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To cite this article: Lucía Wright-Contreras, Julie Perkins, Maria Pascual & Gerard Soppe (2020) Water operators' partnerships and their supporting role in the improvement of urban water supply in Da Nang, International Journal of Water Resources Development, 36:1, 1-26, DOI: [10.1080/07900627.2019.1625753](https://doi.org/10.1080/07900627.2019.1625753)

To link to this article: <https://doi.org/10.1080/07900627.2019.1625753>



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Water operators' partnerships and their supporting role in the improvement of urban water supply in Da Nang

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ABSTRACT

This work analyzes the main outcomes and success factors of the water operators' partnership (WOP) between the Dutch water operators' organization, VEI (formerly Vitens Evides International), and the Vietnamese water utility, Da Nang Water Supply Joint Stock Company (Dawaco), which took place from 2007 to 2010. The partnership is considered within broader international and regional funding programmes, including parallel national and regional WOPs. The article presents WOPs as key processes in larger operations of water infrastructure development and considers WOPs as relevant strategies that contribute to the improvement of urban water services at a global scale.

ARTICLE HISTORY


Received 8 October 2018
Accepted 26 May 2019


KEYWORDS

water operators' partnership; capacity development; utility performance; sustainable development goals; Da Nang

Introduction

In 2000, the United Nations member states signed the Millennium Declaration, which included Millennium Development Goal 7, Target 7C, to 'halve the proportion of the population without sustainable access to safe drinking water and basic sanitation by 2015' (UNICEF, WHO, 2015). After several milestones acknowledging water as a human right, including General Comment 15 (2003), the UN General Assembly adopted Resolution A/RES/64/292 (2010) on the human right to water and sanitation. Now, the post-2015 development agenda, also known as the New Urban Agenda, titled 'Transforming Our World: The 2030 Agenda for Sustainable Development' (United Nations, 2015) lists 17 Sustainable Development Goals (SDGs, or Global Goals) addressing poverty, hunger, inequality, economic growth and infrastructure development, climate change, desertification and land degradation, and loss of biodiversity, as well as diverse pathways to achieve health and well-being, quality education, clean water and sanitation, affordable and clean energy, resilient and sustainable cities, peace, justice, and inclusiveness. SDG 6 specifically seeks to 'ensure the availability and sustainable management of water and sanitation for all' (United Nations, 2017). The complex issues addressed by the SDGs and SDG 6 call for full support from formal and informal institutions across the globe to reduce (if not to eliminate) these problems (Tortajada & Biswas, 2015).

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 Supplemental data for this paper can be accessed at <https://doi.org/10.1080/07900627.2019.1625753>

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Globally, 2.7 billion people suffer from water shortages for at least one month per year (WEF, 2016), and almost 10% of the world's population risk their health because they lack access to clean drinking water (Water Health, 2017). An important shift in the last half century has been to focus on the management of water, rather than just on the physical assets themselves (Hendry, 2015). Based on the observation that 'publicly owned and managed water operators currently provide more than 90% of the world's piped water, and [that] even small managerial improvements could yield major benefits' (UNSGAB, 2006, p. 1), in 2009, the United Nations established the Global Water Operators' Partnerships Alliance (GWOPA) to support not-for-profit, peer-support partnerships between utilities. The objective of the alliance includes raising the capacity and, ultimately, the performance of local water and sanitation service providers around the world.

More than 310 of these water operators' partnerships (WOPs) have been recorded by GWOPA, and over 20 in-depth case studies and factsheets have been produced (GWOPA/UN-Habitat, 2019). GWOPA promotes and guides WOPs' practices on all continents with the support of water utility associations and WOP platforms at national and regional levels (Bjerggaard, 2009; IWA, GWOPA, VEI, 2009). WOPs are supported by a variety of financial institutions (bilateral and multilateral donors and development banks) such as the Asian Development Bank (ADB), the Inter-American Development Bank, the US Agency for International Development (USAID), and the African Development Bank. In Asia and the Pacific, ADB started implementing WOPs in 2007, and has now 77 completed and ongoing partnerships (ADB, 2017; updated number of WOPs provided by C. Moster, personal communication, November 28, 2018). In 2008, ADB signed an agreement with USAID and IWA during the Stockholm World Water Week and established a network called WaterLinks, a non-profit organization aimed at supporting and facilitating WOPs through regional capacity-building programmes and knowledge dissemination (IWA, GWOPA, VEI, 2009; WaterLinks, 2018).

WOPs are defined in the 2006 Hashimoto Action plan as 'cooperation between water operators ... for providing support for capacity building of public water operators', with the objective to 'strengthen local water services ... while ensuring that WOPs are recognized as important means of achieving internationally agreed targets' (UNSGAB, 2006, p. 3). An important understanding is that partnerships are focused on strengthening capacity, not substituting it (i.e. 'institutional transplantation' in Breeveld, Hermans, Veenstra, 2013).

Since its establishment in 2004, VEI (formerly Vitens Evides International), owned by two of the largest, publicly owned water companies in the Netherlands, is considered the world's leading non-profit promoter and implementer of WOPs (VEI, 2017). VEI's work is encouraged by Dutch national policies, given that the Netherlands recognized safe drinking water and sanitation as a basic human right (in 2008) and resolved that '1% of the annual turnover of Dutch water companies can be used for projects in developing countries' (IRC, 2014, p. 2; Ministry of Foreign Affairs of the Netherlands, 2012, p. 43). VEI now shares the expertise of six Dutch water operators (Vitens, Evides, WML, Waterbedrijf Groningen, Brabant Water and Water Laboratorium Noord) in over 20 countries worldwide, and provides over 300,000 people with improved access to water services in Africa, Asia and Latin America by building the capacity of water utilities in each of these regions (VEI, 2018a).

Through a new collaboration with the Ministry of Foreign Affairs of the Netherlands, and all Dutch water operators (from largest to smallest in terms of population served, these are Vitens, Brabant Water, Evides, PWN, Dunea, WML, Waternet, Oasen, Groningen, and WMD; see Vewin, 2017), VEI has launched a new programme called WaterWorX, aimed at increasing sustainable access to water for 10 million people, facilitating loans for large-scale investments in water infrastructure to over two dozen local partner companies in three continents between 2017 and 2030 (Dutch Water Sector, 2017; VEI, 2018b). According to Adriaan Mels (2018), regional director at VEI, 'WaterWorX will mobilize up to USD 500 million in investments from the private sector for infrastructure expansion, rehabilitation, and improvements in the sector.' Prior to this initiative, a foundation called Water for Life has reached 1.1 million people (through the installation of water pipes, taps, toilets and training related to hygiene) by connecting donations from consumers and non-consumers to invest in VEI's projects and strengthen the resources of the Dutch operators' staff who travel to the recipient operator ('short-termers') (Evides Waterbedrijf, 2018; VEI, 2017; Water for Life, 2018).

A criterion for the start of a WOP is that the recipient water utility clearly expresses the need for a partnership. Depending on their duration, WOPs can be classified into simple partnerships (up to 12 months of formal or informal exchanges between utilities) and structured partnerships (including specific partnerships, up to 12 months); comprehensive partnerships, up to 48 months; and long-term, special-purpose partnerships (IWA, GWOPA, VEI, 2009; see Figure 1). An updated review in 2019 of the recorded duration of WOPs in GWOPA's database showed that 24.2% have lasted up to 12 months, 45.5% between 12 and 36 months, 23.7% between 36 and 48 months, and 6.6% are long-term partnerships of between 4 and 13 years.

Because WOPs are not-for-profit partnerships, there is not an explicit need for financial transfers except where there is a support from a donor to the recipient or to the mentoring operator, or both, in the case of multiple-source funding (cf. IWA, GWOPA, VEI, 2009; see Figure 2). Although nearly two-thirds of the records registered by GWOPA do not have information on funding, from the available data, 7.5% have reported costs under USD 25,000, 14.2% between USD 25,001 and 50,000, 20.1% between USD 50,001 and 100,000, 21.6% between USD 100,001 and 1 million, 32.1% from USD 1 to 10 million, and 4.5% from USD 10 million to over 1 billion. ADB, for example, focuses on WOPs in the third range, between USD 50,001 and 100,000 (interview, ADB, 2018).

The academic literature on WOPs amounts to about 20 documents, a dozen of which are listed in Scopus^(*) and less than half of which are both listed in Scopus and have been peer-reviewed^(**) (*Batten, 2010; **Beck, 2018; Bélanger Dumontier, McDonald, Spronk, Baron, & Wartchow, 2016; *Bishop & Kong, 2010; Bjerggaard, 2009; **Boag & McDonald, 2010; **Breeveld et al., 2013; **Gallego-Ayala, Dimene, Munhequete, & Amos, 2014; **Giesemann, Roche, Austin, & Moulton, 2009; Hall et al., 2009; IWA, GWOPA, & VEI, 2009; Mvulirwenande, Wehn, & Alaerts, 2014; **Ndirangu, Ng'ang'a, Chege, de Blois, & Mels, 2013; Pascual-Sanz, 2014; **Pascual-Sanz, Veenstra, Wehn de Montalvo, van Tulder, & Alaerts, 2013; *Patrón-Coppel & Schwartz, 2011; Rusca & Schwartz, 2012; Terhorst, 2012; *Tobon & Yates, 2014; **Tutusaus & Schwartz, 2016; **Wehn & Montalvo, 2016). Accompanying terms used to refer to capacity development support between water utilities include 'capacity development partnerships' (Pascual-Sanz, 2014; Pascual-Sanz et al., 2013), 'knowledge and capacity

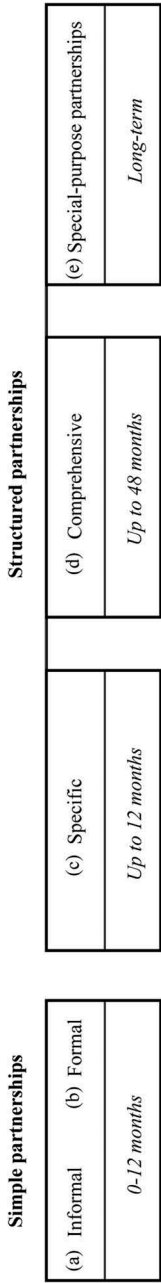


Figure 1. Classification of WOPs by duration. Adapted from IWA, GWOPA, VEI (2009, p. 9).

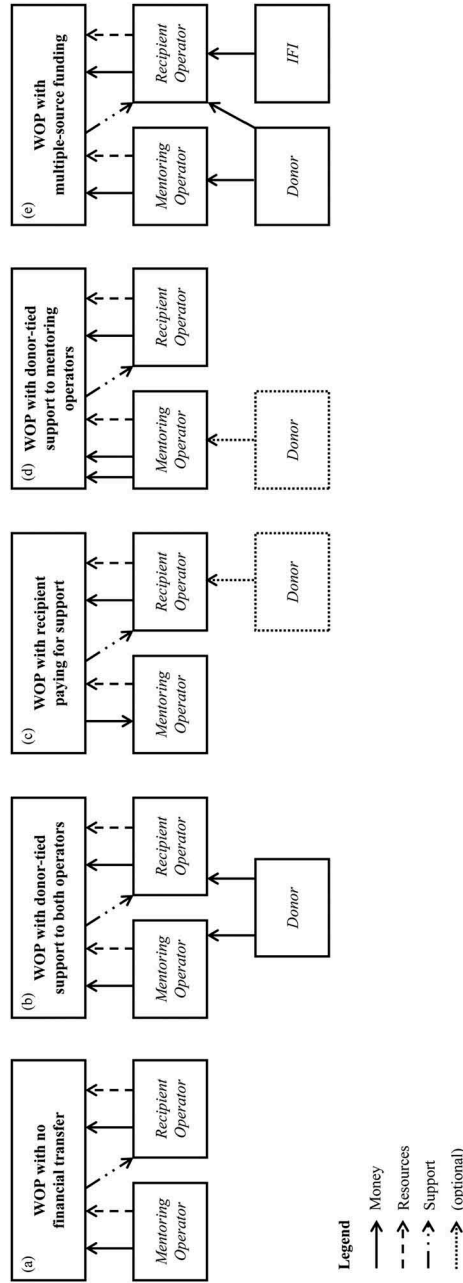


Figure 2. Types of WOPs according to financial flows. Note: IFI = international financial institutions. Adapted from IWA, GWOPA, VEI (2009, p. 8).

development interventions' (Mvulirwenande et al., 2014), 'twinning arrangements' (Bjerggaard, 2009; IWA, GWOPA, & VEI, 2009; Tobon & Yates, 2014), and 'public-public twinning projects' (Rusca & Schwartz, 2012).

The literature has raised critical points regarding the measurability of the effectiveness of WOPs (Breeveld et al., 2013; Gallego-Ayala et al., 2014; Pascual-Sanz & Hoffer, 2009) and the value of knowledge transfer through interaction with external actors (Breeveld et al., 2013; Mvulirwenande et al., 2014; Pascual-Sanz et al., 2013; Wehn & Montalvo, 2016). The present research aims to inform each of these topics and to explore how WOPs work parallel to other forms of technical assistance and financial support from various institutions.

Because VEI is the most active organization promoting North–South development cooperation, this research will zoom in on a WOP with the Vietnamese water utility, Da Nang Water Supply Joint Stock Company (Dawaco). The main question guiding this research is: What were the conditions which supported the long-term improvement of water supply services in Da Nang? The objective is to understand the role of the VEI–Dawaco WOP in the local water utility's performance improvements and its relation to other external forms of assistance.

In the next section, the case study and methods used to assess the changes implemented during the VEI–Dawaco WOP will be explained. The section 'Water Sector Characteristics and Developments in Da Nang' will walk the reader through the city-level developments regarding urban water supply. The details of how the partnership between VEI and Dawaco was initiated, its objectives and its total cost will be described in the section 'Establishment of the VEI–Dawaco WOP'. The following sections build on a multi-layered results framework which lists the organizational changes implemented during the partnership, the changes in performance, and the continuity of results until 2017 (Table A1, in the online supplemental data at <https://doi.org/10.1080/07900627.2019.1625753>). In the section 'Changes Implemented during the VEI–Dawaco WOP from 2007 to 2010', an analysis of activities supporting the partnership's objectives will be described. The section 'Standard Key Performance Indicators from 1996 to 2017' will discuss the water utility's improvements over a longer period of time. Then, 'Dawaco's Operational Capacity and Financial Sustainability vis-à-vis Other Factors' will debate to what extent the improvements can be attributed to the WOP in light of parallel activities and the mobility of resources from other organizations. And finally, the 'Discussion' and 'Conclusion' will summarize the main lessons of the case study and highlight the factors which may have contributed to the success of this particular WOP and its supporting role in the extension and improvement of urban water supply services.

Methodology

This article studies the activities which influenced changes in the capacity of Dawaco between 2007 and 2010, in the frame of the partnership between VEI and Dawaco, in Da Nang, Vietnam. The main study of the VEI–Dawaco WOP took place through Agreement of Cooperation number GC/17/026 between the Technical University of Darmstadt and GWOPA from August 2017 to August 2018 (cf. Wright-Contreras, 2018). The case was suggested by the World Bank to GWOPA because of its financial results and sustainability, offering insight on the opportunities of scaling up the WOP approach. In

addition, active communication with experts familiar with the VEI–Dawaco WOP and the possibility of accessing information prior and posterior to the cooperation facilitated the discussion on whether the WOP contributed to Dawaco’s improvements. Understanding the changes in Dawaco’s performance between 1996 to 2017 was crucial to assess the company’s progress with respect to the partnership and the development of parallel agreements.

To begin with, information was obtained through a review of secondary data, including the partnership’s Memorandum of Understanding, policy paper, strategic plan, inception report, and end project report (Dawaco, 2007; Dawaco, VEI, RNE, PC Da Nang, 2008b; Soppe, 2008a, 2008b, 2011). Field work between 4 and 10 August 2017, in Da Nang, and a remote follow-up in November 2018, enabled the collection of primary data through semi-structured interviews of key informants. Of the nine interviewees, seven were in contact with the activities of the VEI–Dawaco WOP when the partnership took place, including former VEI–Dawaco WOP resident project manager, Dawaco’s current general director, Dawaco’s general director at the time of the WOP (now chairman of management board), head of the Strategic Planning Department, head of the Technical Department, chief accountant, and former ADB senior urban development specialist and team leader for the Da Nang Water Supply Project. We also interviewed Dawaco’s current general director and the current lead facilitator for ADB WOPs.

Following the Boosting Effectiveness in Water Operators’ Partnerships analytical framework developed by GWOPA and UNESCO-IHE to analyze over a dozen case studies (cf. GWOPA/UN-Habitat, 2015), circa 100 questions were directed to Dawaco’s key informants to understand the scope of the partnership, the partnership creation, the project implementation, the evidence of progress towards the impact and effectiveness of the project, and the evaluation of the WOP. The interviews served to validate the information contained in the reports, and to better understand the influence of WOP activities in the changes detected in capacity and performance. Moreover, they illuminated topics related to Da Nang’s context (political, socio-economic, cultural and environmental); first contact and enabling conditions for the collaboration between VEI and Dawaco; motivation of the partners and facilitators to fund the WOP; development and management of the partnership; inter-organizational dynamics; objectives of the partnership; and the evidence of progress towards the impact and effectiveness of the collaboration. Staff members of Dawaco’s Planning Department, Control Centre and Network Management, and Project Management Unit also provided information and followed up with the research process until the end of 2018, providing up-to-date data on the company’s ongoing programmes and performance indicators (including the number of water supply connections, percentages of increased coverage, water quality results, non-revenue water reduction, and the company’s development towards full cost recovery). Lastly, the interviews with ADB’s key informants facilitated understanding of the large-scale investments and policy changes which have occurred in Vietnam over the last two decades.

Water sector characteristics and developments in Da Nang

Da Nang is on the southern-central coast of Vietnam. The city is one of five provinces of the Central Vietnam Key Economic Region. In Decision No. 148/2004/QĐ-TTg, the prime

minister shared the major orientations for socio-economic development of this region, expected to increase its annual GDP growth rate by 1.25 times the national average and contribute 6.5% of the national GDP by 2020 (SRV, 2004). Despite economic growth and the aim to reduce unemployment and the percentage of poor households, in Da Nang's population of just over 1 million inhabitants, poor households still account for over 70% of the housing situation (Quang, 2016).

Da Nang's formal water supply system was developed between 1945 and 1950, drawing water from wells through small piping systems (Dawaco, 2017). The city built its first surface water treatment plant in 1965 and has continuously expanded its water supply network by building new water treatment plants and increasing their capacity (Dawaco, 2017). Da Nang has four water treatment plants: Cầu Đỏ (built in 1965), Sân Bay (1974), Sơn Trà (more accurately, a water treatment station with three catchment points, built in 1985), and An Trạch (2008) (Dawaco, 2017). Most of the water is extracted from the Cầu Đỏ River, and a small percentage from the Lượng Stream and Sơn Trà Mountain (interview, Dawaco, 2017). Two new water treatment plants are planned: Hòa Trung (estimated completion in 2019) and Hoà Liên (estimated completion 2020) (N. H. T. Ngo, personal communication, March 2, 2018).

In 2004, Dawaco was formally established under Decision No. 01/2004/QĐ-CTCN (Dawaco, 2017). In 2010, the company became a limited liability company with the People's Committee of Da Nang (PC Da Nang) as sole shareholder, and in 2016, it became a joint stock company owned in majority by PC Da Nang (60%), Da Nang Miền Trung Joint Stock Company (*Cty cổ phần đầu tư xây dựng, Đà Nẵng Miền Trung*, 35%), and Dawaco staff (5%) (interview, Dawaco, 2017). As a public interest company



Figure 3. Dawaco's water supply distribution network. Source: Dawaco, Da Nang, Vietnam, 2017.

and joint stock company, Dawaco abides by the Investment Law No. 67/2014/QH13, Enterprise Law No. 68/2014/QH13, Law on Securities and the Stock Market No. 70/2006/QH11, Environmental Protection Law No. 55/2014/QH13, and decrees and decisions related to water, urban water supply and the prevention of loss of clean water, especially Decree No. 117/2007/ND-CP and Decree No. 124/2011/ND-CP on production, supply and consumption of clean water (interview, Dawaco, 2017).

Da Nang's development and management of water infrastructures has been supported by foreign capital and foreign expertise, such as the assistance from the French government in 2002 to renovate the Cầu Đỏ water treatment plant (Dawaco, 2017). Technical assistance has also been facilitated by organizations such as the ADB, the Japanese International Cooperation Agency (JICA) and the World Bank. From 2008, the ADB worked on the preparation of the Da Nang Water Supply Project, including the initial assessment and pre-feasibility study of water resources for future development; the feasibility study and basic design for new water infrastructure projects (with focus also on water service provision for peri-urban areas); the extension of existing water distribution networks (Figure 3); and an institutional development programme to review the organizational structures, regulations and policies of the water sector in Da Nang (ADB, 2008a). This particular project (ID 41,456–012: TA 7144-VIE) was valued at USD 2.45 million and took place between November 2008 and October 2009, financed by a grant from the Multi-Donor Trust Fund (with contributions of the governments of Australia, Austria and Norway) together with in-kind contributions from the Vietnamese government (ADB, 2008a, 2008b).

The implementation of the Da Nang Water Supply Project (ID 41,456–033: Loan 2961-VIE) started in January 2013 and is expected to be completed in December 2019 (ADB, 2012a). The project is part of the second tranche of ADB's Periodic Finance Request Water Sector Investment Program, worth USD 212 million, USD 30 million of which have been allocated to the city of Da Nang for the expansion and rehabilitation of the distribution network; the implementation of an institutional strengthening programme; and the implementation of an operational management contract to improve and upgrade maintenance and operational procedures (ADB, 2012a, 2012b; 2013a). This financing is part of a larger fund of USD 1 billion from the Multitranches Financing Facility approved in February 2011 by the ADB Board of Directors for operational improvements of urban water supply in Vietnam between 2011 and 2020 (ADB, 2012a).

Furthermore, technical assistance facilitated by ADB through the Capacity Development Technical Assistance project (ID 44,002–022: TA 8357-VIE) was made possible through a grant from the Netherlands Trust Fund under the Water Financing Partnership Facility administered by ADB (ADB, 2013b). From May 2013 to December 2014, the project worked with selected water companies on improving performance and accountability, reducing non-revenue water, and supporting monitoring and evaluation mechanisms for water supply services (ADB, 2013c).

With a broader focus on sanitation issues, JICA is currently supporting Da Nang with the Da Nang City Water Environment Improvement Project (JICA, 2018). The project started in April 2013 as an international technical cooperation between Yokohama City and Da Nang for sustainable urban development, with the objective of providing technical advice to Da Nang on becoming an environmentally friendly city, increasing

its capacity to treat wastewater and assisting Dawaco in building new water supply networks (JICA, Kajima Corporation, Hitachi, Ltd., Yokohama Water Company, Original Engineering Consultants Co., Ltd., Global Water Recycling and Reuse System Association, 2016). Within this project, the Da Nang City Hòa Liên Water Supply Project builds on ADB's preparatory study, carried out by Black and Veatch (2010), for project ID 414,456–033 and proposes the construction of a new water treatment plant with an investment of JPY 1.8 billion (USD 16 million, equivalent to 30% of the total cost) and a loan amount of JPY 4.2 billion (USD 37 million, 70%) (Kajima Corporation, Hitachi, Ltd., Yokohama Water Company, Original Engineering Consultants Co., Ltd., Global Water Recycling and Reuse System Association, 2012).

Another project which has influenced the water and sanitation sectors is the Da Nang Sustainable City Development Project (ID P123384) of the World Bank, approved on 26 April 2013 and concluded on 30 June, 2019; consisting of a USD 272.2 million country loan to achieve development objectives which include urban infrastructure, service delivery and water resource management plans (World Bank, 2017).

Establishment of the VEI–Dawaco WOP

The VEI–Dawaco WOP is essentially a comprehensive, (medium-term) structured partnership financed by multiple sources (Figures 1(d), 2(e)), with activities linked to additional funding available for investment in infrastructure through international financial institutions (cf. IWA, GWOPA, VEI, 2009). Initially, the contact between VEI and Dawaco was triggered by a funding opportunity through the Royal Netherlands Embassy (RNE) in Hanoi. A timely factor facilitating the start of the partnership was the good communication and relationship between Dawaco's management level and the chairman of PC Da Nang, who supported the cooperation with VEI (interview, Dawaco, 2017). The support from PC Da Nang and the willingness of Dawaco's managerial staff were both important for starting the WOP.

Facilitated by RNE and PC Da Nang, the WOP between VEI and Dawaco took place from October 2007 to December 2010 (Dawaco, VEI, RNE, PC Da Nang, 2007). VEI aimed to contribute to Target 7C of the Millennium Development Goals, while cultivating the interest of the workforce supporting VEI's mission. RNE and PC Da Nang, in turn, supported the WOP with the aim of delivering water to the poor (Dawaco, VEI, RNE, PC Da Nang, 2007). The main objectives of the VEI–Dawaco WOP were to extend and improve water services in Da Nang, to increase management autonomy and strengthen Dawaco's financial position, and to deliver water services to the urban poor in a sustainable manner (Soppe, 2011).

Table 1. Breakdown of costs from Directorate-General for International Cooperation funds.

| Breakdown of costs | Budget | Percentage | 2007 | 2008 | 2009 | 2010 | Remaining |
|--------------------|------------------|-------------|--------|---------|---------|---------|---------------|
| Human resources | 889,660 | 47% | 83,641 | 285,343 | 348,440 | 304,065 | –131,829 |
| Investments | 625,000 | 33% | 0 | 64,282 | 268,942 | 271,794 | 19,982 |
| Operational costs | 179,920 | 9% | 11,039 | 52,512 | 30,222 | 39,760 | 46,388 |
| Training | 185,000 | 10% | 0 | 1,817 | 64,634 | 41,292 | 60,904 |
| Technical audit | 18,000 | 1% | 0 | 0 | 0 | 0 | 18,000 |
| Total | 1,897,580 | 100% | | | | | 13,445 |

Source: Soppe (2011).

On 19 October 2007, VEI, Dawaco, RNE and PC Da Nang signed a memorandum of understanding (Dawaco, VEI, RNE, PC Da Nang, 2007), which was followed by a baseline survey and the development of a strategic work plan for 2008 (Soppe, 2008b). The WOP facilitators and partners made the following contributions. RNE provided USD 1.9 million on behalf of the Directorate-General for International Cooperation of the Netherlands Ministry of Foreign Affairs; PC Da Nang acted as a third party to approve policies and regulations; VEI provided USD 550,000; and Dawaco contributed with USD 282,500 in kind, for a total cost of approximately USD 2.7 million (Soppe, 2011). Dawaco also invested USD 500,000 in the expansion and improvement of the pipe network, contributing to the objectives of the WOP in the same time frame (Soppe, 2011).

The breakdown of the costs from the Directorate-General for International Cooperation shows that the majority of the funds were allocated to human resources (47%); a third of the budget was used for investments in equipment and software (33%); and the remaining budget was assigned to operational costs (9%), training costs (10%), and technical audit costs (1%) (Table 1).

Changes implemented during the VEI–Dawaco WOP from 2007 to 2010

The activities implemented during the VEI–Dawaco WOP supported all three objectives of the partnership: improving water service provision; increasing the company’s management autonomy and strengthening its financial position; and delivering water services to the urban poor. The following subsections list the changes which contributed to each of the

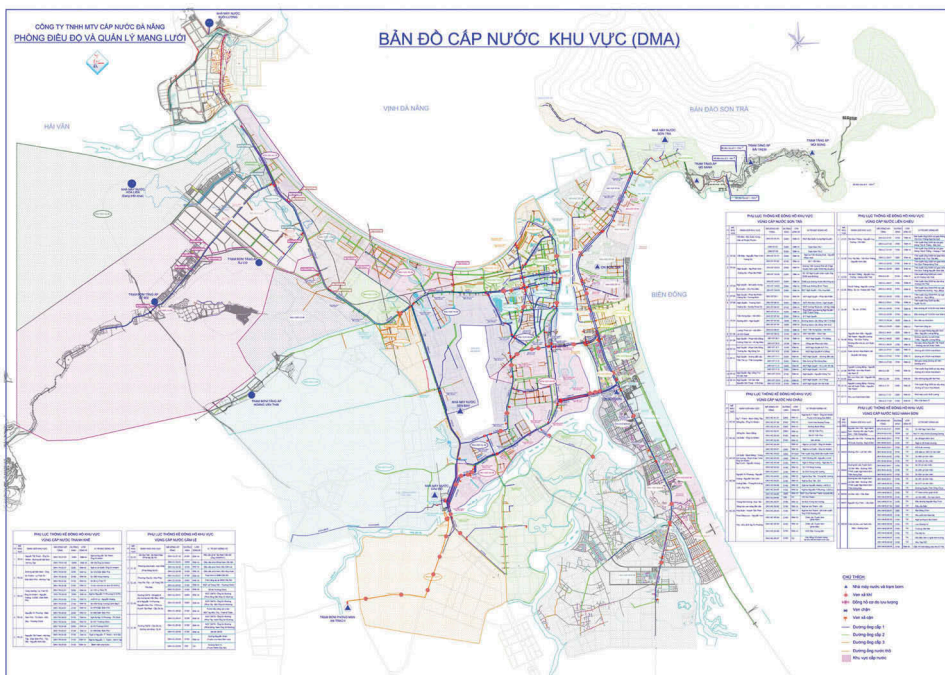


Figure 4. District metering areas. Source: Dawaco, Da Nang, Vietnam, 2017.

WOP's objectives. The multilayered results framework (see Table A1 in the online supplemental data) shows how each of the activities influenced the key performance indicators (KPIs) which are used to evaluate the continuity of results in the next section.

Objective 1: extend and improve water services in Da Nang

Activities related to connectivity and improved coverage (both in the network as a whole and in the areas where poor households are located) included the creation of a Central Control Unit and installation of metering equipment in the network; a study and plan concerning raw water protection and water resources management (as part of ADB's Project ID 41,456; ADB, 2008a); flushing activities for the production of more reliable water; inclusion of a Water Asset Management System to incorporate all data from the network into one system (VidaGIS, 2018); and implementation of a caretaker model.

Although there are often references to the 'caretaker approach' in rural and small-scale, community-managed water supply systems (e.g. Barrington, Fuller, & McMillan, 2013; Greaves & Simmons, 2015; Mahmud et al., 2007; Watsisi, 2017; Whittington et al., 2009), the caretaker model referred to in this case is based on a number of sub-areas (also called district metering areas, see Figure 4) monitored by an assigned team of workers to detect water loss from the pipe network system (cf. McIntosh, 2003). The purpose of the caretaker model is to detect leaks from the network more efficiently and repair them. Da Nang was the first to implement this model for water network management in Vietnam (Soppe, 2011). According to the chairman of Dawaco's Management Board, 'Before [in Dawaco] there was a group of people who took care of all the network. But the caretaker model created a small group to take care of small areas so that they knew everything about the customers, about the network.'

Objective 2: increase management autonomy and strengthen Dawaco's financial position

Dawaco's financial position was strengthened through the implementation of a new financial system and a tariff proposal (Table 2) to achieve full cost recovery and prepare the company to receive larger investments through other organizations. Decree No. 117/2007/ND-CP and its amendments (in Decree No. 124/2011/ND-CP) require water supply companies to operate on full cost recovery, which in essence 'aims to cover the operation and maintenance cost and the higher depreciation or debt service' (ADB, 2012a, p. 1). The amendment and supplement to Clause 1, Article 51 states: 'The price of clean water must be properly calculated, fully covering

Table 2. Dawaco's water tariff structure (VND).

| Groups | Purpose of use | 1992 | 1996 | 1999 | 2002 | 2005 | 2011 | 2014 |
|--------|---------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1 | Households | 500 | 500 | 1,200 | 1,486 | 2,343 | | |
| | Zero to 10 m ³ | | | | | | 3,524 | 3,810 |
| | 11m ³ to 30 m ³ | | | | | | 4,190 | 4,571 |
| | Over 30 m ³ | | | | | | 5,143 | 5,714 |
| 2 | Administration | 1,000 | 1,500 | 1,962 | 2,343 | 3,045 | 5,810 | 6,476 |
| 3 | Industry | 1,000 | 2,000 | 3,010 | 3,486 | 3,867 | 7,714 | 8,476 |
| 4 | Business and service | 2,000 | 3,000 | 4,152 | 4,629 | 5,295 | 11,619 | 12,857 |
| | <i>Effective from</i> | July 1992 | Aug. 1996 | Aug. 1999 | Jan. 2002 | Jan. 2005 | Jan. 2011 | Feb. 2014 |

Source: Received from Dawaco. Da Nang, Vietnam, 2017.

reasonable expenses arising in clean water production and distribution (including also expenses to maintain connection) so as to guarantee the rights and lawful interests of water suppliers and users' (SRV, 2011).

At the time of the VEI–Dawaco WOP, Dawaco was a department of the municipality under direct control of the Department of Construction and, in 2010, it became a limited liability company. In 2016, it transformed into a joint stock company, and according to the former resident project manager of the VEI–Dawaco WOP, 'Moving from a department to a limited liability company was the most important step as the company became more autonomous and could take decisions independently, although there was still control of the PC [Da Nang] over budgets and investments.'

Objective 3: deliver water services to the urban poor in a sustainable manner

The implementation of a tariff structure to benefit the urban poor (Table 2) and the link to the Water for Life foundation helped locate the poorest households in Da Nang and subsidize household connections (Soppe, 2011). The former VEI–Dawaco WOP resident project manager explained: 'The poor are really the ones that deserve the connections. But the near-poor are not always able to afford the connection. To be able to take the near-poor into consideration, we chose the wards which had 80% near-poor. This way we would connect everybody.'

Key performance indicators from 1996 to 2017

An effort was made to obtain information regarding each of the KPIs for the period between 1996 and 2017. This section takes a close look at the changes in the data on connections, service coverage, water quality, non-revenue water reduction and cost recovery. Data for the number of connections exists between 1996 and 2017; data for coverage is documented from 1999 to 2017; evidence of water quality tests is available for 2006 to 2015; and financial information regarding Dawaco's equity, operating profit, and profit after tax is provided from 1996 to 2017. The most evident improvements will be discussed starting with the results achieved in the frame of the VEI–Dawaco WOP between 2007 and 2010.

Number of connections

From 2007 to 2010, a total of 48,933 new connections were achieved. The VEI–Dawaco WOP target of connecting 16,000 households per year was surpassed by 2%, with the equivalent of 16,311 connections per year (Soppe, 2011). At the same time, 7856 household connections for the poor were made, surpassing the target of 2000 by nearly 400%, with an average of 2618 connections per year (Soppe, 2011). The peak in percentage change occurred in 2011, the year after the WOP ended, with an increase of 22% and a total of 185,185 connections; and the percentage of increase stayed between 5% and 9% until 2017, reaching 267,623 connections, equivalent to a population of 992,049 (Figure 5).

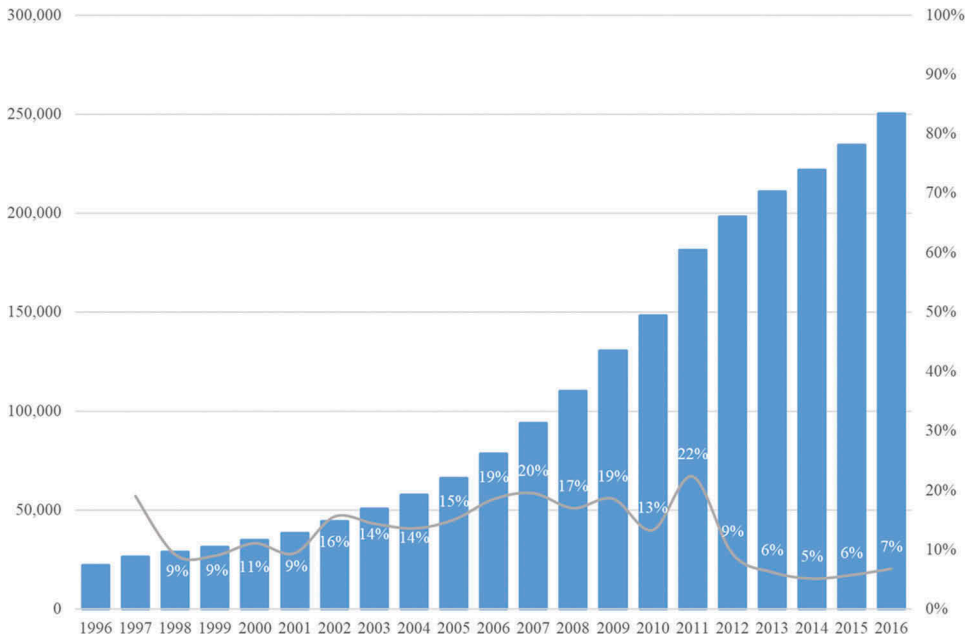


Figure 5. Number of water supply connections (including % change), 1996 to 2017. Data from Dawaco, Da Nang, Vietnam, 2018.

Increased coverage

From 2007 to 2010 service coverage increased from 52% to 66% (Figure 6). The trend of increased coverage continued, including two peaks in percentage of change in 2011, and another time in 2014, reaching 74% and 87%, respectively. In 2017, coverage reached 93%.

Water quality

Records for water quality are available from 2006 to 2015. Between 2006 and 2010 the percentage of tests which passed the quality standards for residual chlorine rose from 72% to 83% (Figure 7), and the percentage of samples which tested other parameters (odour, colour, turbidity, suspended solids, dissolved silicon dioxide, total dissolved solids, total suspended solids acidity, temperature, conductivity, total alkalinity, total hardness, salinity, chemical oxygen demand, organic material, total iron, phosphate, sulphate, nitrate, ammonium, ammonia, chlorine dioxide, manganese, permanganate, lead, arsenic, mercury, cyanogen, alkaloids, residual chlorine, total coliform, alum dose and lime dose) fluctuated between 82% and 88%, registering 87% in 2010 (Figure 8). The tests which did not meet the requirements failed due to turbidity. In 2011, there was a significant increase in the percentage of samples meeting quality standards. The percentage of tests for residual chlorine which passed quality standards was 96% in 2011 and, although the results fluctuated from 90% to 91% between 2012 to 2014, the percentage reached 96% again in 2015 (Figure 7).

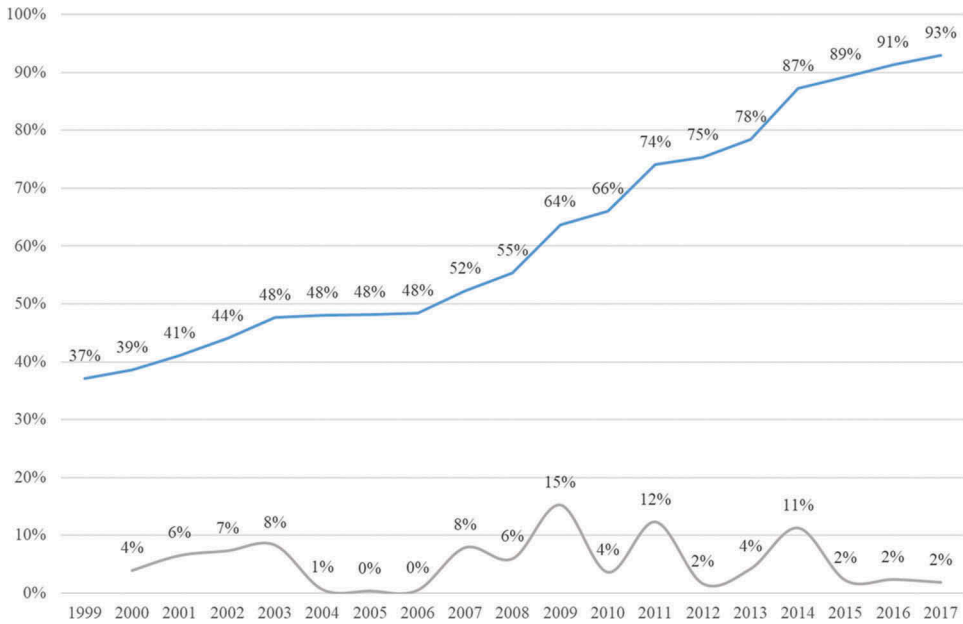


Figure 6. Service coverage of water supply (% and % change), 1999 to 2017. Data from Dawaco, Da Nang, Vietnam, 2018.

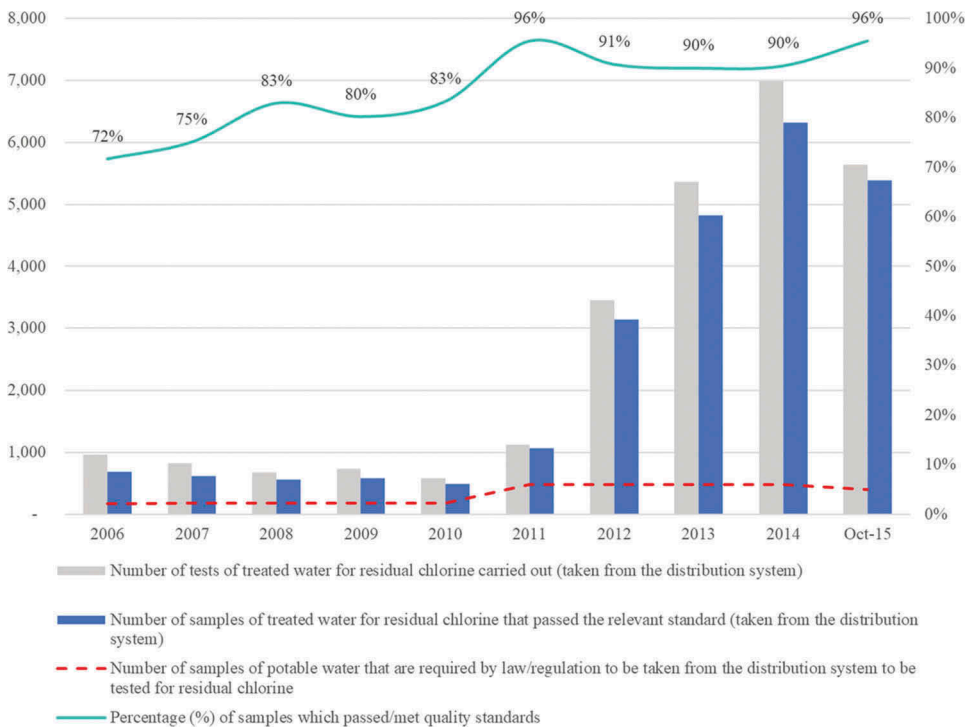


Figure 7. Number of tests of treated water for residual chlorine and percentage of samples which passed quality standards from 2006 to October 2015. Data from Dawaco, Da Nang, Vietnam, 2018.

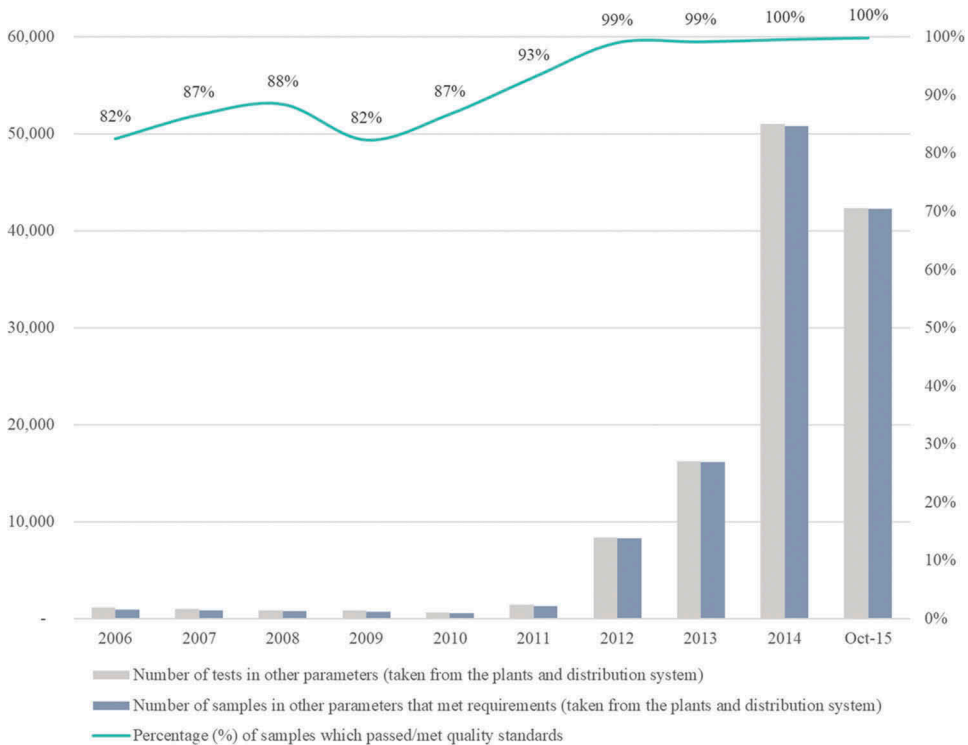


Figure 8. Number and percentage of tests for other parameters and percentage which met requirements from 2006 to October 2015. Data from Dawaco, Da Nang, Vietnam, 2018.

The percentage of tests for other parameters which met requirements increased to 93% in 2011 and to 99% in 2012, reaching 100% by 2014 (Figure 8).

Non-revenue water

The most commonly referred-to KPI is the reduction of non-revenue water, which is the volume of water that is not billed (including unbilled metered and unmetered consumption) or is simply lost (due to unauthorized consumption, metering inaccuracy, or leaks from the network) (see 'IWA Water Balance' in Charalambous & Hamilton, 2011, p. 5). During the time of the VEI-Dawaco WOP, the percentage of unaccounted-for water, or non-revenue water, was successfully lowered from 38.9% to 26.1% (Soppe, 2011). After 2010, non-revenue water dropped to 21% in 2011 and to 17% by 2014. In 2015 and 2016, non-revenue water stabilized at 17% and, in 2017, non-revenue water reached its lowest value with 15% (Figure 9).

Full cost recovery

The percentage change of Dawaco's equity shows a steady increase from 2007 to 2010, a continuing trend which strengthened with the progress the company made since 1999

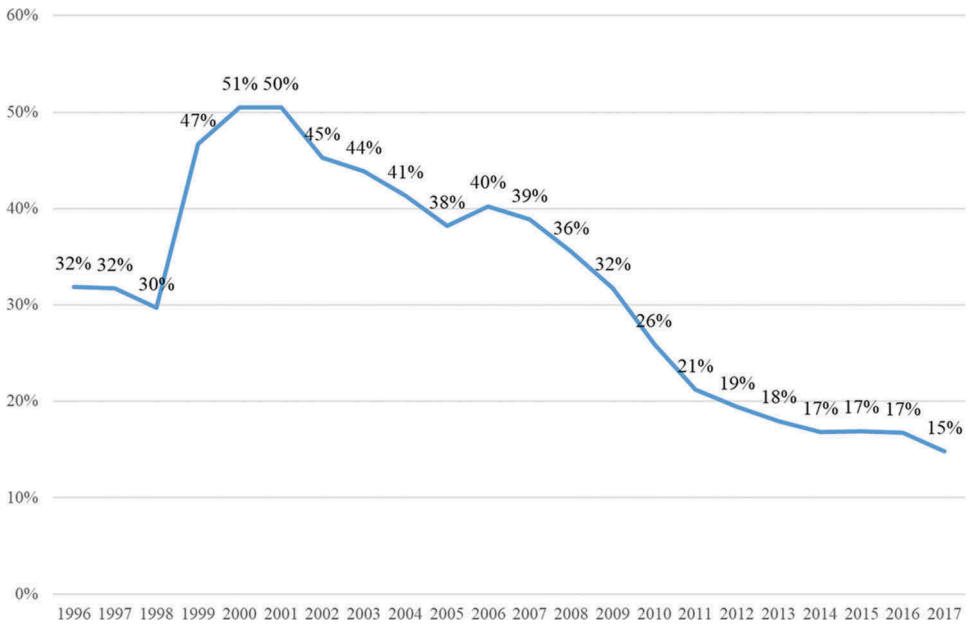


Figure 9. Non-revenue water, % of total, 1996 to 2017. Data from Dawaco, Da Nang, Vietnam, 2018.

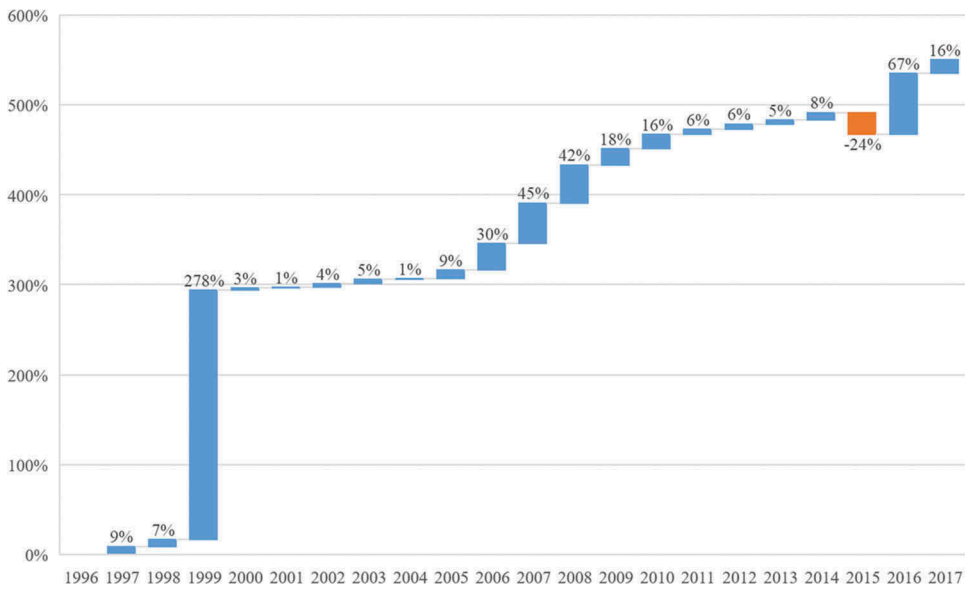


Figure 10. Dawaco's equity (% change), 1996 to 2017. Data from Dawaco, Da Nang, Vietnam, 2018.

(Figure 10). The percentage of change of the company's operating profit also shows a steady growth during the years the VEI–Dawaco WOP took place, a trend which had started in 2006 (Figure 11). As for Dawaco's profit after tax, changes would only be

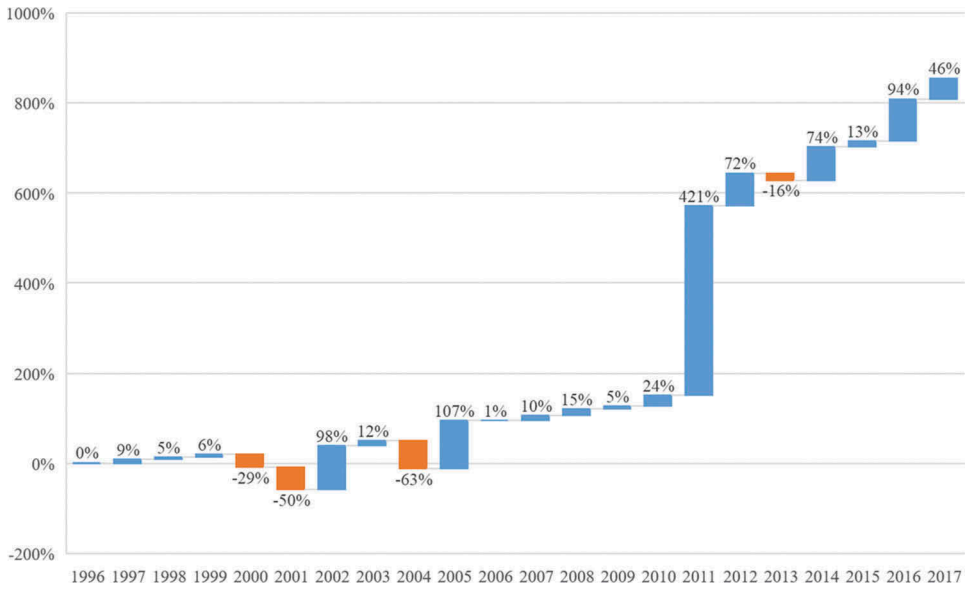


Figure 11. Dawaco's operating profit (% change), 1996 to 2017. Data from Dawaco, Da Nang, Vietnam, 2018.

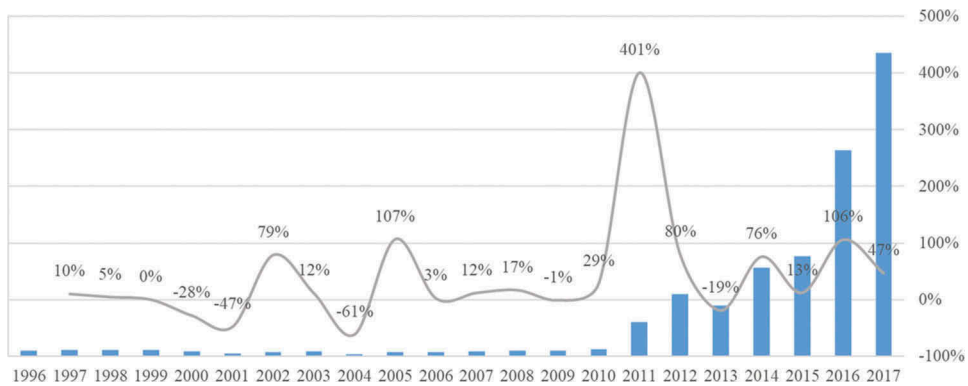


Figure 12. Dawaco's profit after tax (% change), 1996 to 2017. Data from Dawaco, Da Nang, Vietnam, 2018.

apparent with the rapid growth after the partnership ended in 2011, continuing until 2017 (Figure 12).

Structural changes, including the creation of a new tariff structure, the equitization of the company and the changes in its financial system, took place in 2010 and immediately after the WOP ended, in January 2011. The most visible results in the percentage change of Dawaco's operating profit and profit after tax occurred a year after the partnership ended. In 2011, Dawaco's operating profit sky-rocketed 421%, and its profit

after tax increased 401% upon conclusion of the WOP, continuing to increase steadily until 2017 (Figures 11 and 12).

Dawaco's operational capacity and financial sustainability *vis-à-vis* other factors

Not all these improvements can be attributed solely to the VEI–Dawaco WOP. Even though the changes implemented during the partnership seem to have had a permanent effect on the company's performance, parallel projects also played a role in strengthening Dawaco's operational capacity and financial sustainability. From 2008 to 2009, Dawaco worked with Haiphong Water Supply Company (HWSC) and Manila Water Company (MWC) in the frame of two (formal) simple partnerships (Figure 1(b)) (PSIREN, 2009a, 2009b). Between May 2008 and December 2009, the HWSC–Dawaco WOP focused on reducing non-revenue water, increasing productivity by assessing training of personnel for specific tasks, and strengthening management by encouraging cooperation between internal departments (GWOPA/UN-Habitat, 2011a). From December 2008 to April 2009, the MWC–Dawaco WOP concentrated on water quality management, addressing residual chlorine issues and carrying out pipe flushing activities (as specified the VEI–Dawaco WOP as well; see Table A1 in the online supplemental data) (GWOPA/UN-Habitat, 2011b). The HWSC–Dawaco WOP was facilitated by ADB, and the MWC–Dawaco WOP was supported by USAID, under their Environmental Cooperation-Asia project (Dawaco, HWSCO, ADB, 2008a; PSIREN, 2009a; USAID, 2008).

ADB has also played an important role in linking project activities to a larger pool of investment funds through the facilitation of technical assistance (project IDs 41456–012: TA 7144-VIE and 44002–022: TA 8357-VIE) and investments in infrastructure projects (project ID 41456–033: Loan 2961-VIE and the Public-Private-Partnership Infrastructure Project led by JICA) (Figure 13). The activities carried out under the scope of ADB built on the improved operational capacity achieved by the WOPs. In the case of projects with overlapping time frames, there is evidence of a coordination of activities where the partners made efficient use of resources to achieve common goals (see e.g. the overview of the complementary scope of assistance of the government of the Netherlands and the ADB in Dawaco, 2007).

Discussion

The external factors which contributed to the successful implementation of the VEI–Dawaco WOP in Da Nang were the political support from PC Da Nang and the availability of funds from the Netherlands Ministry of Foreign Affairs provided by the RNE in Hanoi. The possibility of allocating a third of these funds to equipment and software, and nearly half to human resources, resulted in a significant investment to build Dawaco's technical and managerial capacity. The internal factors which harnessed the improvement of KPIs during the 27 months that the partnership took place can be attributed to the strong motivation and commitment of Dawaco's management staff to implement changes in the utility, as well as the openness of both VEI and Dawaco to communicate the utility's needs and transfer expertise.

But the factors which contributed to the success of the VEI–Dawaco WOP were not limited to the organizational changes and activities carried out within the frame of the

partnership. Supported by different financial institutions, the parallel WOPs and subsequent support programmes carried out since 2007 contributed to the overall success of the partnership's goals and played an important part in sustaining the results of the WOP. It is possible to infer that the continuity of improvements of the KPI trends was influenced by the technical assistance facilitated by ADB (from 2008 to 2009, and again from 2013 to 2014), accompanied by the funding provided through the Multi-Donor Trust Fund and Water Financing Partnership Facility (from 2013 to 2019), as well as the long-term public–private partnerships supported by JICA and the investments channelled through ADB's Urban Water Supply programme in Vietnam (with planned execution until 2036).

Dawaco's improved operational capacity and stronger financial position prepared the utility to receive and manage larger investments for the modernization of the city's water infrastructure. In other words, the activities carried out during the VEI–Dawaco WOP (including the MWC–Dawaco WOP and HWSC–Dawaco WOP) also improved Dawaco's creditworthiness (cf. Mels, 2018) and allowed the company to draw from a larger pool of funds to sustain its development and ensure safe water provision.

The WOP approach offered the possibility of leveraging the effects of a small budget and build on the company's own capacity, allowing it to subsequently manage larger investments in water infrastructure development projects. Considering that WOPs are relatively inexpensive (cf. Batten, 2010), leveraging funds from other organizations improved the sustainability of the water utility's improvements. Contrary to Patrón-Coppel and Schwartz (2011, pp. 580–581) questions regarding replicability and the unlikelihood that '(external) funding opportunities will frequently exist', we see a high probability of linking WOPs with parallel funding and post-WOP investments, as shown in the representation of WOPs as key processes linking international and regional investments in urban water supply (Figure 13). In the case of ADB, WOPs have supported USD 2.3 billion of investments in water and sanitation provision (ADB, 2017). Furthermore, the WaterWorX programme is set to mobilize loans for large-scale investments in Africa, Asia and Latin America until 2030, making WOPs an integral step in increasing the sustainability of water services.

Contrary to the assumption that WOPs depend on the ability of public mentor utilities to undertake peer-to-peer learning partnerships with their own resources, this study has explored how WOPs can work together with other forms of assistance. However, there is also evidence of where WOPs have differed in other contexts. A critical report from Terhorst (2012) regarding WOPs in Latin America and the Caribbean has raised questions about WOPs being used as 'policy vehicles' to promote an agenda of public–private partnerships and business opportunities. Just as there are failures in public–private partnerships (as demonstrated by the water riots and violence in the 1980s and 1990s; see Datta, 2015), there are bound to be failures in WOPs (e.g. due to poor management or project design, insufficient time investment, lack of data, unrealistic assumptions regarding tariff increases and levying fees, or failure to internalize processes; see EuropeAid, 2017). In such instances, it is important to keep in mind that WOPs are not stand-alone projects. WOPs have a supporting role in the improvement of urban water services and should be understood as a means to an end. The value of a not-for-profit mechanism in an increasingly marketized economy should be highlighted and improved, rather than seen as a threat.

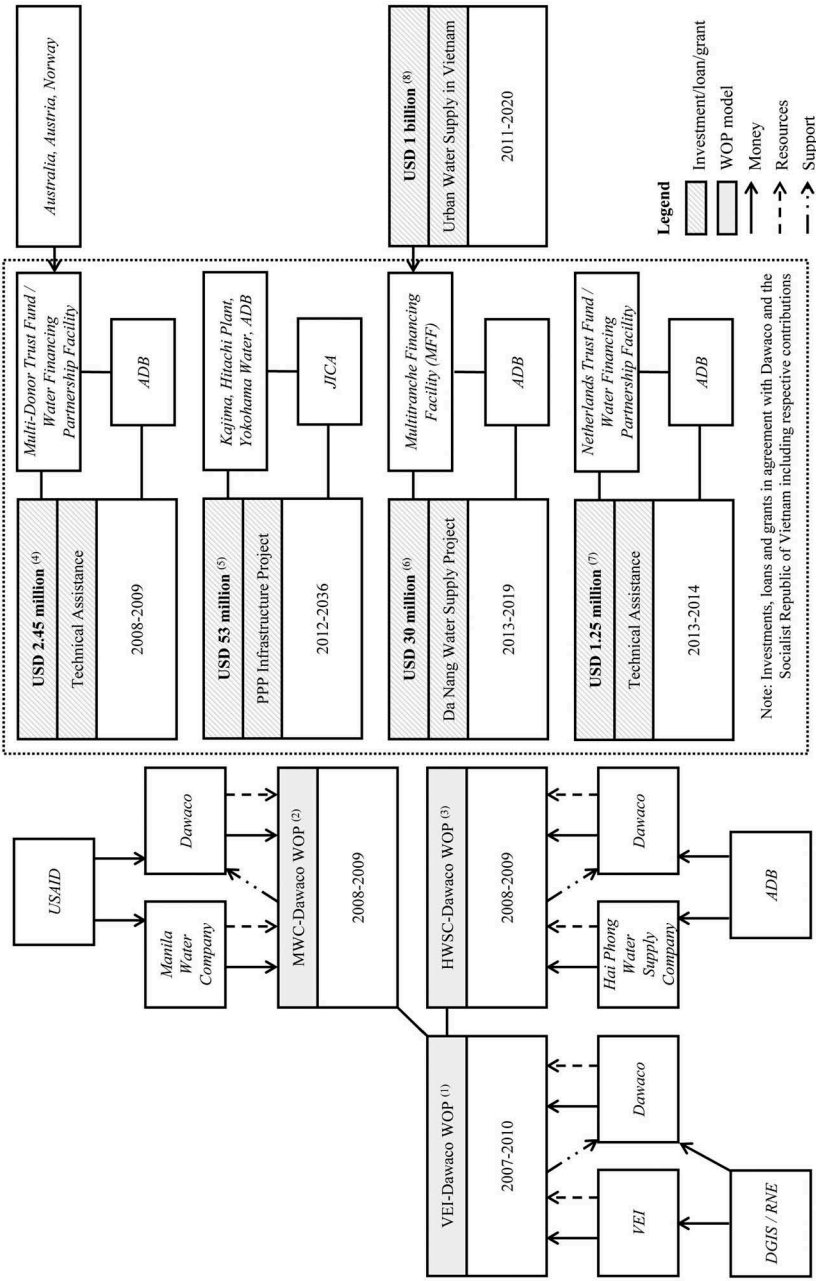


Figure 13. WOPs as key processes of international and regional investments in urban water supply. Sources: (1) This paper and Wright-Contreras (2018); (2) PSIREN (2009a); (3) PSIREN (2009b); (4) ADB (2008a); (5) Kajima Corporation, Hitachi, Ltd., Yokohama Water Company, Original Engineering Consultants Co., Ltd., Global Water Recycling and Reuse System Association (2012); (6) ADB (2013a, 2012a, 2012b); (7) ADB (2013b, 2013c); (8) ADB (2012a).

The case of Da Nang shows the supporting role of WOPs in enhancing utility performance in combination with factors which enabled long-term results. Even though the VEI–Dawaco WOP excelled in capacity building at the project level and paved the road for transnational investment opportunities, some still argue that there is much more work to be done with regard to the institutional development of the water sector (Du, Bui, Buurman, & Quach, 2018; interview, ADB, 2018). This means that socio-technical transitions towards a resilient and sustainable management of water resources depend on the creation of a conducive environment with the political will and the necessary know-how to foster innovation. In this sense, knowledge sharing and capacity building can be achieved through global networks of cooperation (Wright-Contreras, 2019). And WOPs, specifically, have the potential to assist in the implementation of strategies to ensure access to safe water and influence policy making – two WOPs led by ADB, in Nepal and Fiji, have shown that WOP projects on sanitation were first used by utilities, and then elevated to national standards (ADB, 2017).

Conclusion

This article has defined WOPs (in terms of duration and availability of resources) and showed how they function as key processes in larger operations of water infrastructure development. The research has illustrated a comprehensive, (medium-term) structured partnership, integrated within a broader scheme of international and regional funding programmes and external forms of assistance, including parallel, (short-term) national and regional WOPs. The factors which contributed to the successes of the VEI–Dawaco WOP included political support, the availability of funds, and clear communication from both sides of the twinning project. The continuity of results, however, was favoured by the coordination of efforts through simultaneous WOPs which contributed technical know-how (focusing on specific targets such as non-revenue water and water quality), as well as the improvement and the strengthening of the water utility's capacity. The combination of efforts of international financial institutions to promote technical assistance and invest in larger infrastructure development projects also increased the confidence of donors and contributed to the achievement of full cost recovery (also advancing the company's equitization). Regardless of what direction WOPs can be steered towards, this study emphasizes that WOPs are not stand-alone projects. Understanding the nature of WOPs and their supporting role in the improvement of urban water services is necessary to evaluate the direction of development cooperation in the water sector.

Acknowledgments

The authors would like to thank Marco Schouten, CEO of VEI, for authorizing access to documents regarding the VEI–Dawaco WOP, as well the cooperation of Dawaco's current personnel in responding to all queries during the research. Our gratitude is also extended to Hubert Jenny, ADB principal infrastructure finance specialist of the People's Republic of China, and Christopher Moster, lead facilitator for ADB WOPs, for their valuable input during the final writing stage. Thank you also to Cecilia Tortajada, editor-in-chief of the *International Journal of Water Resources Development*, for her guidance and timely feedback, and to the anonymous reviewers for providing valuable comments and suggestions during the peer-review process.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

The writing of the manuscript was supported by the Deutscher Akademischer Austauschdienst [57214224].

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