 Local private companies

The role of the local players is increasingly relevant in Asian countries, particularly in India, Philippines and Thailand (see Table 5.22).

Table 5.22 Local private water companies in Asia

Company	Country	Coverage (million people)	Contract type
BHEL	India	0,10	One O&M
Benguet	Philippines	0,10	One O&M
East Water	Thailand	0,20	Five contracts
IVRCL	India	0,10	One BO project
Larsen & Toubro	India	0,50	One concession
Manila Water	Philippines	3,40	One concession

Source: Global Water Intelligence (2005)

5.7.3 Water price differentials between vendors and utilities

Tariff increases are often unpopular, even if, historically, the poor have often paid massively for black-market water, or privately supplied water-tanker suppliers (see Table 5.23). Lane (71) presents that one of the most common political arguments against private sector participation in water and sewerage services is that it will mean that water will be too costly for poorer people. He adds that, in fact, pragmatic pricing policies based upon charging more per unit of water for households who use water for non-essential purposes have made private water provision both affordable and viable.

According to Lane (71) cross-subsidies and social provisioning lie at the core of service extension and, appropriate and safe water and sanitation services can be provided to 2-5 percent of household income.

Questions about affordability and private sector involvement in developing economies tend to ignore the fact that, under the current arrangements, it is the poorer people living in urban areas who have to pay over the odds to water vendors for supplies of distinctly dubious quality (71).

People are willing to pay an economic price for water services if it comes with guarantees of quality and availability (71).

Table 5.23 Asia - water price differentials between vendors and utilities

City	Country	Ratio
Delhi	India	489:1
Vientiane	Lao PDR	136:1
Faisalabad	Pakistan	68:1
Karachi	Pakistan	56:1
Bandung	Indonesia	50:1
Manila	Philippines	42:1
Mumbai	India	40:1
Ulaanbaatar	Mongolia	35:1
Davao	Philippines	20:1
Jakarta	Indonesia	17:1
Mandalay	Myanmar	14:1
Hanoi	Viet Nam	13:1
Cebu	Philippines	13:1
Dhaka	Bangladesh	13:1
Bangkok	Thailand	10:1
Chonburi	Thailand	10:1
Ho Chi Minh City	Viet Nam	9:1
Chiangmai	Thailand	7:1
Karachi	Pakistan	6:1
Chittagong	India	6:1
Dhaka	Bangladesh	5:1
Jakarta	Indonesia	2:1

Ratio: Price by informal vendors by the cost of water for domestic use
Source: ADB (2003)

It is the absence of piped water that costs more both in financial and public health terms (71).

Popular support exists for adequate supplies for water and improved public health at an affordable rate (71).

Opposition is most visible amongst the better-off households who oppose paying an economic price for piped water supplies for gardens, swimming pools and other non-essential household uses (71). The fact that these are also the people with the most political influence means that the political picture is often distorted (71).

CHAPTER 6

DEVELOPMENT OF THE KNOWLEDGE BASED DECISION SUPPORT SYSTEM

This chapter is organized as follows:

- It first provides an overview of the fundamentals of decision making and problem solving.
- It then discusses the types of methods available for decision making and introduces the concept of decision support systems (DSS) and multiobjective programming.
- The selected method – composite programming – is then described.
- How composite programming can be used to select an option for private sector participation (PSP) in water and sanitation utilities is explained, including
    - the selection of alternatives – seven different approaches to PSP – and
    - the selection of objectives – also seven reasons why governments seek to involve the private sector in the water and sanitation sector.
- An overview of the available indicators used to measure the performance of water and sanitation utilities and benchmarking is given.
- It then discusses the approach used to select thirty six key performance indicators (KPIs) and the impact that efficient knowledge management can have in the process of developing knowledge based decision support system (KB-DSS).
- Finally, the transformation – distinct for industrialized and developing counties - and grouping of the KPIs according to the selected objectives is provided.

6.1 Decision making and problem solving

Decision making differs fundamentally from problem solving. A problem occurs when something is not behaving as it should: something is deviating from the norm; something goes wrong. Decision making is required for the question "Which PSP option shall we choose?" Problem solving is needed for the statement "Our water utility won't perform".

Problem solving is a systematic approach to overcoming obstacles and/or problems in the management process (54). A number of problem solving methodologies exist. Kepner & Tregoe (54) propose the following steps for problem solving:

- Recognizing a problem exists and defining it;
- Generating a range of solutions;
- Evaluating the possible solutions and choosing the best one;
- Implementing the solution and evaluating its effectiveness in solving the problem.

With straightforward, common problems it is common sense to try a series of quick and tested solutions starting with the most simple or cheapest before moving on to those that take longer or cost more. With problems of greater complexity it may not be so easy, or indeed advisable, to try quick solutions.

Decision making is the process of choosing between alternative courses of action. Decision making may take place at an individual or organizational level. The process may involve establishing objectives, gathering relevant information, identifying alternatives, setting criteria for the decision, and selecting the best option.

The nature of the decision-making process within an organization is influenced by its culture and structure, and a number of theoretical methods have been developed. Decision theory can be used to assist the process of decision making. Specific techniques used in decision making include heuristics and decision trees. Computer systems designed to assist managerial decision making are known as decision support systems (DSS).

6.2 Decision Support Systems and multiobjective programming

Reitsma (90) defined a DSS as an interactive computer based support system that helps decision makers utilize data and models to solve unstructured problems.

Multiobjective programming deals with problems involving several objectives that are noncommensurate and conflicting with each other (75). Among the objective functions involved, there is no single one whose importance is overwhelming dominant over all others (75). Under this circumstance, the ideological theme of optimality in the single-objective context is no longer appropriate (75). The solution to a multiobjective problem is a best compromisable solution, according to the decision maker's preference, among the objectives and the options to the problem (75).

To obtain the solution of a multobjective programming problem, the preference of the decision-maker among the conflicting objectives must be known (75). Information concerning the decision maker's preference is commonly called the utility function, which is a function of the objective function values (75).

6.3 Compromise and composite programming

Classical compromise programming is a multiobjective decision analysis technique used to identify the best compromise solution from a set of solutions by some measure of distance (88). The measure of distance, referred to as a distance metric, determines the closeness of a particular solution to a general infeasible (ideal) solution (88). Therefore, obtaining a compromise solution is analogous to obtaining a solution that is as close as practically possible to the ideal solution (88).

Bárdossy (14) modified compromise programming to form composite programming – a methodology that deals with problems of hierarchical nature (i.e., when certain criteria contain a number of sub criteria) (88).
From a variety of multiobjective decision methods composite programming (14) was chosen for the development of this knowledge based decision support systems (KB-DSS), because this method meets the important aspects of a good tool: consideration of all relevant aspects of decision making and methodological transparency (50).

The principle of composite programming may be explained as follows (111): An alternative A_i is characterised by a specific selection of values for each one of the n objectives. The ideal situation is characterised by the maximum possible value for each of the n objectives (111). The ranking, or value, that the alternative will represent is the "distance" of the alternative from the ideal situation. This distance is calculated like the physical Pythagoric distance, in a space with n-dimensions, where the ideal situation is represented by a point with the co-ordinates [max_1, max_2, …, max_n] and the alternative by a point of co-ordinates [A_{i1}, A_{i2}, …, A_{in}].

In particular, composite programming gives the possibility of grouping some objectives in indicators that will in a second step be grouped together to give a final

evaluation of the alternative (111). The comparison between alternatives can than be done on different levels: either comparing the total evaluation factor or comparing the values of the group indicators (111). In the process of grouping, the objectives are given a weight, according to their importance in the total evaluation, and every group is characterised by a compensation factor, which shows the degree of "compensability" between indicators (111). A high value of the compensation factor means that the objectives grouped cannot compensate each other; for a good performance of the group indicator, is required a good performance of each of the indicators (111).

The value of the indicators are normalised with the formula:

$$n_{i,j} = \frac{z_{i,j} - w_j}{b_j - w_j}$$

$n_{I,j}$ = normalized value
$z_{I,j}$ = indicator value
w_j = worse value
b_j = best value

If the indicator value is smaller than the worst value than the normalized value is zero and if the indicator value is higher that the best value, than the normalized value is one:

If $z_{I,j} < w_j \Rightarrow n_{I,j} = 0$

If $z_{I,j} > b_j \Rightarrow n_{I,j} = 1$

The normalized indicators are then grouped in I groups and each group is formed by the aggregation of J_i indicators. The value I_i for the group I is calculated as follows:

$$I_i = 1 - \left[\sum_{j=1}^{J} \alpha_j \left(1 - n_{i,j}\right)^{p_i} \right]^{1/p_i}$$

α_j = weighting factor of the indicator j in group i
$n_{I,j}$ = normalized value of the indicator $z_{I,j}$
p_i = compensation factor within groups

The value I_{TOT} of the overall indicator is calculated with the same formula, substituting $n_{I,j}$ with I_i . The same formula applies in case of grouping at more levels, each time substituting the values of the indicator within the formula with the value obtained from the group at the precedent level.

6.4 Selection of alternatives

A range of options exist for using private initiative and capital in the water sector. Worldwide experience with private sector participation indicates that there is no single model for structuring private sector management and capital participation that is best; the suitability of a particular arrangement depends on the institutional capacity of the host country and project-specific factors (55). The alternatives considered for this KB-DSS model are seven of the basic mechanisms used to secure private sector participation:

- Service contracts
- Management contracts
- Management contracts with a fixed fee
- Lease
- Build-Operate-Transfer (BOT)
- Concession
- Divesture or asset sale

Each of these different contractual arrangements and respective issues are explained at Chapter 4.

6.5 Selection of objectives

The World Bank (124) explains that governments seeking to involve the private sector in water and sanitation generally have one or more of the following objectives in mind:

- Bring technical expertise and managerial expertise and new technology into the sector;
- Improve economic efficiency in the sector-in both operating performance and the use of capital investment;
- Inject large-scale investment capital into the sector or gain access to private capital markets;
- Reduce public subsidies to the sector or redirect them from the groups now served to the poor and those not now served;
- Insulate the sector from short-term political intervention in utility operations and limit opportunities for intervention by powerful interest groups;
- Make the sector more responsive to consumers' needs and preferences.

Although these common objectives necessarily simplify and compress many complex issues, the selection for this KB-DSS is as follows:

- O1. Technical expertise
- O2. Operating efficiency
- O3. Responsiveness to consumers
- O4. Economic efficiency
- O5. Investment
- O6. Managerial expertise
- O7. Insulation from political intervention

Each of these objectives is characterized by a group of key performance indicators.

6.6 Performance indicators and benchmarking efforts

Performance indicators are widely used as tools in many sectors of industry around the world, and their potential in the water industry is unquestionable (6).

A performance indicator is a quantitative measure of a particular aspect of a water utility performance or standard of service (6). It assists the monitoring and evaluation of the efficiency and the effectiveness of the utility, thus simplifying an otherwise complex evaluation (6).

The International Water Association (IWA) and the World Bank are promoting voluntary initiatives to harmonize metric utility performance data (133). The IWA is focusing particularly on the development of reliable universal indicators, while the World Bank is emphasizing the importance of sharing information (133).

The IWA elaborated a list of performance indicators (6) for water supply and provided guidelines for the establishment of a management tool for water supply utilities based on the use of these performance indicators.

Four levels of performance indicators are considered, according to their importance as management tools:

- Level 1. Provide a general management overview of the efficiency and effectiveness of the water utility.
- Level 2. Additional indicators, which provide a better insight than the Level 1 indicators for users who need to go further in depth.
- Level 3. Indicators that provide the greatest amount of specific detail, but are still relevant at the top management level.

The indicators are categorized in six groups: water resources, personnel, physical, operational, quality of service and financial (6).

The International Benchmarking Network for Water and Sanitation Utilities (IBNET) is an initiative – funded by the British Department for International Development (DFID) in partnership with the World Bank and its Water and Sanitation Program (WSP) - to encourage water and sanitation utilities to compile and share a set of core cost and performance indicators, and thus meet the needs of the various stakeholders (59).

IBNET sets forth a common set of data definitions; a minimum set of core indicators, and provides software to allow easy data collection and calculation of the indicators, while it also provides resources to analyze data and present results (59).

Sharing of results is critical to successful performance comparisons (benchmarking), and hence tools for data analysis, resources and links to benchmarking organizations (59).

To encourage sharing of information the World Bank has developed a 'Benchmarking Water & Sanitation Utilities: Start-Up Kit' (127) which includes data definitions, core indicators and computer software to simplify the benchmarking process. A web-based system linking national 'nodes' and individual utility datasets in Start-Up Kit format have been released to facilitate international comparison (133).

6.7 Selection of key performance indicators

For this KB-DSS a top-down approach was used to select the key performance indicators under each of the objectives.

This section includes a justification and the potential impact of the selected seven objectives followed by an explanation of the selected key performance indicators (KPIs) used to evaluate each of the objectives.

Each objective is evaluated according to a range of KPIs varying from three (minimum) to eight (maximum). In total thirty six KPIs were chosen (see Figures 6.2 and 6.3).

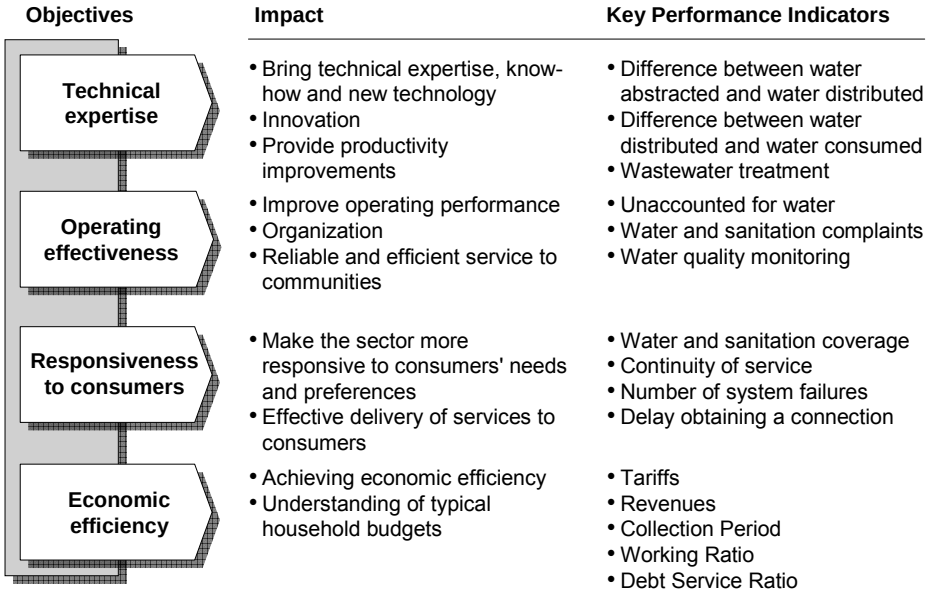


Figure 6.1 How can the private sector contribute to provide reliable water and sanitation services? Main objectives 1/2

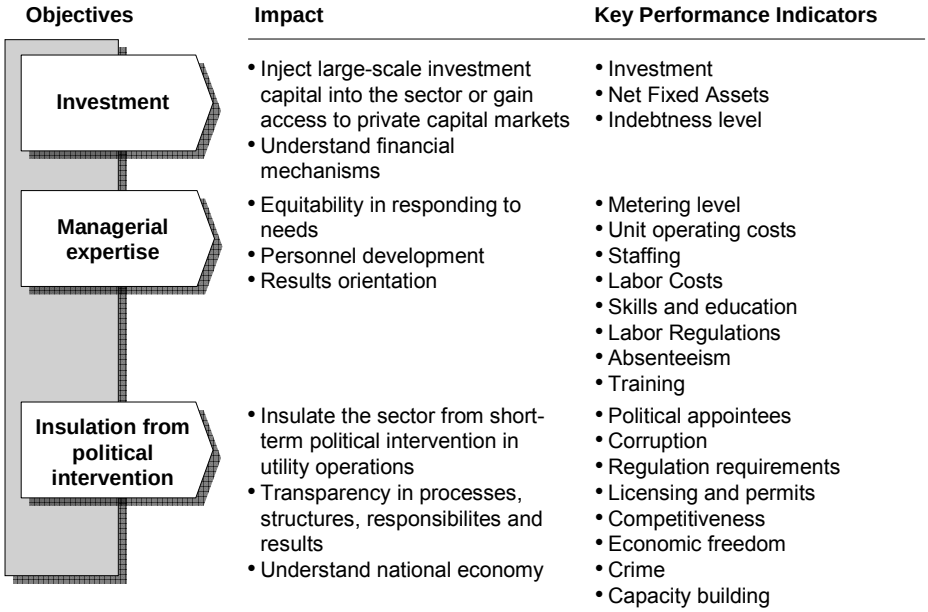


Figure 6.2 How can the private sector contribute to provide reliable water and sanitation services? Main objectives 2/2

The KB-DSS allows the change of KPIs, but the user has to be careful in also changing the benchmarks and later, the respective weight and compensation factor of the group.

The least acceptable value and the desirable value of each KPI is given. These values are result of intensive research from the author on benchmarking efforts, collected from different entities, such as: IWA (6), IBNET (59), World Bank, Benchmark Start

Up (127), AWWA (11) and other specific national, regional and local benchmarking activities (43, 44, 51, 65, 115, 133, 134, 135) . Since there is no single source with all the required benchmarks, therefore no harmonization is available, naturally all the given least acceptable values and desirable values are discussable.

There is general agreement in one aspect: some benchmarks, i.e., the KPIs least acceptable value and desirable value, have to be distinguished between industrialized countries and developing countries. Normally the benchmarks for developing countries are less restrictive, or less demanding, than the ones for industrialized countries, or the other way around, the standards for industrialized countries are higher than the ones for developing countries.

A small table is included to show the different range of values for industrialized and developing countries, in the case where the benchmark can not be the same.

6.8 Technical expertise

Private participation arrangements should bring technical expertise into the sector and thus provide productivity improvements.

Ideally, a well-run water utility produces water at a good rate and the amount of produced water is the same of consumed water and of metered water. Since at least a small per cent of losses in the distribution network is unavoidable and it is a very high achievement to manage all the households to have a metering device, the volume of water produced is normally higher than the one of water consumed and consequently, higher than the volume of water metered. The differences between them are directly related to the technical expertise of the water utility. Clearly, the higher the technical capacity of the company, the lower the differences.

Differences between the three measurements are used to evaluate the technical expertise objective of the water utility, namely the difference between water abstracted (KPI 1) and water distributed and, the difference between water distributed and water consumed (KPI 2).

Follow the definitions used for this KB-DSS of water abstracted, water distributed and water consumed in order to understand:

6.8.1 Difference between water abstracted and water distributed

Note the adopted measurement unit for water volume is cubic meter (m^3). One cubic meter equals 1000 litres (l).

Water abstracted corresponds to the total annual volume of raw water withdrawn from surface water sources, or ground water sources, or both conjunctively (including purchased water, if any).

Water is abstracted from the source, which is usually located at a point that is remote from human activity (for human activity brings about pollution). The water at this point is usually calm and relatively free of soil particles and floating debris. From the source, water is carried through a pipe known as the intake pipe to the treatment works.

Water distributed corresponds to the total annual volume of drinking water processed at the utility's waterworks (including purchased water, if any) supplied to the distribution system via the pipeline system or water trucks.

A typical water distribution system comprises of the installations necessary to transfer water from the water treatment works to the consumer:

- Water reservoirs (tanks) required for temporary storage of water;
- Pipe networks with pipes of various materials and sizes conveying water to the consumers.

The pipe networks contain various fittings required for carrying out specific functions such as: gate valves and air valves which regulate the flow of water and release fire hydrants for conveniently providing large amounts of water from pipe mains for fire extinguishing purposes and water meters for measuring water flows at various point in pipes.

Table 6.1 Benchmarking KPI1 difference between water abstracted and water distributed

	All countries
Desirable value	0
Least acceptable value	250 m^3/year

6.8.2 Difference between water distributed and water consumed

Water consumed corresponds to the total annual volume of metered and unmetered water taken by registered consumers.

Table 6.2 Benchmarking KPI2 difference between water distributed and water consumed

	All countries
Desirable value	0
Least acceptable value	500 m^3/year

The other indicator under the technical expertise objective relates to wastewater treatment.

6.8.3 Wastewater treatment

Wastewater treatment for this KB-DSS refers to the proportion of collected sewage that is treated by primary and biological secondary treatment, in percentage (%).

A well-run utility, with superior technical expertise, treats with secondary treatment all the collected wastewater.

Many utilities limit their treatment to preliminary treatment, i.e., to screen out, grind up, or separate debris is the first step in wastewater treatment. Primary treatment is the second step in treatment and separates suspended solids and greases from wastewater. Waste-water is held in a quiet tank for several hours allowing the particles to settle to the bottom and the greases to float to the top. The solids drawn off the bottom and skimmed off the top receive further treatment as sludge. The clarified wastewater flows on to the next stage of wastewater treatment. Clarifiers and septic tanks are usually used to provide primary treatment.

Secondary treatment is a biological treatment process to remove dissolved organic matter from wastewater. Sewage microorganisms are cultivated and added to the wastewater. The microorganisms absorb organic matter from sewage as their food supply.

Table 6.3 Benchmarking KPI3 wastewater treatment

	Industrialized countries	Developing countries
Desirable value	100%	60%
Least acceptable value	0 (no secondary treatment)	0 (no secondary treatment)

6.9 Operating effectiveness

Private participation arrangements should deliver a reliable and efficient service to communities.

A well-run water utility aims to gain maximum operating effectiveness and productivity. Operation and maintenance (O&M) refers to all activities needed to run a water supply and sanitation utility, except for construction of new facilities:

- Operation includes the planning and control of the extraction/collection, treatment, conveyance, and delivery of water, and/or the collection, treatment, and disposal of effluent. It also covers the management of client and public relations, legal, personnel, commercial, and accounting functions;
- Maintenance may be preventive or reactive. Preventive maintenance--including inspection, cleaning, and lubrication--consists of the systematic routine actions needed to keep the utility plant in good condition. It sometimes also includes minor repairs and replacement as dictated by the routine examination. Reactive maintenance normally occurs as a result of reported pipe breaks and the malfunctioning or breakdown of equipment.

Routine maintenance of the facilities is essential to preserving the operating effectiveness of the utility.

Ideally, a utility that is operating effectively has low Unaccounted-for water (UfW), low pipe breaks and sewerage blockages and the water quality is consistently being tested and controlled.

The selected KPIs for this objective are unaccounted-for-water, water complaints, sanitation complaints and water quality.

6.9.1 Unaccounted for water

Unaccounted for water (UfW) is the difference between the amount of water put into a supply system and that which is billed to consumers. UfW has two aspects:

- Physical losses, or water actually lost through leaks. Leaks may stem from poorly constructed plants, reservoirs, and networks, aging systems and house connections, accidents, and poor maintenance.
- Administrative losses or revenue lost through unbilled or underbilled consumption. This can result from administrative failures such as inaccurate or faulty metering, incorrect billing, and theft.

In other words, UfW corresponds to the difference between water supplied and water sold expressed as a percentage of net water supplied. Though it is a good indicator of the system's efficiency and effectiveness, it happens to be hard to measure - especially if the metering is inadequate.

UFW rates should be 10–15 percent in well-managed systems.

Table 6.4 Benchmarking KPI4 unaccounted for water

	Industrialized countries	Developing countries
Desirable value	10%	10%
Least acceptable value	30%	60%

6.9.2 Water complaints

Complaints are relatively easier to track; therefore this data is normally available. These can be regarding water main breaks, low pressure, meter leaks, repairs, etc.

The indicator is computed as the total number of answered complaints about the water service per number of water department workers per working year.

Table 6.5 Benchmarking KPI5 water complaints

	All countries
Desirable value	1 (all answered)
Least acceptable value	0

6.9.3 Complaints about sanitation service

Complaints can be regarding sewage blockages, overflows from the manhole, sewage odour in house, raw sewage on the ground, etc.

The indicator is computed as the total number of complaints about the sanitation service per day. Note that the calculation is different than water complaints (KPI 5) due to the fact that the number of workers dedicated only to specific sanitation tasks is rarely available.

Table 6.6 Benchmarking KPI6 sanitation complaints

	All countries
Desirable value	0
Least acceptable value	5 (calls a day)

6.9.4 Water quality monitoring

Monitoring is defined as the measurement of information on the implementation progress of a project, program, or policy and the achievement of its objectives. There is a distinction between implementation monitoring, which concerns progress in undertaking activities, completing the work plan and utilizing the budget; and results monitoring, which concerns the measurement of results and the attainment of the project purpose.

The indicator refers to the number of treated water tests required by applicable standards or legislation during the year, expressed in percentage. Tests have to be conducted internally and externally (by independent Labs).

Table 6.7 Benchmarking KPI7 water quality

	Industrialized countries	Developing countries
Desirable value	100%	100%
Least acceptable value	100%	50%

6.10 Responsiveness to consumers

Private participation arrangements should make the sector more responsive to consumers' needs and preferences.

Customers of water supply and sanitation services are legitimate actors with rights, obligations and responsibilities. Gaining the long-term support and acceptance of customers is vital to any organisation wishing to provide services on a sustainable basis. Customers are only willing to pay if they perceive both service standards and quality to be adequate.

The selected KPIs are water coverage, sewerage coverage, continuity of service, number of water supply failures and delay in obtaining a connection.

6.10.1 Water coverage

Population with easy access to water services (either with direct service connection or within 200 m of a standpost)/total population under utility's nominal responsibility, expressed in percentage.

This indicator provides insights into the extent of the infrastructure and how many customers are being served.

Table 6.8 Benchmarking KPI8 water coverage

	Industrialized countries	Developing countries
Desirable value	100%	100%
Least acceptable value	80%	50%

6.10.2 Sanitation coverage

Population with sewerage services (direct service connection)/total population under utility's notional responsibility, expressed in percentage.

Table 6.9 Benchmarking KPI9 sanitation coverage

	Industrialized countries	Developing countries
Desirable value	100%	70%
Least acceptable value	40%	0

6.10.3 Continuity of service

This KPI is measured by the number of hours of service per day of water supply.

Table 6.10 Benchmarking KPI10 continuity of service

	Industrialized countries	Developing countries
Desirable value	24	24
Least acceptable value	24	2

6.10.4 Number of water supply failures

This KPI measures the average number of days per year that consumers experienced insufficient water supply.

Table 6.11 Benchmarking KPI water supply failures

	Industrialized countries	Developing countries
Desirable value	0	5 days per year
Least acceptable value	5 days per year	80 days per year

6.10.5 Delay in obtaining a connection

This KPI measures the average actual delay, in days, that consumers experience when obtaining a connection, measured from the day the establishment applied to the day they received the service or approval.

A connection is the on-grid provision of water and/or sanitation services to a user (customer) on commercial terms in a piped system. The connection itself is normally compensated through the payment of a connection fee.

Table 6.12 Benchmarking KPI connection delay

	All countries
Desirable value	15 working days
Least acceptable value	60 working days

6.11 Economic efficiency

Private participation arrangements should improve economic efficiency in the sector, in both operating performance and the use of capital investment.

Economic efficiency is the term used to describe the allocation of the utility's resources in a way which maximizes net economic product. This outcome is identical with the maximization of net income (revenues from output sales minus the sum of all costs incurred). Efficiency is also sometimes defined as cost minimization when the best technology is utilized.

When economic efficiency of a water and sanitation utility is achieved, water and sanitation prices can be kept at the minimum level compatible with the long-term sustainability of the utility's service, and at the same time, provide consumers with incentives resulting in an optimal water use. If circumstances permit, competition will be the most effective means of promoting economic efficiency. However, when circumstances do not permit, efficiency incentives can still be enhanced through a variety of institutional and regulatory mechanisms.

6.11.1 Tariff affordability

Usually high per capita net incomes are very closely correlated with high standards of living, so one could assume tariffs to be higher in these countries. It is though not the case. Tariffs are still pretty much a political decision and utilities heavily subsidized, therefore lower prices are charged.

In developing countries, people with lower standards of living end up paying more to independent water suppliers and vendors.

The selected KPI for this KB-DSS is the annual cost of 20 litres per day as a proportion of per capita GDP because it is not possible to define a performance target for water tariffs.

The water tariffs vary enormously on a country basis, regional basis and even locally. This is an affordability measure, possible to use for comparisons and benchmarking.

Table 6.13 Benchmarking KPI13 tariff affordability

	Industrialized countries	Developing countries
Desirable value	2% of annual per capita GDP	100% of annual per capita GDP
Least acceptable value	3% of annual per capita GDP	150% of annual per capita GDP

The fact is that it is where the people are the poorer that water is more expensive. This confirms what everybody knows, that the poor can not afford a clean glass of water per day. On the other way around, in many industrialised countries, the water bill is lower than a coffee per day.

6.11.2 Operating revenues

The KPI is calculated dividing the total annual operating revenues per population served by the national GDP per capita, expressed in percentage.

Table 6.14 Benchmarking KPI14 operating revenues

	Industrialized countries	Developing countries
Desirable value	100%	200%
Least acceptable value	0	100%

The percentage is higher for developing countries because their GDP per capita is lower, which adds more stress to the utility.

6.11.3 Collection period

Collection period is an efficiency ratio that is helpful in analyzing the "collectability" of accounts receivable, or how fast a business can increase its cash supply.

Billing customers and getting paid are two different things. The effectiveness of the collections process is measured by the amount of outstanding revenues at year end compared to the total billed revenue for the year. This is expressed in month equivalents.

In other words, it corresponds to the year-end accounts receivable divided by the total annual operating revenues expressed in months equivalent of sales.

Table 6.15 Benchmarking KPI15 collection period

	All countries
Desirable value	0,5
Least acceptable value	5

Many utilities in developing countries are very slow to collect revenues. Even some of the best performers have a collection period of nearly 10 months.

6.11.4 Working ratio

It is the ratio of total annual operating expenses, excluding depreciation and debt-related expenditures, to total annual pre-tax collections from billed services and subsidies.

In other words, this KPI is calculated dividing the total annual operating expenses by the total annual operating revenues.

A working ratio >1 means that a utility fails to recover even its operating costs from annual revenue; a ratio <1 means that a utility covers all operating costs plus some or all of its capital costs.

Table 6.16 Benchmarking KPI16 working ratio

	All countries
Desirable value	0,2
Least acceptable value	1,5

6.11.5 Debt service ratio

The KPI corresponds to the total annual debt service expressed as a percentage of total annual operating revenues.

Table 6.17 Benchmarking KPI17 debt service ratio

	Industrialized countries	Developing countries
Desirable value	10	500
Least acceptable value	50	1000

6.12 Investment

Private participation arrangements should inject large-scale investment capital into the sector and/or access to private capital markets, thereby reducing public investment.

Increasing investment depends on the ability of service providers to generate more cash flow from operations by increasing revenues and reducing costs.

According to the World Bank's Water Supply and Sanitation (134), public finance is and will continue to be as the main source of funding water and sanitation investments. In the past years, public investment declined in many countries.

Public investment in infrastructure bore a disproportionate share of the burden, as it is one of the few discretionary spending categories of governments.

Private financing in water supply and sanitation has accounted for less than 10 percent of investment in water utilities over the last decade. It also declined in recent years, alongside declines in private flows for other infrastructure sectors. Overseas Development Assistance (ODA) has also been a minor source of funds for developing countries. ODA to the water sector is declining since middle of the 1990s, although there are some preliminary indications that the trend is being reversed.

The overall ability of governments to leverage funds for investments is a major factor in improving water and sanitation service delivery.

New approaches for mobilizing private investment need to look beyond operator companies. Pension funds, insurers, banks and other institutional investors such as mutual funds are potentially large sources of funding for water and sanitation projects, if utilities offer more secure long term investment.

Drawing on the World Bank's Private Participation in Infrastructure Project Database, data for 2004 show that total investment in water and sewerage projects

with private participation amounted to nearly US$2 billion (an increase of 36 percent).

Recent private activity in water was concentrated in a few countries and focused on treatment plants and smaller projects.

6.12.1 Investment

Total annual investments expressed as a percentage of total annual current expenses. Current expenses correspond to the sum of selling expenses and general and administrative expenses. Selling expenses include salaries, advertising, transportation and depreciation. General and administrative expenses include office expenses, utilities such as electricity and water and miscellaneous other expenses.

Table 6.18 Benchmarking KPI18 investment

	All countries
Desirable value	20 %
Least acceptable value	5 %

6.12.2 Net fixed assets

Net Fixed Assets are the assets of the utility that are of a relatively permanent nature and are not intended for resale, such as property, water filtration plants, sewage treatment plants, water and sewage pumping stations and reservoirs. The capital intensity of the utility is captured by the net fixed assets per capita served indicator. The KPI corresponds to the total annual net fixed assets per (water) capita served.

Table 6.19 Benchmarking KPI19 Net Fixed Assets

	Industrialized countries	Developing countries
Desirable value	500 Euro per capita	n.a.
Least acceptable value	50 Euro per capita	n.a.

6.12.4 Indebtedness level

This KPI is calculated adding all the short-term and long-term debts divided by the total liabilities, expressed in percentage.

Table 6.20 Benchmarking KPI20 Indebtedness

	All countries
Desirable value	0
Least acceptable value	100%

6.13 Managerial expertise

Private participation arrangements should bring managerial expertise into the sector and thus provide productivity improvements.

Managerial expertise, such as strategic management, marketing and resource management, has been viewed as critical factors for the success of a water and sanitation utility.

On the other way, poor managerial expertise is viewed as a major reason of a utility failure.

Unfavourable business environments, poor infrastructure, lack of managerial expertise and difficulty in accessing institutional finance are factors that influence the growth and performance of a water and sanitation utility.

Frequently, performing engineers at a water utility as years pass by become the utility managers. Management by these engineers is focused on technical efficiency and effectiveness but sometime forgetting customer excellence. Utility administrators are also often political appointees.

The lack of vision and managerial capability of these engineers and political appointees can be an obstacle to the overall performance of the utility.

Frequently, the problem of NGO's willing to improve water supply in developing countries is the lack of managerial expertise.

The chosen indicators for the managerial expertise objective are the metering level, the unit operating cost, staffing, labour costs, education, labour regulations, absenteeism and training.

6.13.1 Metering level

The water meter is the instrument used for measuring the quantity of water passing through a particular outlet. Water consumption is usually metered, and afterwards billed to the customer on the basis of a water tariff.

Proportion of connections that are metered (Metering Level) is calculated as the total number of connections with operating meter over the total number of connections, expressed in percentage.

Table 6.21 Benchmarking KPI21 Metering level

	Industrialized countries	Developing countries
Desirable value	100%	80%
Least acceptable value	75%	10%

6.13.2 Unit operating cost

Unit operational costs provide a "bottom line" assessment of the mix of resources used to achieve the outputs required. The preferred denominator related to operational costs is the amount of water sold. This ratio then reflects the cost of providing water at the customer take off point.

Lack of universal metering, lack of accurate household meters, and a focus in the past on water production mean that an alternative measure of operational cost per cubic meter of water produced is also relevant in the short term.

The unit cost of water provision in peak- demand periods exceeds the unit cost of provision in off-peak periods.

The unit operational cost is frequently one of the major topics of cost-recovery and subsidies discussions.
Few countries have realistic policies, operational strategies or plans for cost recovery and financing for sustainable water supply services, particularly for the poor.

Total annual operating expenses/total annual water sold

Operating expenses are the expenses necessary for the maintenance, operation and collection of revenue for a specific utility. Usually these include the expenses on:

- Purchased water
- Power
- Pump
- Administrative and general
- Personal
- Maintenance
- Property taxes and other non-income taxes
- Depreciation and amortization
- Income taxes
- Other operational costs

Depreciation and amortization is a non-cash charge that represents a reduction in the value of fixed assets due to wear, age, or obsolescence. This figure also includes amortization of leased property, intangibles, goodwill, and depletion. Income Taxes include any taxes on income, net of any investment tax credits.

This indicator varies enormously according to the country and at regional or local level. The values used for this KB-DSS are only a reference. The common goal of utilities is to improve operational efficiency and reduce operational costs.

The KPI corresponds to the total annual operating expenses over the total annual water sold.

Table 6.22 Benchmarking KPI22 Unit operating cost

	Industrialized countries	Developing countries
Desirable value	0,8 Euro/ m^3	2,0 Euro/ m^3
Least acceptable value	2,0 Euro/ m^3	5,0 Euro/ m^3

As surprisingly as it may seem, in reality utilities in developing countries end up having much higher costs than utilities in industrialised countries. Also because most developing countries are water scarce and have to use desalination or other technologies to have water, which brings up the costs.

6.13.3 Staffing

This indicator reflects the efficient staffing and economy of scale utilization.

The KPI is the number of full time employees (FTE) in water services divided by the total population served in thousands.

Table 6.23 Benchmarking KPI23 Staffing

	All countries
Desirable value	0,3
Least acceptable value	1

6.13.4 Labour costs

The KPI corresponds to the total annual labour costs (including benefits) expressed as a percentage of total annual operating costs.

Table 6.24 Benchmarking KPI24 Labour costs

	Industrialized countries	Developing countries
Desirable value	29%	50%
Least acceptable value	49%	80%

6.13.5 Skills and education

Water and Sanitation utilities provide career opportunities for persons with varying levels of experience and education. However, skills developed in one department of the utility may not be transferable to other segments.

High (or Secondary) school graduates qualify for many entry-level production jobs. In some cases, however, new safety and security regulations have led to stricter requirements for employment, such as documented proof of the skills and abilities necessary to complete the work. As a result, a degree from a University or technical school may be required. Production workers may start as labourers or in other unskilled jobs and, by going through an apprenticeship program and gaining on-the-job experience, advance into better-paying positions that require greater skills or have greater responsibility. Substantial advancement is possible even within a single occupation. Advancement in production occupations generally requires mastery of advanced skills on the job, usually with some formal training provided by the employer or through additional vocational training at a 2-year technical University or institute.

Most computer, engineering, and technician jobs require technical education after high school, although opportunities exist for persons with degrees ranging from an

associate degree to a doctorate. These workers are usually familiar with company objectives and production methods which, combined with University education, equip them with many of the tools necessary for advancement to management positions. Graduates of 2-year technical institutes usually fill technician positions. Sometimes, graduates of engineering programs will start as technicians until an opportunity to advance into an engineering position arises.

Managerial jobs generally require a 4-year University degree, although a 2-year technical degree may be sufficient in smaller plants. Managers usually can advance into higher level management jobs without additional formal training outside the workplace. Competition is expected to be keen for management positions, as industry restructuring is forcing utility companies to shed excess layers of management to improve productivity and competitiveness.

The used KPI for this KB-DSS is the percentage of workers who only have the mandatory education or less.

Table 6.25 Benchmarking KPI25 Education

	All countries
Desirable value	60
Least acceptable value	90

6.13.6 Labour regulations

Rigid labour regulations can present major or severe obstacles to the operation and growth of the utility's business.

The chosen indicator is based on the World Bank's Rigidity of Employment Index (REI), which is an average of the three indices:

- Difficulty of Hiring Index
- Rigidity of Hours Index
- Difficulty of Firing Index

The REI measures the flexibility with which labour laws meet the needs of the market. In other words, REI evaluates:

- how difficult it is to hire a new worker,
- how rigid the regulations are on increasing or reducing the number of working hours,
- how costly and difficult it is to dismiss a redundant worker.

On a scale of 1-100, with higher values representing more rigid regulations, the OECD average is 34 and the European Union average is 42, indicating some rigidity.

Table 6.26 Benchmarking KPI26 Labour regulations

	All countries
Desirable value	0 (flexible)
Least acceptable value	100 (rigid)

6.13.7 Absenteeism

Absenteeism represents the failure of employees to report for work when they are scheduled to work. Employees who are away from work on recognized holidays, vacations, approved leaves of absence, or leaves of absence allowed for under the collective agreement provisions are also included.

Causes of absenteeism can also be:

- serious accidents and illness
- low morale
- poor working conditions
- boredom on the job
- lack of job satisfaction
- inadequate leadership and poor supervision
- personal problems (financial, marital, substance abuse, child care etc.)
- poor physical fitness
- inadequate nutrition
- transportation problems
- the existence of income protection plans
- stress
- workload
- employee discontent with a collective bargaining process and/or its results

The cost of absenteeism is translated into a decrease in productivity and an increase in financial and administrative costs.

The KPI is calculated using the total annual number of production days lost divided by the total annual maximum employee potential, expressed in percentage. Total annual maximum employee potential is calculated multiplying 50 weeks x 5 days x total number of employees (permanent + contract basis).

Table 6.27 Benchmarking KPI27 Abseentism

	All countries
Desirable value	0
Least acceptable value	12%

Actions to control absenteeism are not always obvious. Traditional methods of absenteeism control based only on disciplinary procedures have proven to be ineffective. If absenteeism is to be controlled, the physical and emotional needs of employees must be addressed.

6.13.8 Training

A quality workforce is a crucial factor that significantly influences the competitiveness of a water and sanitation utility.

Staff qualifications through training are fundamental for the utility's good performance.

Usually lack of funds lead to shortages of managers qualified to organize O&M, shortages of skilled staff and training.

Inadequate training can lead to incompetence, which leads to losses, physical or non-physical (administrative) losses. Therefore, managers have to invest in adequate training of the utility's staff. Training may also be needed, not only within the utility but also within the utility's parent organization in the central or local government.

The KPI corresponds to the total number of hours spent in trainings over the total number of full time employees (FTE) per year.

Table 6.28 Benchmarking KPI28 Training

	All countries
Desirable value	20 hours per FTE per year
Least acceptable value	0

This indicator can have other limits for the cases in developing countries. It also varies according to the management strategy. As an example, if the utility is being restructured, during that and next year more training will be needed. The ideal situation would be that every employee would perform at least one training per year,

according to its needs. Since training is normally expensive, the desirable value decreases to half of the permanent employees. The least acceptable is zero, which could, as an example, represent a common cost-cutting measure, i.e., "no-trainings-for-anyone-this-year".

6.14 Insulation from political intervention

Private participation arrangements should insulate the sector from short-term political intervention in utility operations and limit opportunities for intervention by powerful interest groups.

Water governance describes the political, economic, administrative, social processes and institutions by which public authorities, communities and the private sector take decisions on how best to develop and manage water resources.

Governing water wisely – one of the United Nations challenges (134)- is ensuring good governance, so that the involvement of the public and the interests of all stakeholders are included in the management of water resources.

Effective governance systems should, following the United Nations principles, enable the more practical management tools to be applied correctly. Public-private partnerships, public participation, economic, regulatory or other instruments will not be effective unless the political will exist and broader administrative systems are in place.

The ways in which various government agencies, civil society organizations, private firms and the market relate to each other is crucial for effective public-private partnerships (134). Governance draws explicit attention to these relationships (134). Partnership formulation can bring about substantial benefits. In cases where less public funding is available for water-related initiatives, partners outside government have sometimes contributed, through money or voluntary action, to expediting activities that would otherwise have been difficult to support (134). In this manner, partnership arrangements have shown that they can help to maintain or improve water services (134).

6.14.1 Political appointees

The utility administrators have to act according to the needs of the community the company serves. This community is represented by the local politicians, which were elected, or voted, for that task. The link between the utility administrative body and

the local politicians should be strong. But it does not have to be so strong that they have to be the same people.

A water and sanitation utility is potentially subject to strong political influences for funding, operating issues, etc, if it includes political appointees in its administration. Political decision making can be short-sighted, negatively impacting the productivity and competitiveness of the utility.

The KPI is evaluated based on the number of political appointees in administration over the total number of full time equivalent employees dedicated to administration expressed in percentage.

Table 6.29 Benchmarking KPI29 Political appointees

	All countries
Desirable value	0
Least acceptable value	100% (all administrators are politically appointed)

6.14.2 Corruption

The water sector has a particularly high propensity for corruption (39). Corruption in the water sector is poorly analysed and not subject to policy dialogue and public attention (39). The international community is engaged in fighting corruption to meet the international water targets, since corruption, abuse and inefficiency are directly correlated (39).

Terms such as transparency and accountability are more frequently used than corruption because corruption touches many aspects and has situation (case)-specific dimensions (110). Transparency seems to be easier to define than corruption (110)

Examples of where corruption occurs include:

- setting water prices and cost recovery
- use of disaster relief funds
- construction of large tanks
- preparation of estimates
- substandard materials
- non-implementation
- bribes
- political

Useful indicators would be:

- Value of unofficial payments and gifts to officials/annual sales.
- Average value of gifts or informal payments to public officials to "get things done" with regard to customs, taxes, licenses, regulations, services, et cetera.

This data is not available for obvious reasons. For this KB-DSS model Transparency International (39) Corruption Perception Index (CPI) is used. The annual Corruption Perceptions Index (CPI) ranks more than 150 countries in terms of perceived levels of corruption, as determined by expert assessments and opinion surveys.

Table 6.30 Benchmarking KPI30 Corruption

	All countries
Desirable value	10 (highly clean)
Least acceptable value	0 (highly corrupt)

The CPI also provides information about the stability of the informal sector. The informal sector consists of persons engaged in the production of goods and services with the primary objective of generating employment and income to the persons concerned. These units typically operate on a low level of organization, with little or no division between labour and capital as factors of production and on a small scale.

The informal sector includes, first, unregistered commercial enterprises, and second, all non-commercial enterprises that have no formal structure in terms of organization and operation. In African cities, the informal sector accounts for 40% to 80% of all employment.

6.14.3 Bureaucracy

Time spent dealing with requirements of regulations based on national estimates from the World Bank on Doing Business.org.

Table 6.31 Benchmarking KPI31 Bureaucracy

	All countries
Desirable value	70 days
Least acceptable value	350 days

6.14.4 Licensing and permits

Total number of processes required for licensing and permits based on national estimates from the World Bank on Doing Business.org.

Table 6.32 Benchmarking KPI32 Licensing and permits

	All countries
Desirable value	7 processes
Least acceptable value	30 processes

6.14.5 Competitiveness

The Growth Competitiveness Index (GCI) data is the one to use for this KB-DSS. The GCI Ranking of the Global Competitiveness Report of the World Economic Forum (132) aims to measure the capacity of the national economy of 104 countries to achieve sustained economic growth over the medium term, controlling for the current level of the economic development.

Table 6.33 Benchmarking KPI33 Competitiveness

	All countries
Desirable value	1
Least acceptable value	104

6.14.6 Economic freedom

The Index of Economic Freedom is published by the Heritage Foundation (57, 58). It measures how countries score on a list of 50 independent variables divided into 10 broad factors of economic freedom. The higher a country's score on a factor, the greater the level of government intervention in the economy and the less economic freedom there is. The Heritage Foundation's view is that countries with the most economic freedom also have higher rates of long-term economic growth and are more prosperous than are those with less economic freedom.

These 50 variables are grouped into the following categories:

- Trade policy
- Fiscal burden of government

- Government intervention in the economy
- Monetary policy
- Capital flows and foreign investment
- Banking and finance
- Wages and prices
- Property rights
- Regulation
- Informal Market Activity

Depending on their score, countries are then separated into four categories: free, mostly free, mostly unfree, and repressed.

Table 6.34 Benchmarking KPI34 Index of economic freedom

	All countries
Desirable value	1 (free economic environment)
Least acceptable value	5 (repressed economic environment)

6.14.7 Crime

The utility losses that can be attributed to theft, robbery, vandalism, arson or other crimes.

The KPI measures losses due to crime over annual sales, expressed in percentage

Table 6.35 Benchmarking KPI35 Losses due to crime

	All countries
Desirable value	0
Least acceptable value	10%

Interestingly, the incidence of crime in a community can be correlated to the need of adequate basic services such as water supply and sanitation in this community.

Passive cruelty is typified by cases of neglect, where the crime is a lack of action rather than the action itself. The lack of water supply and sanitation is considered by many as a crime.

6.14.8 Capacity building

Capacity building (individuals, organizations, institutions) is the process by which (i) individuals and groups develop the skills, knowledge and competence to perform functions, solve problems and achieve objectives more effectively and efficiently, (ii) an organization or a system of organizations is strengthened to serve a specific existing or new purpose and role, and (iii) the institutional framework (laws, attitude rules, norms) is created, reformed, developed, and/or strengthened (85).

In short, capacity building is about acquiring skills and the capacity to use them.

Strengthening of institutional capacity building and training is internationally recognised as a top priority because capacity building expands the opportunities for a more dynamic use of tools by the utility middle level managers, senior managers and policy and decision makers; and the execution of flexible and appropriate solutions.

Table 6.36 Benchmarking KPI36 Capacity building

	All countries
Desirable value	1 (priority)
Least acceptable value	0 (no participation)

Networks have proven to be effective at promoting the understanding and knowledge gathering of water and sanitation utilities and play a key role in supporting the development of the utilities efficiency, productivity and competitiveness.

6.15 Knowledge management

Managing the internal and external knowledge (data, information) needed to calculate the key performance indicators selected for this KB-DSS is research intensive and time consuming.

Figure 6.4 schematizes the required process of data acquisition: gathering, filtering, refining and introducing in the KB-DSS model.

Each water and sanitation utility has its own knowledge management techniques and their efficiency is directly reflected in the quality of the data and the amount of time necessary to collect and disseminate it.

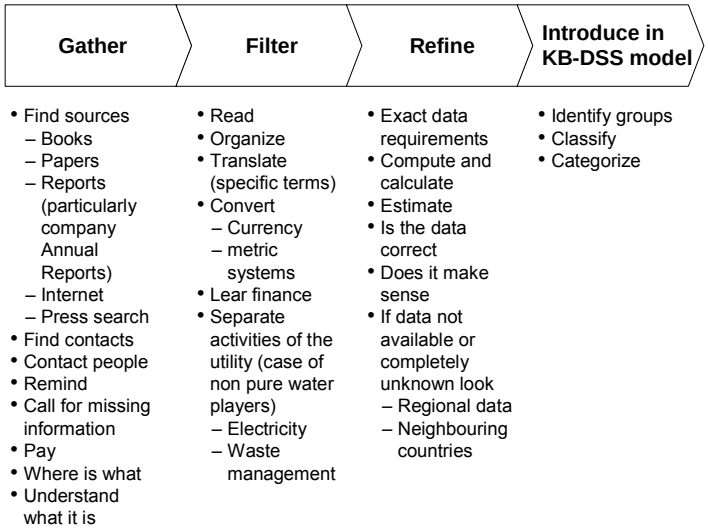


Figure 6.3 The process of data acquisition is research intensive and time consuming

The major advantage of efficient knowledge management is that is leads to full understanding of the utility's practices. It allows rapidness in identifying processes (and consequently improving) and is the basis for distinctive benchmarking efforts (see Figure 6.5). For this KB-DSS four main areas of knowledge are identified: water and sanitation services (physical), personnel, business environment and financial.

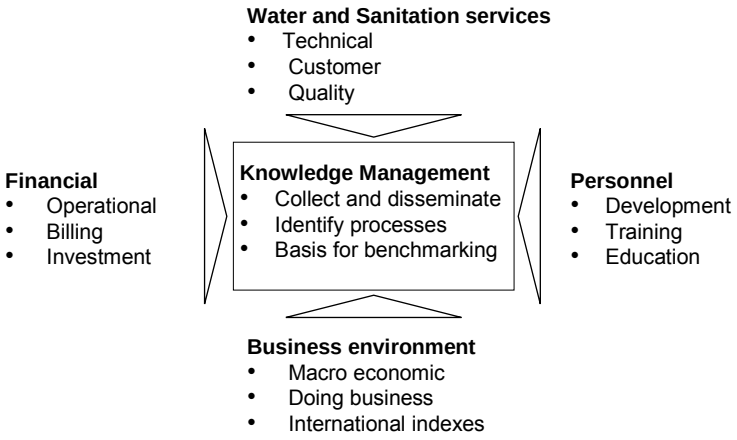


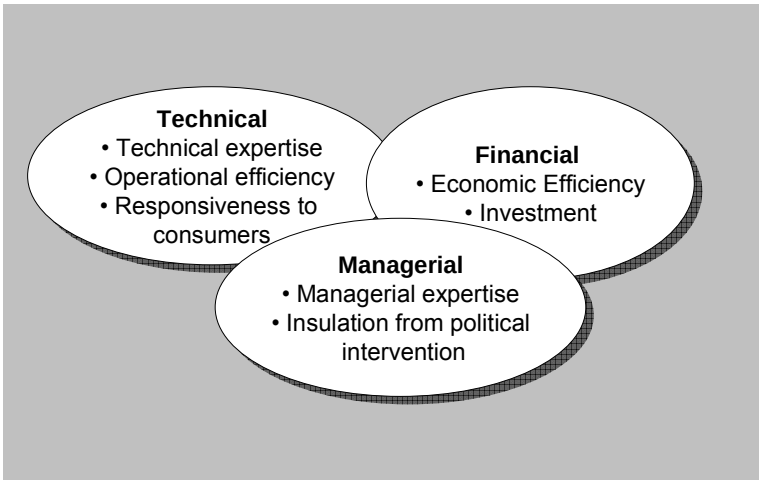
Figure 6.4 Effective knowledge management lead to full understanding of the utility

6.16 Group structuring

First, the concept of capacity elements has to be explained: water and sanitation utilities' capacity (not to be confused with water production capacity as measured in units of water) is the ability to plan, achieve and maintain compliance with applicable industry and regulatory key performance indicators and legislation (41). A capable water and sanitation system is better positioned to consistently comply with applicable legislation and provide customers with safe and reliable water and wastewater services (41). Capable systems are also better positioned to meet key performance indicators that are generally accepted by the industry or required by the regulatory agencies (41).

For a system to have capacity, adequate capability is required in three distinct but interrelated groups or capacity elements (CE) – technical, financial and managerial (41). Each element of capacity is necessary (essential) but not sufficient to maintain the water and sanitation system (41). Monitoring, assessment and strategic planning can address all three elements of capacity (41).

The seven selected objectives of this KB-DSS model (discussed above) are distributed within the three capacity elements (see Figure 6.6).



Source: Adapted from EPA (2005)

Figure 6.5 Interrelated capacity elements of water and sanitation systems

6.17 Weighting and compensation factors

The hierarchical structure in cascading levels of the groups is represented in Table 6.37.

The explanation starts describing the structure, weighting (α) and compensation factors (p) attribution at Level 4 and ends at Level 1. Note that values of p higher than 1 account for increasingly lower degrees of compensability of criteria.

6.17.1 LEVEL 4

The compensation factor (p) for the total evaluation - Level 4 - grouping the three capacity elements – technical, financial and managerial is 3, as they can only partially compensate each other (discussed above).

6.17.2 LEVEL 3

Technical capacity is the physical and operational ability of a water and sanitation system to meet the industry and regulatory KPIs, including the adequacy of physical infrastructure and the technical knowledge.

The weighting factor of the technical capacity at Level 4 is 35% because for this KB-DSS managerial capacity is considered a more evolving group.

This group takes into account the indicators of the following three group-objectives:

- Technical expertise
- Operational efficiency
- Responsiveness to consumers

The weights are respectively of 20%, 30% and 50%. This KB-DSS tries to bring up a focus on water and sanitation utility customer-orientation. The compensation factor is 2, because the group-objectives can partly compensate each other, e.g., good technical expertise can compensate to some degree for bad operational efficiency and vice versa.

Table 6.37 Groups, weights and compensation factors used for the KB-DSS

KPI	α	p	Level 1	α	p	Level 2	α	p	Level 3	α	p	Level 4
1	0,40	1	Supply-Demand	0,70	3	Technical Expertise	0,20	2	Technical capacity	0,35	3	Total Evaluation
2	0,60											
3				0,30								
4				0,50	4	Operational Efficiency	0,30					
5	0,50	1	Performance	0,30								
6	0,50											
7				0,20								
8	0,50	2	Coverage	0,40	1	Responsiveness to Consumers	0,5					
9	0,50											
10	0,70	3	Quality of service	0,60								
11	0,20											
12	0,10											
13	0,40	3	Billing & Collection	0,50	3	Economic Efficiency	0,40	1	Financial capacity	0,25		
14	0,30											
15	0,30											
16	0,60	1	Financial ratios	0,50								
17	0,40											
18				0,50	2	Investment	0,60					
19				0,40								
20				0,10								
21				0,20	6	Managerial Expertise	0,50	4	Managerial capacity	0,4		
22	0,40	6	Staff & Cost	0,30								
23	0,30											
24	0,30											
25	0,30	7	People management	0,50								
26	0,10											
27	0,25											
28	0,35											
29				0,10	3	Insulation from political intervention	0,50					
30				0,10								
31	0,50	1	Bureaucracy	0,10								
32	0,50											
33	0,30	2	Rankings	0,20								
34	0,70											
35				0,10								
36				0,40								

Financial capacity is the ability of a water and sanitation system to acquire and manage financial resources to allow the system to achieve and maintain the industry and regulatory KPIs.

The weighting factor at Level 4 is 25% because for this KB-DSS financial engineering comes just after managerial and technical capacity.

The financial capacity group takes into account the indicators of the following two objectives:

- Economic efficiency
- Investment

The weights are respectively of 40% and 60%, because investment is frequently the main reason for considering private sector participation. The compensation factor is 1 because the indicators can compensate each other, i.e., good economic efficiency can compensate some lack of investment and vice versa.

Managerial capacity is the ability of a water system to conduct its affairs in a manner enabling the system to achieve and maintain compliance with the industry and regulatory KPIs, including institutional and administrative capabilities.

The weighting factor at Level 4 is 40% because for this KB-DSS managerial capacity is considered as the key to sustainable water use.

The managerial capacity group takes into account the indicators of the following two objectives:

- Managerial expertise
- Insulation from political intervention

The weights equal 50% for both of the indicator group-objectives. The compensation factor is 4, because compensation is not very expectable, i.e., good managerial expertise can only very limitedly compensate for short-sized political intervention. In another way, good political intervention can only partially compensate bad management; which frequently ends up in the Municipality paying the utility's loss using a subsidy: It may help, but it does not solve the problem.

6.17.3 LEVEL 2 AND LEVEL 1

O1. Technical expertise

The technical expertise group-objective at Level 2 considers a sub-group of two indicators and one separate indicator:

- Supply-demand management
    - Abstraction to distribution
    - Distribution to consumption
- Wastewater treatment

The weights are respectively of 70% for the sub-group and 30% for the separate indicator, because rehabilitation and extension of the network are frequently the reason to consider private sector participation. Wastewater treatment is though more and more where the private sector is taking action, for several reasons, the most common being the lower risk factor. The compensation factor is 3, because the indicators can only partially compensate each other.

The sub-group of supply-demand management has a compensation factor of 1 because the indicators can compensate each other. The first indicator has a weight of 40% and the second of 60%.

O2. Operational efficiency

The operational efficiency group-objective considers one sub-group of two indicators and two separate indicators:

- Unaccounted-for-Water
- Performance
    - Water complaints
    - Sanitation complaints
- Water quality

The weights are of 50% for the famous UfW, 30% for the sub-group related to performance and 20% for water quality. The compensation factor for this group-objective is 4 because compensation of the sub-group by the two separate indicators and vice versa is not very expectable.

The sub-group related to the performance of the water and sanitation utility measured using data on the number of complaints has a compensation factor of 1 because frequently the customer complaints, requirements and requests are related. The weight is equally 50% for each of the sector of complaints origin.

O3. Responsiveness to consumers

This group-objective considers two sub-groups of two and three indicators each, respectively:

- Coverage
    - Water coverage
    - Sewerage coverage
- Quality of service
    - Continuity of service
    - Failures
    - Connection delays

The weights of the sub-groups are respectively of 40% and 60%. Increase in coverage of water and/or sanitation coverage is also frequently the main reason for considering private sector participation. This KB-DSS is though putting a bit more importance on the quality of service. The compensation factor of this group-objective is 1 because they can compensate each other.

The indicators of the sub-group related to coverage have equal weight of 50%. The compensation factor is 2 because sanitation services normally do not exist in a community if water services were not there in first place

The indicators of the sub-group related to quality of service have the following weights: 70%, 20% and 10%. The delay in obtaining a connection has the lowest weight, as though it is a good indicator of the quality of service, the other two have more importance on the daily life of a water and sanitation utility. The compensation factor is 3 since the indicators can compensate each other only until a limited degree.

O4. Economic efficiency

The economic efficiency group-objective considers two sub-groups of three and two indicators each, respectively:

- Billing & collection
    - Tariffs
    - Revenues
    - Collection period
- Financial ratios
    - Working ratio
    - Debt service ratio

Both sub-groups are weighted equally with 50% as the indicators involved provide good economic efficiency measurements. The compensation factor of this group-objective is 3 because they can only partially compensate each other.

The indicators of the sub-group related to billing & collection have weights of: 40%, 30% and 30%. The compensation factor is 3.

The indicators of the sub-group related to financial ratios have the following weights of 60% and 40%, respectively. The compensation factor is 1 since the indicators can compensate each other.

O5. Investment

This group takes into account three indicators directly, i.e., without creation of sub-groups:

- Investments
- Net fixed assets
- Financing

The weights are respectively of 50%, 40% and 10%, because investments are key to good performance of the water and sanitation utility. The financing indicator represents the solvency ratio, which for this KB-DSS is not given a significant weight.

The compensation factor is 2 because the indicators can partly compensate each other, e.g., good assets can compensate for the low level of investment.

O6. Managerial expertise

This group-objective considers one independent indicator and two sub-groups of three or four indicators each, respectively:

- Metering
- Staff & Cost
    - Operational cost
    - Staff/population
    - Labor cost
- People management
    - Skills and education
    - Labor regulations
    - Absenteeism
    - Training

The weight of the independent indicator related to the metering level is 20%. The weights of the sub-groups are respectively of 30% and 50%. KB-DSS is though putting more weight, therefore conferring more importance, to people management. The compensation factor of this group-objective is 6 because compensation by the independent indicator of one or both of the sub-groups or vice versa is not very expectable. As an example, poor skills and low level of employee education can not lead to good metering practices.

The indicators of the sub-group related to staff and cost have weights of 40%, 30% and 30%. The compensation factor is 6 because the indicators can not compensate each other.

The indicators of the sub-group related to people management have the following weights: 30%, 10% 25% and 35%. The labor regulations indicator has the lowest weight because frequently it is not an option of the water and sanitation utility managers; it is imposed by the region or country. The compensation factor is 7 because the indicators can not compensate each other. As an example, low levels of absenteeism can not compensate for the lack of training as a high training attendance level can not compensate for employee absenteeism.

O7. Insulation from political intervention

This group-objective considers four independent indicators and two sub-groups of two indicators each:

- Political appointees
- Corruption
- Bureaucracy
    - Regulation requirements
    - Licensing and permits
- Rankings
    - Competitiveness
    - Economic freedom
- Crime
- Capacity building

The weight for the sub-group Rankings is 20% and the weight of the indicator related to capacity building is 40%. All the others are weighted equally with 10%. Capacity building, a very popular term these days, is weighted the highest within this group-objective for this KB-DSS because it proves to be worth. The compensation factor of this group-objective is 3 because bad performance of one or more indicators does not mean bad performance overall. To prove are examples in developing countries, with

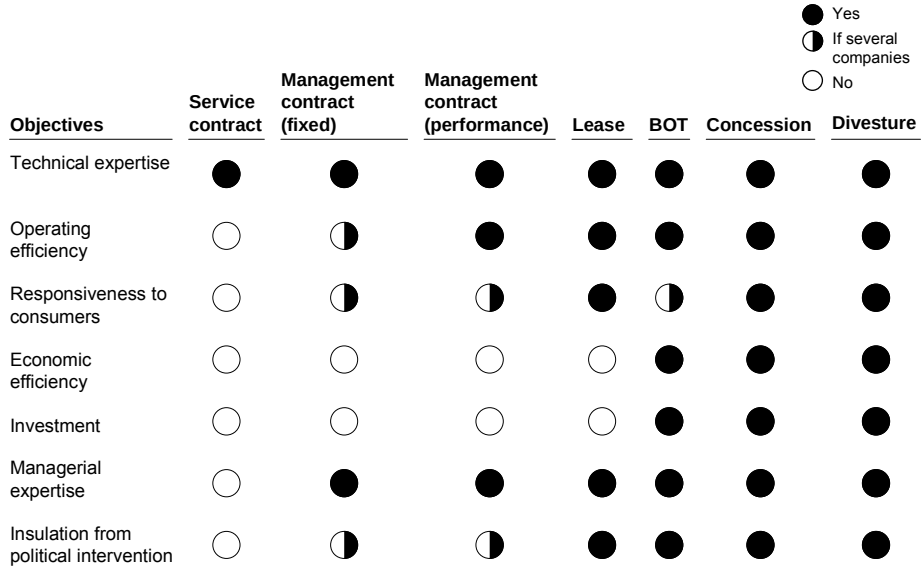
high rates of corruption, crime and bureaucracy that through capacity building increased the performance of their water and sanitation utilities.

The indicators of the sub-group related to bureaucracy are weighted equally with 50%. The compensation factor is 1 because they can theoretically compensate each other.

The indicators of the sub-group related to rankings have the following weights: 30% and 70%. The compensation factor is 2 because competitiveness can partially compensate economic freedom and vice versa.

6.18 Transformation matrix

Figure 6.7 shows the responsiveness of different private sector alternatives to the selected objectives of the model - which correspond to the common government objectives in involving the private sector (as discussed above). It answers to a certain extent the question "What do governments want – and which private sector options deliver it?"(124). A government seeking improvements in operating efficiency and responsiveness to consumers, for example, will prefer a management contract with performance incentives or a lease or either a service contract or a concession (124). A government seeking greater efficiency and new investment will prefer a concession or divesture – or, for investment in bulk services, a BOT (124).



Source: Adapted from World Bank (1997), Toolkit 1

Figure 6.6 The transformation matrix represents the ability of options to cope with the objectives

This matrix is both the basis and the summary of the transformation matrix used for this KB-DSS. The responsiveness of the PSP options to the objectives has to be broken

down according to the responsiveness of each of the selected key performance indicators. Figure 6.8 shows the transformation matrix used for the objective "insulation from political intervention".

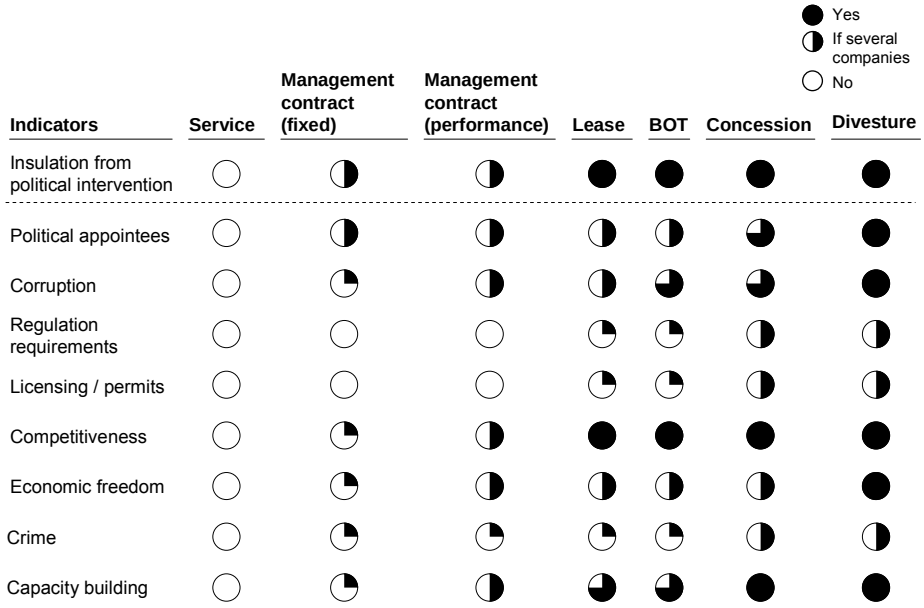


Figure 6.7 Responsiveness of PSP options to objective "insulation from political intervention"

6.19 Results and conclusions

The KB-DSS results enable the government (national, regional, as appropriate) to make a decision about which kind of private sector arrangement to pursue.

The final output of this KB-DSS model will point the government to different choices on arrangements for private sector participation. It is given in the form of a rank of responsiveness of each private sector participation alternative to meet the government objectives. The closer the calculated final value of an alternative is to one, the higher the responsiveness of this alternative to meet the government objectives. The same way around, if the resulting value is close to zero, this alternative will not respond to the government objectives and thoughtful consideration and analysis of the utility's issues is essential.

However rigorous the early analysis of the utility's - and surrounding environment - issues, the selection of objectives and alternatives, the selection of the KPIs and their least acceptable and desirable values; the elaboration of the transformation matrix and the use of the formulas necessary in composite programming, the best private sector arrangement – most likely to meet the local needs - is likely to be modified during the detailed preparation that follows. But much time – and political anguish – can be avoided through careful knowledge management.

A government's preferred option may not be attractive to the private sector. Where regulatory capacity is weak and political commitment is low, a concession will be difficult to implement. The most direct way to tackle this problem is to build political commitment and regulatory capacity. In the meantime the government could implement a simpler arrangement, such as a management contract.

This KB-DSS model can also be used by private companies.

6.10 How to use the KB-DSS

Figure 6.9 provides in the form of flow the five main steps on how to use the knowledge management decision support system (KB-DSS).

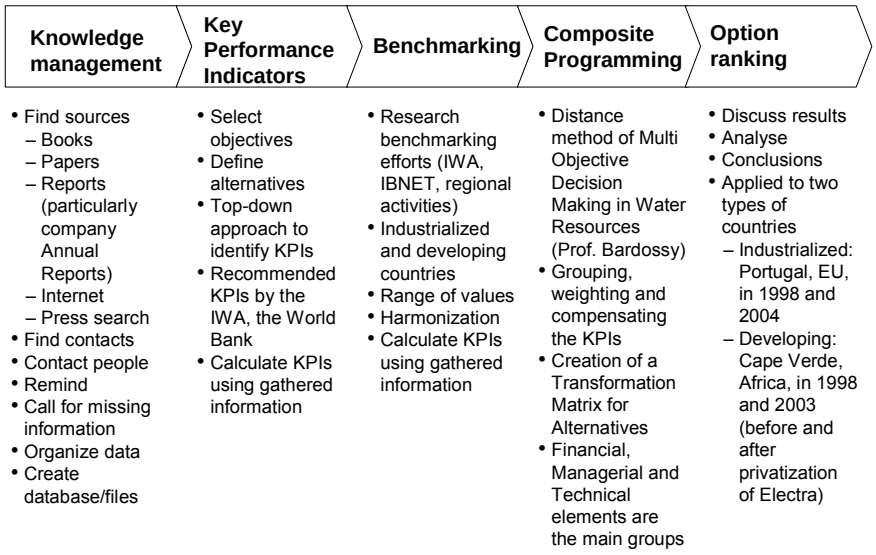


Figure 6.8 How to use the KB-DSS model

An initial analysis of the state of the water and sanitation utility and its business and political environment is essential early on. Knowledge management plays a key role in this phase. Second, identify and define objectives and alternatives (if not the same suggested above). Select the relevant key performance indicators according to objectives, reviewing the performance indicators suggested by the International Water Association and the World Bank (and other entities, as appropriate). Third, look for results of benchmarking efforts and calculate your own KPIs. Fourth, use the method of composite programming – grouping, transforming or normalizing, weighting and compensating – to have an evaluation of each of the alternatives. Finally, discuss and analyze the ranked results and elaborate conclusions on which alternative better meets the objectives.

CHAPTER 7

USE OF THE KB-DSS TO CASE STUDIES

In this chapter the applications of the developed knowledge based decision support system (KB-DSS) in an industrialized country and in a developing country are described. In both types of countries, the KB-DSS model is run before and after approaches by the private sector:

- The selected industrialized country is a Western European country, member state of the European Union since 1986, Portugal. The water and sanitation utility object of study is municipally owned and is named *Serviços Municipalizados de Saneamento Básico de Viana do Castelo* (SMSBVC). The KB-DSS model is run before and after the 30 year concession that created the multi-municipal company named *Águas do Minho e Lima* (ADML). ADML is a subsidiary of *Águas de Portugal* (AdP) and operates *em alta* – until distribution to consumers, which continues to be done by the municipalities - in the Minho-Lima region, including the city of Viana do Castelo, where its headquarters are based.
- Cape Verde, located in the mid-Atlantic Ocean - ten islands and five islets - some 450 kilometers off the west coast of Africa, is the chosen case of a developing country. The KB-DSS is run before and after the 36 year concession of Electra – the local water and electricity utility. Electra is now an international subsidiary of *Energias de Portugal* and *Águas de Portugal* (EDP/AdP).

Juxtaposing the Minho-Lima concession against the Cape Verde concession is instructive as the two reflect very different approaches to private participation by the same company.

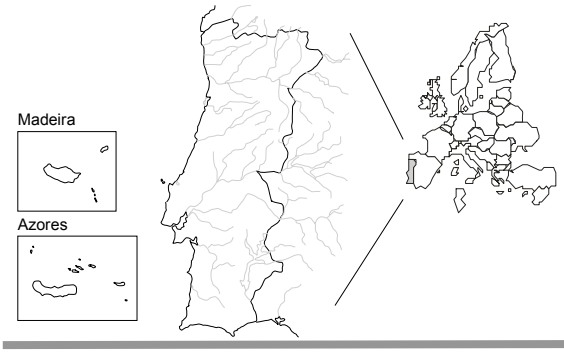
7.1 Impact of a multi-municipal concession in Viana do Castelo

To address the issues of the municipalized water and sanitation services of Viana do Castelo, this section is organized as follows: it begins by reviewing the major trends of the Portuguese water sector and, by examining the public company Águas de Portugal (AdP) SGPS, SA currently dominating the Portuguese water market. The region of the Minho-Lima River Basins and its economic and institutional characteristics are then described. The concession that created the subsidiary of AdP operating in the region, Águas do Minho e Lima (ADML) and its objectives are reviewed. The state owned company object of study, the Municipalized Services of

Viana do Castelo (SMSBVC) is examined and the KB-DSS model is run for years 1998 and 2003. All the used data and results are given and examined. Finally, SMSBVC's performance is analyzed considering the impact of ADML's investment and operations in the region.

7.1.1 County and sector background

Portugal shares with Spain the Iberian Peninsula, located in the south-western edge of Europe. The country counts over 10 million inhabitants and is mainly irrigated by four international rivers with their source in Spain: Guadiana, Tejo, Douro and Minho (see Figure 7.1). The major hydraulic resources of the country are located in the North, which partially explains the Portuguese current economic configuration: companies installed themselves in this region to benefit from its hydraulic and energetic resources.



Water resources

Precipitation	855	mm/year
Surface water	77,400	Km³/year
Groundwater	4,000	Km³/year
Total*	77,400	Km³/year
Water/capita	7.411	Km³/year
Dependency	44,69	%
Desalination	5,920	m³/day
Water coverage**	95	%
Sanitation coverage**	90	%

Outlook

- Portugal and Spain share five international rivers − Minho, Lima, Douro, Tejo and Guadiana. Several agreements were signed.
- Portugal suffers from the peripheral location towards the European Union
- The economy grew by only 1% in 2004, and the jobless rate has reached 7,1% in March 2005

Country and population in 2005

Total area	91 980	Km²
Population	10 444	thous.inh.
Density	114	inh/Km²
GDP/capita	10,398	USD/year
HDI rank***	27	Top 30

*Total water resources= total internal and external renewable, water resources (TIRWR+TERWR). There is an overlap of surface water and groundwater of 4,000 Km3/year; ** Target for 2006, *** Human Development Index (out of 175 countries)

Source: Heritage Foundation (2006), AQUASTAT (2005), *Água em Revista* (2005), *Ambassade de France au Portugal* (2005), INAG (2000 and 2001), Maia, R. (1999), Martins, J. P. (1998)

Figure 7.1 Portugal has good water resources though dependency from Spain

A specific regulator institution (IRAR) was created in 1998 (DL 326/98), with the purpose of ruling over multi-municipal and municipal concession explored urban water supply, residual water and solid waste systems, in order to protect and safeguard citizen interests and rights (63).

7.1.2 One public company dominates the Portuguese water and sanitation sector

The company Águas de Portugal (AdP) SGPS, SA (3), is a public holding company, which was created in 1993 to develop multi-municipal water and wastewater

systems. It had the objectives of stimulating the investment and improving the water quality, in order to respect the European regulations (3). The AdP Group is currently 100 percent state owned and different models of opening its capital to private hands are being considered, but so far no Government has reached any conclusion or final vision for AdP and the water sector itself.

A significant percentage of the Portuguese population is served by AdP (3). The Group supplies water to more than 70 percent of Portuguese households, while providing 40 percent of them with wastewater collection, treatment and disposal (3).

The Group is composed of 67 companies (mostly public capital). In 2004 it registered a sales turnover of 417,2 M Euro, a raise of 10,8 percent compared to the previous year, and consolidated results of 12,9 M Euro, a raise of 360 percent (8).

As far as the urban cycle is concerned, Águas de Portugal handles water catchments, treatment and distribution for public consumption, as well as urban and industrial wastewater collection, treatment and disposal. Its solid waste operation covers collection and treatment of urban and industrial waste (40). Through subsidiaries, AdP supplies to more than 70 percent of Portuguese households, while providing 40 percent of them with wastewater collection, treatment and disposal (40).

AdP performs its economic activity in an indirect way, i.e., through its subsidiaries (3). At the time of its creation, the only operating enterprise within the AdP Group was EPAL, which was responsible for supplying water to the region of Lisbon. According to recent estimates, EPAL and the remaining 16 multi-municipal companies represent about 90 percent of the value of the AdP holding. Today AdP is a shareholder, either directly or indirectly, in 63 companies. Seven of its subsidiaries operate on international markets.

The 1993 significant changes occurred in the Portuguese legislation modifying the legal framework of the sector in two directions (74):

- Private sector can participate in this sector, namely the bidding process for municipal systems' delegated management contracts, and in participating with a minority stake in the capital of multi-municipal systems' concessionaires;
- Multi-municipal systems were created, whose main difference in relation to traditional municipal systems (including inter-municipal) is the fact that the State is responsible for financing the necessary investments, while in municipal systems municipalities hold this responsibility.

In fact, the Portuguese legal framework for the water supply and wastewater sectors considers two types of systems (40, 63, and 74):

- Multi-municipal systems, whose object is the operation and management of the system of intake, treatment and distribution of water for public consumption, collection, treatment and rejection of effluents and the collections and treatment of solid waste provided that they serve at least two municipalities and require investments that are predominantly to be made by the State given reason of national interest;
- Municipal systems, which are all other systems, including those managed through an association of municipalities (inter-municipal systems).

In terms of the management of these systems, Decree-Law379/95, November 5, states that (i) the management of a multi-municipal systems is delegated, through a concession directly awarded by the state, to a public entity or to an enterprise resulting from the association of public and private entities, as long as the public body keeps the majority holding; and (ii) municipal and inter-municipal systems may be directly managed by the municipality, or their management can be delegated to a public or private entity or to an association of users.

In this context, AdP was created in order to develop multi-municipal systems, which are managed by multi-municipal companies owned by AdP, 51 percent and by the local councils of the respective municipality, 49 percent. Today, besides multi-municipal companies, AdP in partnership with the private sector has also won concession contracts through its Aquapor subsidiary to manage municipal systems in the water and wastewater sectors.

There is a feeling (from private operators) that public bodies are going beyond their role when bidding for concession contract for water retail activities, making private involvement more difficult. In fact, in 2001 the Association of Portuguese Enterprises in the Environmental Sector complained to the European Commission (DG Competition) about the discrimination of private entities in favor of the public holding. The final decision of the Commission was in favor of the private sector, which has obliged AdP to change its strategy, namely in what concerns Aquapor. Indeed, the policy towards PSP in Portugal has still to be clarified and, in particular, the future of AdP is one open question currently largely debated.

At present the Águas de Portugal Group employs about 4,300 people and is made of up to 63 companies operating in water supply, sanitation and urban waste sectors. There are 16 concessionaire companies supplying water services to multi-municipal systems, from which 4 operate only in the sanitation factor (40).

AdP also operates water supply and sanitation municipal systems. The most important (inter)municipal company in the Group is EPAL, which is responsible for supplying water to the region of Lisbon. AdP's core market is Portugal yet the Group

also operates, through its subsidiaries, in Brazil, Cape Verde, East Timor and Mozambique.
Águas de Portugal works in all segments of water supply and sanitation sectors. The Group's annual turnover in 2003 was 275 million euro, from which 92 percent corresponds to the home market (40).

The Portuguese National Strategic Plan of Supply and Sanitation for 2000-2006 sets targets that raise the percentage of population served by water supply (by 95 percent), and by wastewater collection, treatment and disposal (by 90 percent). The Group is actively engaged in achieving the operational goals programmed for those areas, and it is therefore commited to reinforcing strategic alliances with municipalities in order to establish and develop multi-municipal water-supply, sanitation, and solid urban waste systems (40).

In fact, the strategy of AdP towards the municipalities is based on active collaboration from two perspectives: as a partner (shareholder) and as a client. A mutual agreement between the company and municipalities establishes the duties and obligations of each party, such as the obligation the concessionaire has to guarantee the provision of water services; the penalties for non-compliance; and the minimum annual revenue to be guaranteed by users (so that the company's financial feasibility and the concession's economic and financial balance are ensured) (40).

Municipalities are held responsible for defining and approving water services' tariffs. In the delegated management cases, the legal act fixing the bases of the concession agreement defines the criteria to be followed in calculating the tariff, which are based on the principles of user-payer and total recovery cost. In general, tariffs must be sufficient to ensure: (i) the amortization of the initial investments within the concession period; (ii) the proper conditions of operation, maintenance and rehabilitation of the assets allocated to the concession; (iii) covering operating cost, bearing in mind the concessionaire's duty to manage the system efficiently; and (iv) the suitable remuneration of own equity. The operator then proposes the value of the tariffs and their evolution according to the above stated principles, which ultimately must be approved by the municipality (40).

Under this approach AdP has been adopting a strategy of full cost recovery for allocating financial resources from the users to maintain and develop the network. Moreover, AdP has a social strategy based on cross subsidies from heavily populated urban areas towards rural areas. This is made possible because AdP's activity regarding the development and management of multi-municipal systems is considered a public service by the State, which has therefore granted the company the exclusivity to explore these systems (40).

AdP, as well as all enterprises operating under a concession in the water services Portuguese market, is subject to a sector regulator – the Water and Residues Regulator Institute (63). Its competencies cover pricing policy (to comment on the tariffs); quality policy (to propose regulatory standards to gather information about quality levels of the services); entry in the market (to issue recommendations about concession awarding); and investment policy (to comment on the investment plans). In practice, IRAR has a weak capacity of intervention, solely giving advices, issuing recommendations, preparing regulations, reporting on performances of the systems, and supervising the economic balance of the whole sector. In fact, it is only a consultive body of the Ministry of Environment as municipalities are the only responsible for the assignment of management concession and for approving the tariffs (40).

7.1.3 AdP market strategies

AdP Group's core business is the development, operation and management of water supply, wastewater and solid waste systems (3). The company has been considering expanding its business to other sectors, such as energy and telecommunications (3).

In geographical terms, AdP's main market is Portugal yet the group is also present in other markets, especially in former Portuguese colonies. The first attempt of internationalization, which was directed to the Spanish market through an alliance with a Spanish regional company, was characterized by a failure. Only then AdP decided to extend its businesses to Africa and South America, namely to Portuguese speaking countries benefiting from privileged cultural and political ties. Normally, AdP forms joint ventures with other companies in bidding around the world. Águas de Portugal and Energias de Portugal (EDP) bid and won the concession to providing electricity and water services in Cape Verde (3).

AdP also provides technical assistance in other countries (e.g., East Timor) as part of national cooperation policy, but as well as part of a strategy to strengthen the Group's position in future bidding process (through a privileged knowledge of the local reality) (3).

At present AdP is intending to consolidate its presence in Mozambique, Brazil and Cape Verde, participating with local governments in the necessary technical assistance to develop water supply and sanitation systems (40). There have been some cases of transnational corporations' breach of contract in these countries (e.g., SAUR abandoned the consortium that won the concession for water supply in Mozambique) (40). According to AdP, the Group has decided to keep their concessions in these countries even in the event of financial problems so as to honor

its social commitments (40). In fact, in certain markets AdP operates more like a cooperation agency entrusted with some type of public-mission (40).

7.1.4 Towards an awaited opening of the sector

In the last years several political orientations towards the water and sanitation sector were taken. Sometimes these orientations were contradictory due to the fact that the Minister of Environment was a different one, with a different model in mind, every 2 to 4 years. This caused obstacles defining a new strategy and delays in meeting the Portuguese objective of reaching the same level of the other countries of the European Union in this sector.

The Portuguese Government currently faces budgetary difficulties and has to reply to Brussels regarding the public deficit and debt (8). The opening of the market to the private sector proposed by the Government in 2004 will have to be reviewed (8). The new Government plans to keep AdP in the public sphere and establish partnerships with the financial markets (8).

The European Commission in putting pressure to the Government to move on with the process, arguing that the competition rules of the market are not being respected (43).

The current debate about the future of AdP considers several options implying various degrees of PSP, namely (40):

- The privatization of non-core business such as Aquapor and EPAL, the subsidiaries operating in municipal systems;
- AdP remains public but its subsidiary companies operating multi-municipal systems delegate management responsibilities to private operators;
- Sell a minority stake of multi-municipal companies to the private sector;
- A complete disintegration of AdP, with the progressive opening of capital of various companies (municipal and multi-municipal systems) to municipalities and private companies. This solution is attractive for private operators but it meets strong opposition from some municipalities.

The opening of the entire capital of AdP to private investors, which would get money to the government but in practice, would not imply major structural changes, is not being seriously considered. According to the Government, the water sector needs to be re-structured before augmenting the participation of the private sector, so as to avoid the transformation of a public monopoly into a private one.

In sum, AdP is the instrument of the Portuguese State in order to fulfill its strategic objectives, both in terms of channeling EU funds to the extension of water systems and technical assistance to developing countries. The objectives of AdP are dependent on the Government and correspond essentially to the provision of public services.

7.1.5 Principal companies in Portuguese market

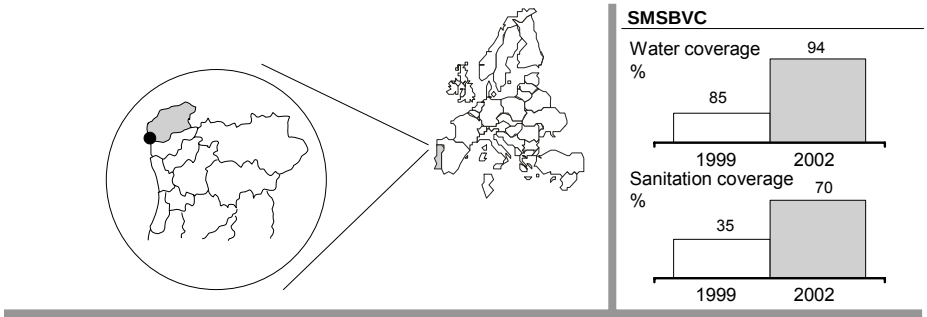
As discussed above, there is limited place for private companies to operate in the Portuguese water and sanitation sector: AdP is the biggest operator in the Portuguese water supply and sanitation sectors, followed by municipalities and some smaller private operators. The main competitors perceived by AdP in the domestic market are the following national private enterprises:

- INDÁQUA - Indústria e Gestão de Águas, S.A., a public limited company with private shareholders, namely Soares da Costa Concessões, Mota Engil Ambiente e Serviços and Hidrante (Monte Adriano);
- Compagnie Générale des Eaux Portugal S.A., subsidiary of Veolia Water (Vivendi Environment);
- AGS – Administração e Gestão de Sistemas de Salubridade, S.A., subsidiary of Somague Serviços (Somague SGPS Group).
- ValorÁgua – Águas e Saneamento de Portugal, S.A., owned by EDP Águas (50 percent) and Thames Water (50 percent).

INDÁQUA and the other national private enterprises member of the Portuguese Association of Environmental Businesses are lobbying to exert pressure on the national government to promote a model of progressive liberalization of the market. Companies wish this new management model to have an independent regulator and legislation that allows for the entrance of private capital in every segment of the water system (like the British model, though there is no consensus).

7.1.6 Background on the Minho-Lima region

This sub-region is bounded to the north and east by the border with Spain and to the west by the Atlantic Ocean (see Figure 7.2). The coastal city of Viana do Castelo is the largest conurbation in this predominantly rural sub-region. With an area of 2 210 km2, Minho-Lima is the fourth biggest sub-region of the North Region. Its coastline has a number of beaches. It has a fairly abundant river system, since the two main rivers which give the sub-region its name are served by many other small watercourses, the biggest of which are tributaries of the Minho or the Lima.



SMSBVC

Water coverage %: 85 (1999) → 94 (2002)

Sanitation coverage %: 35 (1999) → 70 (2002)

Outlook

- A multi-municipal company was created through a concession to build necessary infrastructure for intake and water and wastewater treatment using Cohesion Funds from the European Union (65%)
- Water distribution and wastewater collection continues a task of the local municipalities. These can also buy water to the concessionaire
- The new system will also contribute to reduce pollution in the Minho-Lima river basin

Region and population

River Basins		
Minho - area*	800	Km^2
Lima - area*	1100	Km^2
Population	>300	thous.inh.
SMSBVC		
Total area	312	Km^2
Population	88	thous.inh.

* Area in Portuguese territory (the River Basins extend to Spain)

Source: *Água em Revista* (2005), Jornal de Notícias (2005), APDA (1999 and 2002), *Águas do Minho e Lima* (2004), *Correio do Minho* (2002), SMSBVC (1998 and 2004)

Figure 7.2 The Municipalized Services of Viana do Castelo is the largest utility in the Minho-Lima Region

Minho-Lima, situated at the extreme north-west of Portugal, suffered for centuries from its peripheral location and its consequent inaccessibility, exacerbated by the rugged mountain terrain of its eastern zones. The opening up of frontiers as part of the building of the European Union and the improved access through investment in road-building have brought new opportunities, however, and given the sub-region a different profile.

Minho-Lima's geographical position is thus a determining factor for any study of this sub-region of the Norte. It can be expected to become progressively less of an obstacle and more of a development factor. The sub-region's years of isolation have, however, left it the legacy of an economic base centered largely on the primary sector, which represented 21 percent of employment in 1999 (44). The industrial sector (including energy and water) employed roughly 35 percent of workers in 1999, and its effects are felt chiefly in the western half of Minho-Lima, above all in Viana do Castelo (44). The tertiary sector is the main employer; in spite of it relative small share in employment (44 percent in 1999 against 58 percent for the national average) (44). The low average income of the population is a further determining factor.

Minho-Lima's economic structure shows limited industrialization, above all in its eastern half, which is dominated by agriculture. The percentage of persons working for an employer (54 percent) is the second lowest of the sub-regions of the Norte, largely because of the dominance of family labour (above all in agriculture, but also in the distributive trades). Only two firms in Minho-Lima employ more than 1000 persons: Cablinal Portuguesa-Equipamento Para a Industria Automovel LDA and Estaleiros Navais de Viana do Castelo, a publicly-owned shipbuilding company. A

third of the resident population and 45 percent of firms in Minho-Lima are to be found in the municipality of Viana do Castelo, giving the district an industrial dynamic unparalleled elsewhere in the sub-region and three-quarters of Minho-Lima's industrial turnover.

7.1.7 Águas do Minho e Lima

Águas do Minho e Lima, S.A. (ADML) is one of the multi-municipal companies of Águas de Portugal (4). It was created by Decree-law nº 158/2000 of 25 July 2000 to develop the water and wastewater systems of the following municipalities in the region of the rivers Minho and Lima: Arcos de Valdevez, Caminha, Melgaço, Monção, Paredes de Coura, Ponte da Barca, Ponte de Lima, Valença, Viana do Castelo and Vila Nova de Cerveira (4).

The municipalities were suffering from high levels of water pollution, which was affecting the River Basins of Minho and Lima and the water quality of the region in general (21). This geographical area had a lack of water supply structures in quantitative terms as well as qualitative (21).

The company intends, through sustainable management and optimization of the water and sanitation systems, to contribute to the improvement of the affected environment and the quality of life of the populations of Minho and Lima (68). ADML is contributing to solve industrial pollution problems and improve the damaged ecosystems (68).

The concession contract has the duration of 30 years (2000-2030) and was celebrated on 18 September 2000(63). ADML is responsible for designing, building, operating and managing the multi-municipal water and sanitation system of the Minho-Lima River Basins (63). The company has 3 approved applications to the Cohesion Fund of the European Union in the amount of 122 Million Euro (68). The total investment is about 200 Million Euro (68).

ADML is 51 percent owned by AdP and 49 percent by the municipalities. Note that AdP is currently 90 percent owned by the Portuguese Government and 10 percent by *Energias de Portugal* (EDP).

ADML is currently serving 310,000 inhabitants in water and sanitation (4). ADML's system has a water supply capacity of 100,000 cubic meters per day and a sanitation capacity of 66,000 cubic meters per day (4).

The investment from ADML is the highest public investment in the region (21). Until the end of 2007 ADML is spending 180 Million Euro - 65 percent from the Cohesion

Fund of the European Union – using the Fund to improve the intake and distribution water systems *em alta* to about 300 thousand inhabitants from 10 municipalities (21). These measures are according to the National Water Plan (PNA) 2000 – 2006 stating that 95 percent of the total population should be connected to water supply and 90 percent served with sewerage and wastewater treatment (21). The feeling in general in Portugal is that these were high expectations, particularly with sewerage and wastewater treatment. Some decision-makers started proposing the creation of intermediary systems to treat residual waters from smaller communities disperse in the territory.

ADML's water supply infrastructure (21):

- 7 Intake stations (2 under construction)
- 6 Water treatment Plants (2 under construction)
- 284 Km Pipelines (234 Km under construction)
- 6 Pumping stations (4 under construction)
- 41 Reservoirs (16 under construction)

ADML's sanitation infrastructure:

- 18 Wastewater treatment plants (12 under construction)
- 193 Km Sewerage pipelines (131 Km under construction)
- 73 Pumping stations (47 under construction)

The wastewater treatment plant of Vila Nova de Cerveira will treat 1,381 cubic meters per day of residual water from 6,408 inhabitants-equivalents from Gondarém, Loivo, Lovelha, Reboreda e Vila Nova de Cerveira (21). The WWTP of Caminha will treat until 3,328 cubic meters per day of residual water from 17,205 inhabitants-equivalents from Lanhelas, Seixas, Vilarelho, Caminha, Vilar de Mouros e Argela (21).

The wastewater treatment plant of Gelfa will treat 5,700 cubic meters per day of residual water, serving about 27,023 inhabitants-equivalents from Moledo, Vila Praia de Ancora, Cristelo, Ancora e Riba de Ancora (21).

Finally, the wastewater treatment plant of Viana do Castelo will treat until 8,580 cubic meters per day of residual waters from 45,257 inhabitants-equivalents from Portuzelo, Perre, Meadela, Monserrate, Santa Maria Maior, Carreço and Areosa (21).

7.1.8 SMSBVC: The Water and Sanitation Municipalized Services of Viana do Castelo

The Water and Sanitation Municipalized Services of Viana do Castelo (SMSBVC) is basically responsible for water distribution to households, and drainage of residual domestic waters – the so called service *em baixa*. Water in Viana do Castelo is supplied in two sections: ADML, the multi-municipal water company, provides the infrastructure for abstracting water from aquifers and surface water sources. It treats and transports water *em alta* to municipal piped water supply systems which are maintained, extended and operated by the SMSBVC *em baixa*. Similarly, sewage water collection networks are maintained, operated and implemented by the SMSBVC *em baixa* while sewage water treatment and discharge is implemented and operated by ADML *em alta*.

Municipalized Services in Portugal are managed in a way so that the Municipality is, though in an indirect way, the titular of the Services (9). The Municipality nominates the Board of the Municipalized Services (9). The Municipalized Services nominate the Director of the Board. Investments are normally financed by the Budget of the Municipalized Services, independent from the Municipality's Budget (9).

In SMSBVC 2004 Annual Report (102), the company managers pass the message that they feel current legislation to be more demanding and, the population of Viana do Castelo is introducing new challenges to the company. The employees, managers and administrators feel their responsibility is increasing and have to better perform their tasks.

In 2004 the Municipalized Services noted a reduction of absenteeism, of work accidents and of the number of extra hours charged by its employees. The company also invested in purchasing self protection material. The company invested in human resources training and IT equipment (hardware and software) to support technical and administrative activities.

The increase in water production and distribution, associated to the quality and monitoring of the same has been deepened. The number of users of the system increased and a significant renewal and extension of the distribution net had to be performed. The preparation and support of current construction works by the Municipality, Vianapolis, Águas do Minho e Lima had a significant weight in the resource allocation of the SMSBVC. Besides this effort, the construction works by direct administration had a positive impact throughout the region.

The extension of the sewerage network, renewal and substitution of unifying collectors by separation nets also required significant resources. This had to be done in accordance to the investments of the Municipality and of Águas do Minho e Lima.

Besides the water supply and drainage of domestic wastewater activities the SMSBVC are also responsible for the Municipality's waste management and city cleaning, i.e., the company is not a pure water player, making the data analysis more complex and less accurate.

The Municipalized Services have in total 249 employees, of these 212 are effective, 31 are on a contract basis and 6 under service contracts. In the water and wastewater section one counts 63 employees in 2004 (approximately 25 percent). At the SMSBVC no one has a Ph.D., Doctoral or Masters level of education. There are 8 employees with *Licenciatura* (Portuguese degree which requires 4 or 5 years at University) and 6 other employees with *Bacharelato* (Portuguese degree which requires 3 years at University). Other 5 employees have a Professional degree and the rest has done 12 years of Secondary School or less.

In the year of 2004 several water supply infrastructure renewals (e.g. the reservoir of Ursulinas) were performed. In terms of the distribution net, efforts to renew the most frequently damaged pipelines still need to be continued. The SMSBVC in 2004 also started construction of 12,5 Km of drainage of domestic wastewater from Barroselas, Mujães, Vila de Punhe e Alvarães.

The number of consumers in 2004 is 35,806. The number of employees is 59. Consequently, the ration consumers/employees is 607. Recalling the same ratio 7 years before, in 1998, which was 478. The ratio in 2004 is higher than in 1998, which shows that the number of consumers increased (17 percent) and the number of employees decreased (4 employees less). Stated at the Annual Report 2004, this increase in the number of consumers per employee is a trend and is directly related to the evolution of the management vision for the company. The strategy is to control the growth of the number of employees, maintaining the service operational, i.e., focusing on the core business and leaving the rest to service contracts (e.g. for renewal of the pipelines, renting equipment).

The company purchased self protection material for the employees in the amount of 30.475,68 Euro. The investments in the Administrative and Financial Departments focused particularly in the acquisition of new IT equipment (Hardware and Software) in the amount of 28.565,41 Euro. The SMSBVC spent 2.281 Euros in Training. It did not spend a single Euro in Investigation and Research.

The preparation of the Monitoring Plan and implementation of the Control Program follow the current Portuguese legislation, namely the Decree-Law 243/2001 of September 5. The water quality is controlled in 72 different sampling points strategically dispersed in the geographical area of Viana do Castelo. The tests performed internally on a daily basis and by an external entity 2 or 3 times per week. In total, 81 parameters of quality characterization are tested.

The water supply system operated by the Municipalized Services of Viana do Castelo is permanently under control and all over the distribution network. The supplied water presented quantities of organic compounds, metal residues and pesticides below the limits of detection of analytical methods. In sum, the water for human consumption distributed by the SNSBVC in the year 2004 respected the qualitative norms for human consumption of the Decree-Law above mentioned. The water can be used for domestic purposes, in a safely manner, to all consumers.

The analysis of the structural budget shows a global increase of the current revenues, resulting from the extension of the water distribution network and an increase of 5,2 percent of water production in the geographical area of focus. The current savings rounded 1 Million Euro, which allowed the reinforcement and extension of the distribution network as well as the modernization of services and equipments. The works performed by the SMSBVC (direct administration) registered an increase of 184.183 Euro, which translates a significant impulse relatively to year 2003. This fact, added to the increase in water sales and increase in sanitation tariffs lead to positive financial results.

The management ratios show a growing independence degree towards external financing. SMSBVC acquired current goods and services in water and wastewater from Águas do Minho e Lima in the total amount of 1.613.095,26 Euro. Sales in 2004 are of 2.964.539,96 Euro, which represents a 33,82 percent increase to 2003. The operational costs are below the operational revenues due to an increase in the SNSBVC activity and the implantation of cost cutting measures. The operational costs are 8.321.323,59 Euro and the operational revenues 8.765.563,16 Euro.

7.1.9 Knowledge Base

The most relevant sources of internal data needed to run the KB-DSS about SMSBVC are its annual reports of 1998 (101) and 2004 (102). These do not follow the same format and do not contain the same indicators, therefore and it was quite time consuming to get familiar with both types of reports and calculate and/or estimate the missing data (see Chapter 6). Adding to that, translation from Portuguese to English and currency conversion, as in 1998 the national currency was the Portuguese Escudo – the Euro entered into force in 2000. Several interviews were needed to complete the necessary information.

Concerning external data, publications from different types of institutions, books, papers and above all, press articles and the internet were key to find the required knowledge. Appendix A summarizes the key data collected for the years of 1998 and 2004. The sources are carefully indicated.

Note the structure of the KB follows the scheme proposed for knowledge gathering as discussed in Chapter 6.

7.1.10 Benchmarking and transformation

Using the knowledge base, the selected thirty six indicators are calculated. The least acceptable value (or worse value) and the desirable value (or best value) are then used to normalize (or transform) the obtained KPIs (see methodology at Chapter 6). Appendix B summarizes the benchmarking and gives the results of the KPIs and respective normalized values – between zero and one (TR) – under the objective-group to which they belong and characterize.

7.1.11 Results and conclusions

The spreadsheet output of the developed KB-DSS model for the selection of the private sector mechanism that has higher responsiveness to the objectives of the municipality of Viana do Castelo is given in Table 7.1, in descending order.

Table 7.1 KB-DSS ordered results for SMSBVC, Portugal in 1998 and 2004

SMSBVC, Portugal 1998			SMSBVC, Portugal 2004		
A1	Service contract	0,38	A1	Service contract	0,44
A4	Lease	0,35	A5	BOT	0,34
A3	Manag. contract fixed fee	0,33	A3	Manag. contract fixed fee	0,32
A7	Divesture	0,32	A4	Lease	0,31
A2	Management contract	0,32	A7	Divesture	0,30
A6	Concession	0,31	A2	Management contract	0,29
A5	BOT	0,31	A6	Concession	0,29

The KB-DSS final rank identifies a service contract as the most appropriate form of partnership between the municipally owned utility and a private organization in year 1998 as well as in 2004. A service contract of certain duration would serve to initially address the problems of failures in the system and consequently reduce the number of service complaints. In fact, this is also the strategy taken by the SMSBVC managers, but the duration of the contract(s) should be extended or a more careful selection of the private operator(s) should be taken as the major problems seem to remain the same along the years.

The next results for 1998 are examined as follows:

- Under the lease route – originated in France, the so called *affermage* – the private operator would take responsibility for operation and maintenance (O&M) of the SMSBVC system which it would rent from the municipality of Viana do Castelo. The municipality would continue the owner of the assets and would remain responsible for capital expenditure. This procurement route would have to provide the private operator with incentives to improve operating efficiency and to minimize costs;
- By choosing a management contract with a fixed fee, whist Viana's municipality would continue to retain financial control providing funds for working capital and investment, the private operator would take complete responsibility for the O&M of the water and sanitation systems;
- A divesture would be more responsive than a concession or a BOT, but there would be a need for a stronger regulator than the current Portuguese IRAR.

Water supply was in 1998 the most profitable but also the most costly of SMSBVC activities (see Figure 7.3). Water supply activities represented 74 percent of the revenues and 54 percent of the costs. In contrast, urban waste management represented 15 per cent of the revenues and 37 percent of the costs.

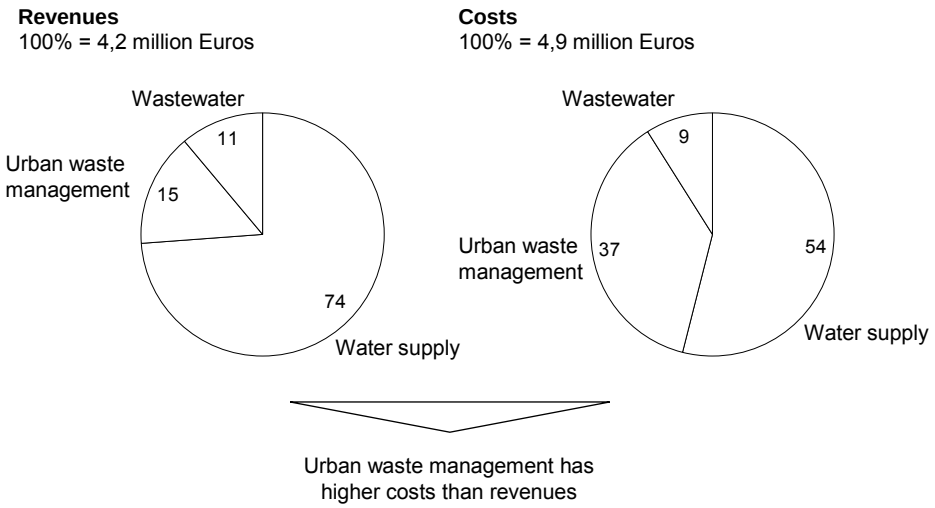
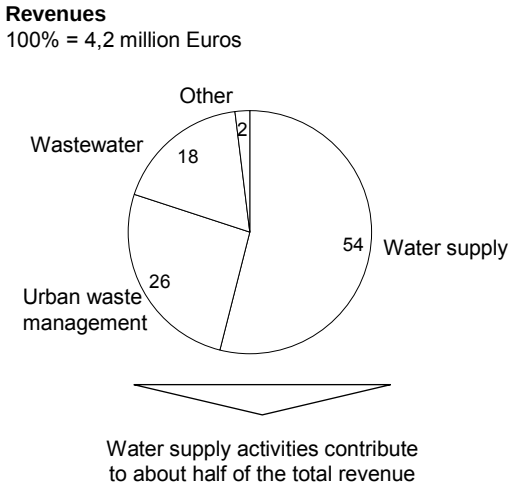


Figure 7.3 Water supply has been the most profitable and most costly activity of SMSBVC

The situation in 2003 improved – after the creation of ADML and respective huge investment in the region. The SMSBVC became then responsible for the *em baixa* services – distributing water to households, and draining residual domestic waters, and ADML for the *em alta* services - providing the infrastructure for abstracting and

transporting water and implementing and operating sewage water treatment and discharge.

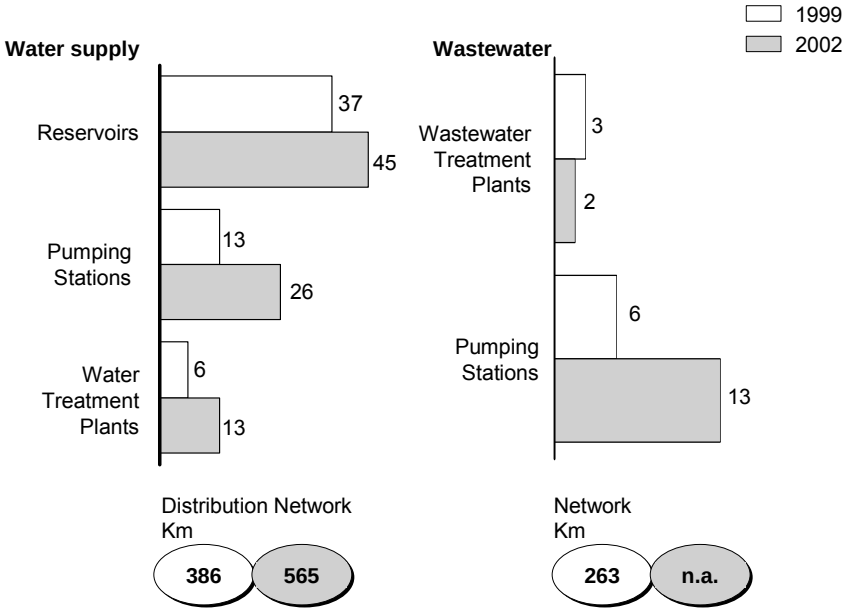
In 2003, urban cleaning and wastewater activities started to become more profitable than in 1998 (see Figure 7.4). Water supply activities contributed to 54 percent of the revenues, urban waste management and wastewater activities contributed to 26 and 18 percent of the revenues respectively.



Split on costs is not available. Water supply and sanitation costs estimated to be 54% of total cost
Source: SMSBVC (2004)

Figure 7.4 SMSBVC urban cleaning and wastewater activities started to become more profitable

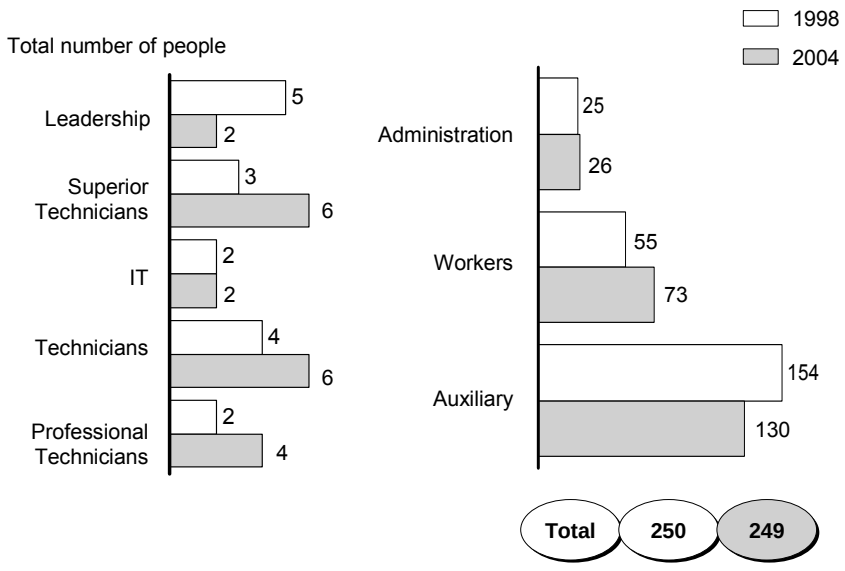
Investment in water supply and wastewater infrastructure has been a priority of the SMSBVC (see Figure 7.5). Reservoirs, pumping stations and water treatment plants have been built, as well as wastewater treatment plants and wastewater pumping stations.



Source: APDA (1999 and 2002)

Figure 7.5 Investment in infrastructure has been a priority of the SMSBVC

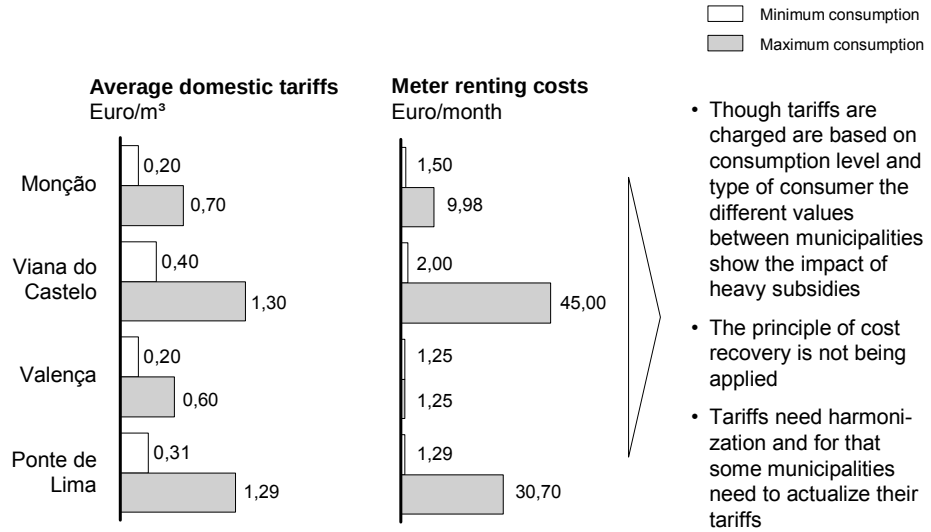
The regulations of the Municipality of Viana do Castelo allow the services *em baixa* to be performed by the private sector. The SMSBVC are still performing these, and the fear that a concessionaire may come and take their jobs is there. ADML is seen by the lens of SMSBVC employees as "the enemy". The current rates of absenteeism of SMSBVC employees would hardly be tolerated by a private company. With some variations, the total number of employees of SMSBVC remain practically the same (see Figure 7.6)



Source: SMSBVC (1998 and 2004)

Figure 7.6 SMSBVC number of employees remains practically the same

The tariffs paid by the consumers in the Minho-Lima Region vary significantly between municipalities and is one of the obstacles towards privatization of the *em baixa* services, still responsibility of the different municipalities (see Figure 7.7).The tariffs are proposed by the Board of Administration of the Municipalized Services to the Municipality for final approval. According to Decree-Law No. 42/98, art. 20/3 the tariffs should not be lower than the direct and indirect costs from the supply of goods and services (9).



Source: Phone interviews

Figure 7.7 Different politics, different tariffs in the Minho-Lima region

The new harmonized tariff would not be higher than the highest one already applicable. For Municipalities whose consumers have a lower tariff, then the price would have to increase. The population does not seem to suffer greatly from the increases in water prices, given the overall purchasing power of the majority has increased much more in the last years. It is fundamental that the water providers get close to the population towards a system of quality.

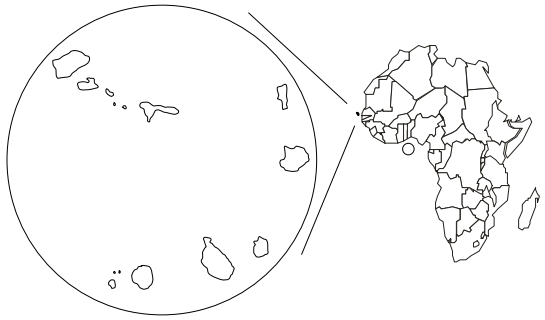
7.2 Water and electricity concession in Cape Verde

In this section, an overview of Cape Verde and the economic and institutional characteristics of its water and sanitation sector are described. The process of privatization of Electra – the power and water company - is reviewed. The KB-DSS model is run for the years 1998 and 2003 – before and after Electra's stake acquisition. While firm conclusions are premature in yet a recent concession, certain lessons emerge for successful private sector involvement in the Cape Verdean water and sanitation sector.

7.2.1 Country and sector background

Cape Verde gained independence from Portugal in 1975, and, since holding its first multiparty elections in 1991, it has been characterized by peaceful democratic transitions. Portuguese is the official language in Cape Verde, but the national language is Creole, which blends Portuguese and West African linguistic features. The country has close economic and political ties to Portugal and the European Union. The currency is pegged to Euro, which the government is considering adopting officially.

The archipelago is one of Africa's smallest territories and has poor natural resources, frequent droughts, and serious water shortages (see Figure 7.8). The economy is dominated by services, which accounted 73 percent of the GDP in 2004 (57). Domestic fishing and agriculture account about 11 percent of the GDP (57). Cape Verde can produce only 15 percent of its food and heavily relies on food imports (57).



Water resources

Precipitation	228	mm/year
Surface water	0,181	Km³/year
Groundwater	0,124	Km³/year
Total*	0,300	Km³/year
Water/capita	634	Km³/year
Dependency	0,00	%
Desalination	10,500	m³/day
Water coverage	80	%
Sanitation coverage	42	%

Outlook

- Cape Verde has frequent droughts and serious water shortages and can produce only 15% of its food
- The economy is dominated by services which accounted 73% of GDP in 2004; agriculture and fishing employ much of the population but account for only 11% of the GDP

Country and population

Total area	4,030	Km²
Population	473.000	inh.
Density	117	inh/Km²
GDP/capita	1,290	USD/year
HDI rank**	105	In 2005

* There is an overlap of surface water and groundwater of 0,005 Km3/year

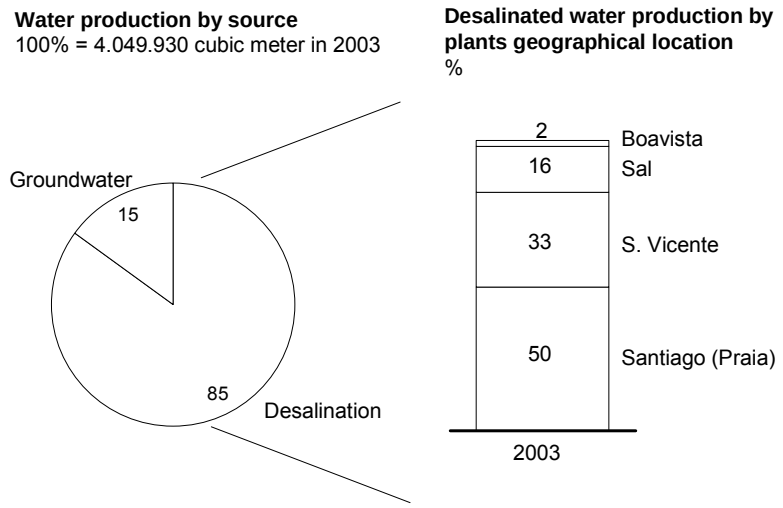
** Human Development Index (out of 175 countries)

Source: Heritage Foundation (2006), Reuters Foundation (2006), AQUASTAT (2005), EIU (2005), Industry Canada (2003)

Figure 7.8 Cape Verde is one of Africa's smallest territories and has poor water resources

Economically driven emigration is common, and remittance from abroad is an important contribution to the GDP. Severe droughts in the 1900s led to 200 thousand deaths and caused many people to migrate (91). Nowadays more people of Cape Verdean origin live outside the country than inside, and it is estimated that remittances from expatriate Cape Verdeans account for 20 percent of the country's GDP (91). Cape Verdeans represent 22 percent of Portugal's foreign residents (91).

Desalinated water represents 85 percent of Cape Verde's water (see Figure 7.9).



Source: Electra (2004)

Figure 7.9 Desalinated water is what flows in Cape Verde

In spite of all the difficulties Cape Verde faces, the government has made a great effort over the past years to promote a market-oriented economic model aimed at private sector development, foreign investment and integration of Cape Verde into the global economy (62). It has been a model of reform through economic liberalization, good governance, and judicious public investment (62). New financial and economic legislation has shifted the government's role in the economy from that of a direct economic agent to one of a major promoter and regulator of economic activity (62). These policies have received the endorsement and support of the World Bank, the IMF and many multilateral and bilateral donors: in 2005, Cape Verde signed a 110 million dollar compact for development grants from the U.S. Millennium Challenge Account.

More than half of the foreign direct investment (FDI) in the country comes from Portugal. Portuguese companies are present in the big sectors such as telecommunications and energy, but also in textiles and shoe manufacturing (30). Currently, the Portuguese entrepreneurs compete with Chinese, Brazilians, Italian and Spanish, mostly in the tourism sector (30).

Business risks… (30)

- It is a small territory, with about 470 thousand inhabitants, spread in nine islands;
- Difficulties in water supply and electricity;
- Bureaucracy and inertia;
- Lack of infrastructures;
- Cost of telecommunications (more expensive than in Portugal).

… and opportunities (30)

- New wave of privatizations (port management, pharmaceutical industry and shipbuilding);
- Human resources relatively qualified;
- Security and lack of diseases;
- Political and social stability;
- Currency is pegged to the euro;
- Strategic position in the Atlantic;
- Commercial agreements with Europe, U.S.A., Canada, China and,
- Member of the Economic Community of West African States (ECOWAS), enlacing 500 million consumers, which makes the country attractive for investment in exporting activities.

In 1997, the Cape Verdean government quickened the pace of privatization in accordance with its five-year World Bank privatization program (62). The first stage of the program ended in December 1997 (62). In June 1998, the World Bank agreed to assist the second stage of accelerated privatization with a 9 million dollar loan from the International Development Association (IDA) (62).

Several state-owned enterprises have been privatized, including three hotels, the national telecommunications company, Cabo Verde Telecom, the oil distribution company, Enacol, two commercial banks, the Banco Comercial do Atlantico (BCA) and the Caixa Económica de Cabo Verde (CECV), an insurance company, Garantia, and the power and water supply company, Electra (62). They were all sold to Portuguese companies, with the exception of Enacol which was partially acquired by Angolan Sonangol (62).

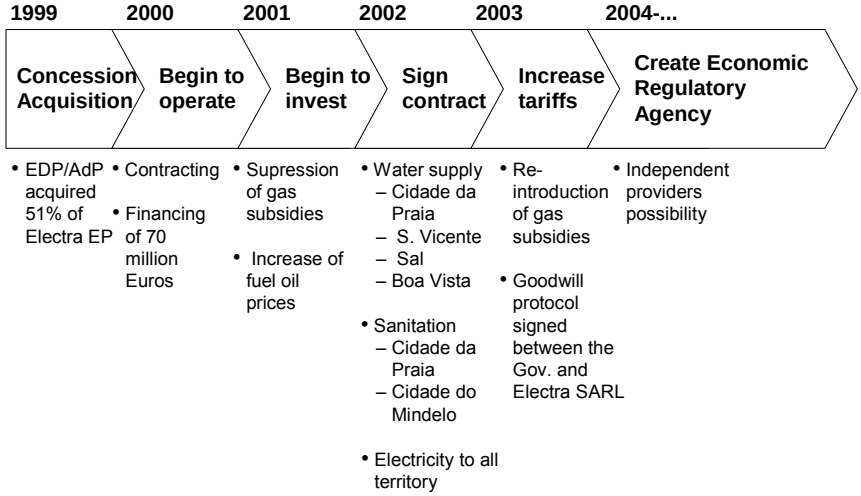
7.2.2 Privatization of Electra

Electra, the Cape Verdean power and water utility created in 1982, faced serious difficulties in meeting growing electricity and water demand in Santiago, São Vicente, Sal, and Boa Vista, the main islands with rapid urban growth (130). In 1998, the sewer system served only 8 percent of the city's population and only 24 percent of the population had septic tanks, with the remaining households having no means of sanitation (130). This lack of basic sanitation infrastructure, present in other urban areas too, was contributing to environmental degradation and the re-emergence of water-related diseases (130).

In May 1999, the government of Cape Verde received a loan of 22 million dollar from the World Bank to help with restructuring electricity and water and privatization of

Electra. The 48 million dollar total cost of the Energy and Water Sector Reform and Development Project in Cape Verde was financed by a 17.5 million dollar equivalent credit from the International Development Association (IDA), the World Bank's lending arm for the poorest countries, and a GEF Trust Fund Grant of 4.7 million dollar. The government and other co-financiers (European Union, OPEC Fund, Austria, ELECTRA, and private concessionaires) funded the project with the equivalent of 25.8 million dollar.

In late 1999, EDP/AdP formed a consortium, 60% owned by EDP - Energias de Portugal and 40% owned by AdP - Águas de Portugal, which was chosen by the government of Cape Verde to acquire a 51% interest in Electra for 45.4 million Euro (3). EDP alone paid 27 million euro. The concession contract initially agreed to last 50 years changed to 36 years. Figure 7.10 summarizes in chronological order the main actions of EDP/AdP after the acquisition.

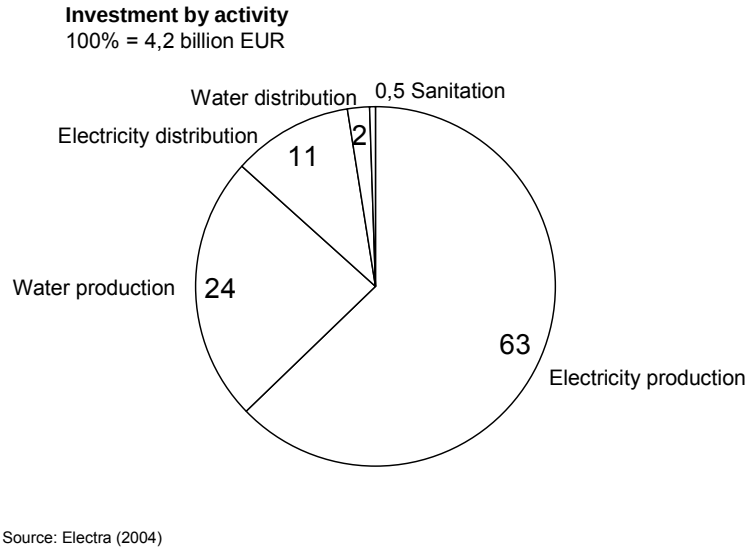


EDP: Energias de Portugal, AdP: Águas de Portugal (Portuguese electricity and water companies); EP: Empresa Publica (Public company)

Source: Electra (2004)

Figure 7.10 Electra's concession initially agreed to last 50 years changed to 36 years

Electra invested 4,2 million euro in the water and power supply in 2003. Figure 7.11 gives the breakdown of this investment per sector. In the water sector - production, distribution and sanitation - about one million euros were invested.

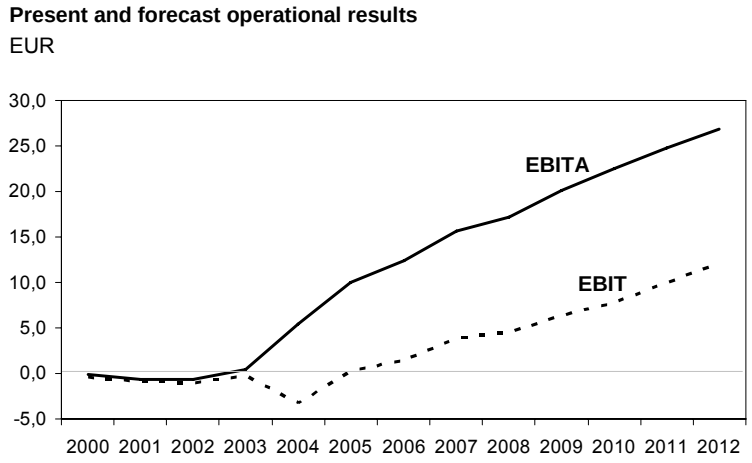


Source: Electra (2004)

Figure 7.11 Electra invested one million euros in the water sector in 2003

In 2004, Electra produced 4.1 million cubic meters of water and distributed 2.8 million cubic meters of water to 25,102 customers. Electra had revenues of 31.7 million euros and a net loss of 4.4 million euros in 2004.

The company expects to have a positive EBIT during the course of the year 2006 (see Figure 7.12).



EBITA: Earnings before interest, tax and amortization; EBIT: Earnings before interest and tax
Source: Electra (2004)

Figure 7.12 Electra plans to increase its results

7.2.3 Knowledge Base

A clear benefit of Electra's privatization is the improvement in the quality of its Annual Report. The annual report of 1998 seems a patchwork of data and information collected from different departments without harmonization, while the same document for year 2003 is carefully written, includes clear figures and tables; and has consistent and relevant data. Apart the difficulties in translation - from Portuguese to English - and currency conversions - from Cape Verdean Escudo to Euro - the search for information was not as hard as initially expected for the case of a developing country due to great cooperation from Electra's engineers. Other important sources of information were press articles and various web sites. Appendix C gives the knowledge base data used to run the KB-DSS in the years 1998 and 2003.

7.2.4 Benchmarking and transformation

Using the least acceptable values and desirable values indicated for the key performance indicators of developing countries, the resulting transformed or normalized values vary between zero and one (see Appendix D).

Once the values are normalized composite programming can be applied using the weights and compensation factors as described in Chapter 6.

7.2.5 Results and conclusions

The KB-DSS final indexed rank of private sector alternatives for Cape Verde in 1998 and 2003 are listed in Table 7.2 in descending order:

Table 7.2 KB-DSS ordered results for Electra, Cape Verde in 1998 and 2003

Electra, Cape Verde 1998			**Electra, Cape Verde 2003**		
A7	Divesture	0,40	A7	Divesture	0,42
A6	Concession	0,39	A6	Concession	0,40
A4	Lease	0,39	A5	BOT	0,38
A3	Manag. contract fixed fee	0,33	A4	Lease	0,30
A2	Management contract	0,30	A1	Service contract	0,26
A5	BOT	0,29	A3	Manag. contract fixed fee	0,25
A1	Service contract	0,25	A2	Management contract	0,20

The ranking of indexed values indicates that, for the year of 1998, the private sector mechanism bringing higher responsiveness to the Cape Verdean government's objectives concerning the need for improvements and investment in the water and sanitation sector would be a divesture – asset sale or full privatization, followed by a concession or a lease:

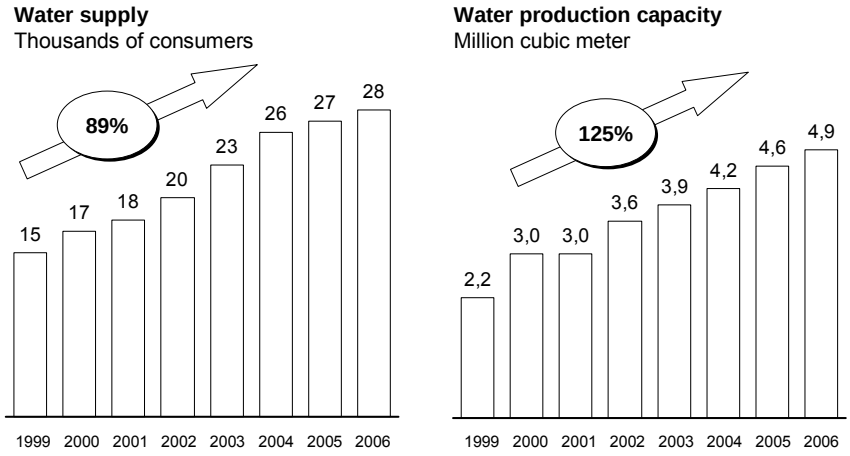
- By choosing a full divesture, in addition to responsibilities for service delivery, ownership of existing assets, such as the physical infrastructure of the water system - including desalination plants, would be transferred from the public to the private sector. If there would be political agreement on this, the second major obstacle would be finding or attracting a private company interested in buying it;
- In a concession, the private sector organization would be responsible for financing the investment costs of the system including systems expansion, as well as for all of the operation and maintenance, in order to prescribed service delivery objectives. In fact, this was the choice of the Cape Verdean government and other co-financiers (European Union, OPEC Fund, Austria, Electra, and private concessionaires) and supported by the World Bank;
- A lease or *affermage*, would mean that the private sector would be responsible for providing agreed levels of service to customers and for providing working capital for repairs. The main tasks would be operation and maintenance but with a greater degree of autonomy than management contracts;
- If Electra would retain responsibility for system expansion and other capital works and the private sector would take over responsibility for part of the operations, such as all O&M, a management contract would be the proper type of contractual arrangement;
- Service contracts or outsourcing, where Electra would contract out services to the private sector for a specific package of work such as repair, metering, customer billing and/or collection, would bring in limited value.

For year 2003 – few years after the acquisition of 51% of Electra by the consortium EDP/AdP - the approach that would meet the country's government objectives would still be a divesture. This result is as expected, because in the first years of a concession the private sector organization has not yet been able to bring significant operational and financial improvements.

A BOT (Build Operate Transfer) contract involving the construction, ownership and operation of new facilities by the private sector together with the transfer of those facilities to the public authority at the end of the contract is in 2003 more responsive to the government's objectives.

In conclusion, Electra's concession contract, although still in its first years, has improved performance by almost every measure, notably the increase in water

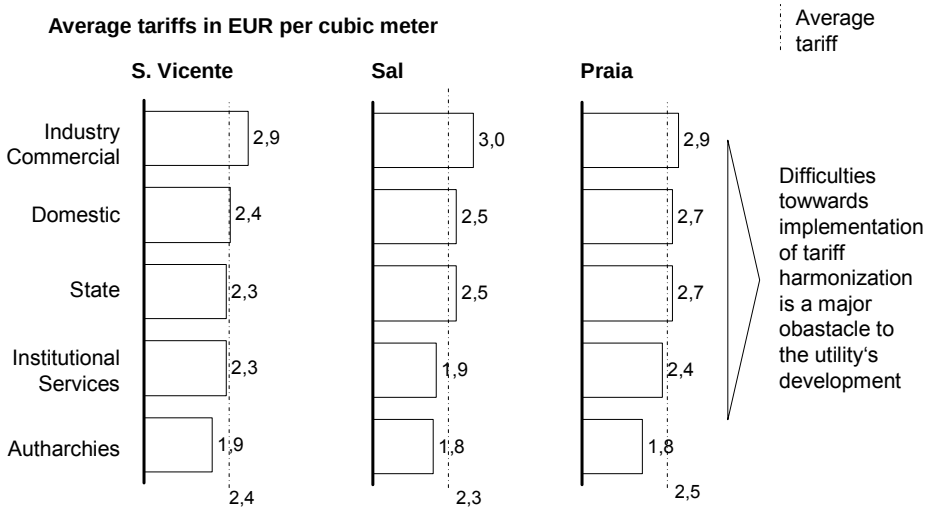
coverage and production (see Figure 7.13). In 1999, Electra counted 15 thousand customers and the estimate for 2006 indicates an increase of 89 percent - 28 thousand customers. In terms of water production, it more than doubled between 1999 and 2006, from 2.2 to 4.9 million cubic meters.



Source: Electra (2006)

Figure 7.13 Electra's concession is serving much more people

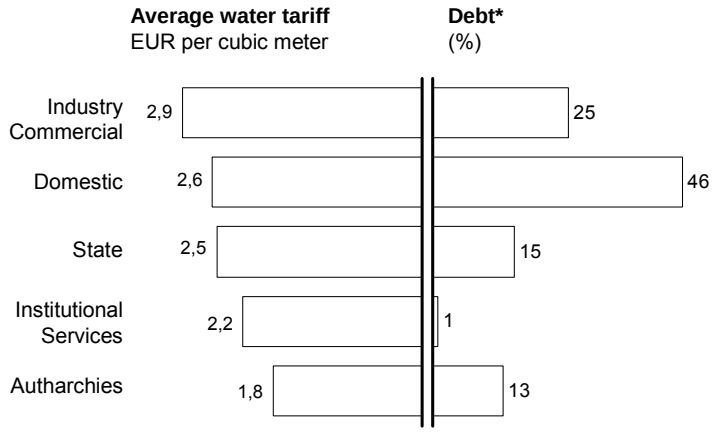
But tariffs had to increase… One of the major challenges of Electra is tariff harmonization: the water tariffs vary considerably between islands, type of consumer and consumption level (see Figure 7.14).



Source: Electra (2004)

Figure 7.14 Water tariffs in Cape Verde vary considerably between islands, type of consumer and consumption level

Finally, although efforts from the government to increase tariffs before privatization, the willingness to pay for water and sanitation services is still not there, and is a major obstacle to the success of the private sector participation in Cape Verde. Public entities themselves - state, institutional services and autarchies - accumulate outstanding debts to Electra. Domestic users are not willing to pay higher tariff rates; representing 46 per cent of the debt (see Figure 7.15).



* Debt related to water and electricity tariffs; Data of 2003; correlation factor =0,51
Source: Electra (2004)

Figure 7.15 Domestic users in Cape Verde are not willing to pay high tariffs

CHAPTER 8

THE WAY FORWARD

The knowledge based decision support system (KB-DSS model) that has been developed points how to choose a contract for private sector participation that is well tailored to local needs, in industrialized countries as well as in developing countries. However, the results are only as good as the information entered in the knowledge base. The more comprehensive the information on the water and sanitation utility and its economical environment, the more accurate the ranked results will be. The KB-DSS strong points are in the analysis of the objectives and identification of the severity of problems measured by the selected key performance indicators (KPIs) under the selected objectives, and consequently under the three capacity elements – managerial, technical and financial. The choice of a contractual arrangement for a public private partnership is secondary to the understanding of the critical issues of a water and sanitation utility.

The key performance indicators considered in the KB-DSS model can be quantifiable or not. The advantage of composite programming is that through transformation all KPIs will be valued between zero and one. The desirable value of a non-quantifiable KPI will be one and the least acceptable value zero, as for example the last selected KPI of the present KB-DSS, capacity building.

The KB-DSS provides a useful tool for utility managers to analyze their current situation and identify the problems and, through benchmarking, obtain an indication of the severity of those problems, in industrialized countries as well as in developing countries. It also opens the door to the responsiveness of private sector participation approaches for addressing the problems utilities face.

Another advantage of this KB-DSS is that the grouping and weighting, and selection of compensation factors, can jointly be done by the different stakeholders, and by doing so, the achievement of an agreement and/or compromise on the priorities done in early stages may save a lot of pos-privatization hurdle.

Further research and recommendations to improve the developed KB-DSS:

- The selection of key performance indicators could be extended to allow more detail – the International Water Association listed over 200 performance indicators – though continue to work with interactive spreadsheets could become complex and some type of specific software could be required; on the other way around, the list of KPIs could also be shortened to make the process of gathering

all the necessary knowledge less time consuming. In fact, utilities are generally not using state of the art knowledge management technologies and frequently the queries run from person to person from one department to another without answer;

- The benchmarking process and the choice for desirable values and least acceptable values could be even more accurate, or more limitative. It would require further intensive research in specific technical, financial and managerial publications;
- The selection of alternatives could be extended (or simply another selection), as the number of options for approach by the private sector is limited to seven (so to say, the classical ones), and there is a full range to be researched. For example, the so-called tri-partnerships, between the private sector, the public sector and a non-governmental organization (NGO) or donor or investor seems to be more and more an attractive option in developing countries and is not yet well documented;
- The seven objectives selected for this KB-DSS follow a pattern by the World Bank. Research on these specific issues could be very valuable;
- The transformation matrix quantifying the responsiveness of the selected contractual arrangements according to the selected objectives and respective KPIs also follow a pattern from the World Bank. In depth research on the ability of the private sector to meet the water and sanitation utilities would bring distinctive value;
- A system that would easily update the data at the KB-DSS and facilitate calculations for next years would be outstanding;
- Development of a KB-DSS using fuzzy composite programming could deliver even more accurate results.
- This KB-DSS was conceived for the use of a government (national, regional, as appropriate). It could be adapted to be used by the private sector – the objectives would then be others.

In summary, the knowledge base decision support system (KB-DSS) that has been developed trough this research represents a standardized procedure for analyzing the problems of water and sanitation utility. The ease with which it can be used makes it attractive, and allows the user to gain a broad understanding of the current situation of the water and sanitation utility in focus – technically, financially and from a management perspective.

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APPENDIX A

Knowledge Base - SMSBVC in 1998 and 2004

	Unit	Source	1998	2004
Water services				
Total annual volume of water abstracted/produced	m3	Annual Report	5.897.741	6.301.026
Total annual volume of water distributed	m3	Annual Report	5.897.741	5.002.605
Total annual volume of water consumed/sold	m3	Annual Report	3.450.816	4.043.757
Number of customers	#	Annual Report	30.158	35.806
Population served in '000	#	Annual Report/ interview	73	85
Population in '000	#	Census	86	89
UFW	%	Annual Report	24,20	17,43
Number of complaints in water services per year	#	Annual Report/ interview	5.875	6.000
Water quality tests performed	%	Annual Report/ interview	100	100
Water coverage	%	Annual Report/ interview	85,0	95,0
Hours of service per day for water supply	# hours a day	Annual Report/ interview	24	24
Number of days with insufficient water supply	# days	Annual Report/ interview	6,0	4,4
Average actual delay obtaining a water connection	# days	Annual Report/ interview	40	31

(table cont. next page)

Knowledge Base - SMSBVC in 1998 and 2004 (cont.)

	Unit	Source	1998	2004
Metering level	%	Annual Report/ interview	100	100
Sanitation services				
Percentage of wastewater receiving secondary treatment	%	Annual Report	47,0	90,5
Number of complaints in wastewater services per year year	#	Annual Report/ interview	952	1.000
Sewerage coverage	%	Annual Report	35,00	70,00
Personnel				
Total number of employees	#	Annual Report	250	249
FTE	#	Annual Report	201	212
Total number of employees in water services	#	Annual Report/ interview	63	59
Political appointees	%	Annual Report/ interview	100	100
Training - total number of hours per year	# hours	Annual Report	2.160	2.209
Total number of employee lost production days	# days	Annual Report	6.484	4.575
Employees with less or equal than mandatory education	#	Annual Report	214	204
Participation in capacity building programs	#	Annual Report/ interview	0,10	0,20

(table cont. next page)

Knowledge Base - SMSBVC in 1998 and 2004 (cont.)

	Unit	Source	1998	2004
Financial				
Tariif charged per m3 of water	EUR	Annual Report/ contracts	0,41	0,42
Total annual operational expenses/costs	EUR	Annual Report	3.068.892,53	4.493.514,74
Total annual operational revenues	EUR	Annual Report	3.586.533,51	6.373.440,97
Collection Period	months	Annual Report	1,78	0,72
Total annual debt service	EUR	Annual Report	1.356.783,96	1.388.456,31
Total annual current expenses	EUR	Annual Report	4.881.270,10	8.407.633,82
Investment	EUR	Annual Report	924.486,99	1.012.521,88
Total annual net fixed assets	EUR	Annual Report	7.208.172,06	10.498.441,35
Total annual labor costs	EUR	Annual Report	2.153.969,93	3.246.805,83
Losses due to crime/fraude	EUR	Annual Report	0,01	0,01
Management ratio				
Indebtness level	#	Annual Report	12,14	10,84
Doing Business				
GDP per capita	EUR	National Bank	12.511,6	14.114,5
Time spent in days dealing with requirements and regulations to complete a process	# days	World Bank doingbusiness.org	343,0	327
Processes needed for licensing and permits	#	World Bank doingbusiness.org	22	20

(table cont. next page)

Knowledge Base - SMSBVC in 1998 and 2004 (cont.)

	Unit	Source	1998	2004
International Indexes				
Rigidity of Employment Index (REI)	#	World Bank Doingbusiness.org	54	58
Corruption Perception Index (CPI)	#	Transparency International	6,5	6,3
Growth Competitiveness Index (GCI)	#	World Economic Forum	23	24
Index of Economic Freedom (IEF)	#	Heritage Foundation	2,40	2,38

APPENDIX B

KPI Benchmarking and transformation - SMSBVC in 1998 and 2004

	Objective KPI	Worse value	Best value	Viana 1998	TR Viana 1998	Viana 2004	TR Viana 2004
O1	**Technical expertise**						
1	Abstraction to distribution	250,00	0,00	0,00	1,00	100,73	0,60
2	Distribution to consumption	500,00	0,00	225,38	0,55	74,39	0,85
3	Wastewater treatment	0,00	100,00	47,00	0,47	90,50	0,91
O2	**Operating effectiveness**						
4	UFW	60,00	10,00	24,20	0,72	17,43	0,85
5	Water complaints	0,00	1,00	0,35	0,35	0,28	0,28
6	Sewerage complaints	5,00	0,00	2,64	0,47	2,78	0,44
7	Water Quality	99,00	100,00	100,00	1,00	100,00	1,00
O3	**Responsiveness to consumers**						
8	Water Coverage	80,00	100,00	85,00	0,25	95,00	0,75
9	Sewerage Coverage	40,00	100,00	35,00	0,08	70,00	0,50
10	Quality of Service	24,00	24,00	24,00	1,00	24,00	1,00
11	Failures	5,00	0,00	6,00	0,20	4,41	0,12
12	Connection	60,00	15,00	40,00	0,44	31,00	0,64
O4	**Economic efficiency (cost recovery)**						
13	Tariffs	0,03	0,02	0,024	0,26	0,022	0,67
14	Revenues	0,00	1,00	0,39	0,39	0,53	0,53
15	Collection Period	5,00	0,50	1,78	0,72	0,72	0,95
16	Working Ratio	1,50	0,20	0,86	0,50	0,71	0,61
17	Debt Service Ratio	50,00	10,00	37,83	0,30	21,79	0,71

(table cont. next page)

KPI Benchmarking and transformation - SMSBVC in 1998 and 2004 (cont.)

	Objective KPI	Worse value	Best value	Viana 1998	TR Viana 1998	Viana 2004	TR Viana 2004
O5	**Investment**						
18	Investments	5,00	20,00	18,94	0,93	12,04	0,47
19	Net Fixed Assets	50,00	500,00	239,01	0,42	293,20	0,54
20	Financial	100,00	0,00	12,14	0,88	10,84	0,89
O6	**Managerial expertise**						
21	Metering	75,00	100,00	100,00	1,00	100,00	1,00
22	Costs	2,00	0,80	0,89	0,93	1,11	0,74
23	Staffing	1,00	0,30	0,86	0,20	0,70	0,43
24	Labor Costs	59,00	29,00	70,19	0,37	72,26	0,44
25	Skills and education	90,00	60,00	85,60	0,15	81,93	0,27
26	Labor Regulations	100,00	0,00	54,00	0,46	58,00	0,42
27	Absenteeism	12,00	0,00	10,37	0,14	7,35	0,39
28	Training	0,00	20,00	10,75	0,54	10,42	0,52
O7	**Insulation from political intervention**						
29	Political appointees	100,00	0,00	100,00	0,00	100,00	0,00
30	Corruption	0,00	10,00	6,50	0,65	6,30	0,63
31	Regulation requirements	350,00	70,00	343,00	0,03	327,00	0,08
32	Licensing and permits	30,00	7,00	22,00	0,35	20,00	0,43
33	Competitiveness	104,00	1,00	23,00	0,79	24,00	0,78
34	Economic freedom	5,00	1,00	2,40	0,65	2,38	0,66
35	Crime	0,10	0,00	0,01	0,90	0,01	0,90
36	Capacity building	0,00	1,00	0,10	0,10	0,20	0,20

TR: Transformed Result (the closer to 1 the better)

APPENDIX C

Knowledge Base - Electra in Cape Verde in 1998 and 2003

	Unit	Source	1998	2003
Water services				
Total annual volume of water abstracted/produced	m3	Annual Report	1.785.998	4.049.930
Total annual volume of water distributed	m3	Annual Report	1.785.998	4.023.329
Total annual volume of water consumed/sold	m3	Annual Report	1.452.574	2.845.404
Number of customers	#	Annual Report	9.919	22.578
Population served in '000	#	Annual Report/ interview	242	370
Population in '000	#	Census	417	463
UFW	%	Annual Report	18,67	29,09
Number of complaints in water services per year	#	Annual Report/ interview	3.500	10.000
Water quality tests performed	%	Annual Report/ interview	40	80
Water coverage	%	Annual Report/ interview	58,0	80,0
Hours of service per day for water supply	# hours a day	Annual Report/ interview	2	4
Insufficient water supply	# days	Annual Report/ interview	78,0	39,2
Average actual delay obtaining a water connection	# days	Annual Report/ interview	30	18

(table cont. next page)

Knowledge Base - Electra in Cape Verde in 1998 and 2003 (cont.)

	Unit	Source	1998	2003
Metering level	%	Annual Report/ interview	12	40
Sanitation services				
Percentage of wastewater receiving secondary treatment	%	Annual Report	0,0	30,0
Number of complaints in wastewater services per year year	#	Annual Report/ interview	200	1.600
Sewerage coverage	%	Annual Report	8,00	37,50
Personnel				
Total number of employees	#	Annual Report	362	681
FTE	#	Annual Report	293	458
Total number of employees in water services	#	Annual Report/ interview	78	115
Political appointees	%	Annual Report/ interview	100	40
Training - total number of hours per year	#	Annual Report	1.972	193
Total number of employee lost production days	#	Annual Report	2.416	375
Employees with less or equal than mandatory education	#	Annual Report	275	568
Participation in capacity building programs	#	Annual Report/ interview	0,06	0,07

(table cont. next page)

Knowledge Base - Electra in Cape Verde in 1998 and 2003 (cont.)

	Unit	Source	1998	2003
Financial				
Tariif charged per m3 of water	EUR	Annual Report/ contracts	1,43	2,51
Total annual operational expenses/costs	EUR	Annual Report	3.326.325,15	11.017.049,94
Total annual operational revenues	EUR	Annual Report	2.162.981,17	7.555.847,06
Collection Period	#	Annual Report	6,09	4,70
Total annual debt service	EUR	Annual Report	15.362.661,25	74.500.798,17
Total annual current expenses	EUR	Annual Report	12.858.533,18	38.840.646,88
Investment	EUR	Annual Report	1.554.330,08	4.200.000,00
Total annual net fixed assets	EUR	Annual Report	25.893.207,23	42.000.000,00
Total annual labor costs	EUR	Annual Report	2.637.575,74	5.886.396,62
Losses due to crime/fraude	EUR	Annual Report	0,05	0,03
Management ratio				
Indebtness level	#	Annual Report	73,74	72,39
Doing Business				
GDP per capita	EUR	National Bank	1.028,4	1.316,3
Time spent in days dealing with requirements and regulations to complete a process	#	World Bank doingbusiness.org	251,5	250
Processes needed for licensing and permits	#	World Bank doingbusiness	20	20

(table cont. next page)

Knowledge Base - Electra in Cape Verde in 1998 and 2003 (cont.)

	Unit	Source	1998	2003
International Indexes				
Rigidity of Employment Index (REI)	#	World Bank doingbusiness	54	53
Corruption Perception Index (CPI)	#	Transparency International	2,8	3,2
Growth Competitiveness Index (GCI)	#	World Economic Forum	80	75
Index of Economic Freedom (IEF)	#	Heritage Foundation	3,69	3,30

APPENDIX D

KPI Benchmarking and transformation - Electra (Cape Verde) in 1998 and 2003

	Objective KPI	Worse value	Best value	CV 1998	TR CV 1998	CV 2003	TR CV 2003
O1	**Technical expertise**						
1	Abstraction to distribution	250,00	0,00	0,00	1,00	3,27	0,99
2	Distribution to consumption	500,00	0,00	93,37	0,81	144,92	0,71
3	Wastewater treatment	0,00	60,00	0,00	0,00	30,00	0,50
O2	**Operating effectiveness**						
4	UFW	60,00	10,00	18,67	0,83	30,00	0,60
5	Water complaints	0,00	1,00	0,12	0,12	0,24	0,24
6	Sewerage complaints	5,00	0,00	0,56	0,89	4,44	0,11
7	Water Quality	50,00	100,00	40,00	0,20	80,00	0,60
O3	**Responsiveness to consumers**						
8	Water Coverage	50,00	100,00	58,00	0,16	80,00	0,60
9	Sewerage Coverage	0,00	70,00	8,00	0,11	37,50	0,54
10	Quality of Service	2,00	24,00	2,00	0,00	4,00	0,09
11	Failures	80,00	5,00	78,00	0,03	39,24	0,54
12	Connection	60,00	15,00	30,00	0,67	18,27	0,93
O4	**Economic efficiency (cost recovery)**						
13	Tariffs	1,50	1,00	1,004	0,99	1,374	0,25
14	Revenues	1,00	2,00	0,87	0,13	1,55	0,55
15	Collection Period	5,00	0,50	6,09	0,24	4,70	0,07
16	Working Ratio	1,50	0,20	1,54	0,03	1,46	0,03

(table cont. next page)

KPI Benchmarking and transformation - Electra (Cape Verde) in 1998 and 2003 (cont.)

	Objective KPI	Worse value	Best value	CV 1998	TR CV 1998	CV 2003	TR CV 2003
17	Debt Service Ratio	1000	500	710,25	0,58	986,00	0,03
O5	**Investment**						
18	Investments	5,00	20,00	12,09	0,47	10,81	0,39
19	Net Fixed Assets	2000	3000	2610	0,61	1860	0,14
20	Financial	100,00	0,00	73,74	0,26	72,39	0,28
O6	**Managerial expertise**						
21	Metering	10,00	80,00	12,00	0,03	40,00	0,43
22	Costs	5,00	2,00	2,29	0,90	3,87	0,38
23	Staffing	1,00	0,30	0,32	0,97	0,31	0,99
24	Labor Costs	80,00	50,00	79,29	0,02	53,43	0,89
25	Skills and education	90,00	60,00	75,97	0,47	83,41	0,22
26	Labor Regulations	100,00	0,00	54,00	0,46	53,10	0,47
27	Absenteeism	12,00	0,00	2,67	0,78	0,22	0,98
28	Training	0,00	20,00	6,73	0,34	0,42	0,02
O7	**Insulation from political intervention**						
29	Political appointees	100,00	0,00	12,00	0,88	40,00	0,60
30	Corruption	0,00	10,00	2,80	0,28	3,20	0,32
31	Regulation requirements	350,00	70,00	251,50	0,35	250,00	0,36
32	Licensing and permits	30,00	7,00	20,00	0,43	20,00	0,43
33	Competitiveness	104,00	1,00	80,00	0,23	75,00	0,28
34	Economic freedom	5,00	1,00	3,69	0,33	3,30	0,43
35	Crime	0,10	0,00	0,05	0,50	0,03	0,72
36	Capacity building	0,00	1,00	0,06	0,06	0,07	0,07

TR: Transformed Result (the closer to 1 the better)

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