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Literature Review

Global Study on the Aggregation of Water Supply and Sanitation Utilities

AUGUST 2017

Gustavo Ferro

WORLD BANK GROUP

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Chapter 1 Introduction

The following comprehensive literature review encompasses the literature related to the aggregation of water supply and sanitation (WSS) utilities. The objectives are to show the different strands of the literature and their evolution in recent years in order to yield insights about what is known and how useful such knowledge can be for policy goals.

After this introduction, chapter 2 defines the problem, chapter 3 analyzes briefly related literature on agglomeration of municipalities, chapter 4 points to the rationale behind WSS aggregation, and chapter 5 concentrates on economic issues that motivate the aggregation of utilities, mainly the attempt to achieve economies of scale. The institutional aspects matter: chapter 6 concentrates on policy interventions if institutions are considered exogenous—that is, if there are no internal obstacles to reforming the WSS sector. On the other hand, chapter 7 considers the problem of what political economy issues are hampering the achievement of the goals—that is, if institutions are endogenous.

Chapter 2

What Is Aggregation in the Context of Water Supply and Sanitation Utilities?

WSS utilities are natural monopolies, and the organization of the sector is generally based on a municipal-scale supply. Such fragmented provision impairs the services because of (a) the absence of scale economies, (b) the loss of synergies, (c) limited technical resources given scarce human capital and knowledge in the territory, (d) negative environmental externalities owing to a lack of basin-level coordination for catchment and discharges, (e) difficulties in financing cross-subsidies, and (f) politization and patronage, among others.

Decentralization was pursued in the WSS delivery industry as a way to boost transfer and accountability at lower government levels because devolution was expected to increase the voice and participation of citizens in the provision of services. The results sought were enhanced service delivery, increased allocative and productive efficiency, improved cost recovery and sustainability, and stronger social cohesion.

Aggregation is defined as the process by which two or more service providers consolidate some or all their activities under a shared organizational structure, whether it implies physical infrastructure interconnection or not. Aggregation processes aim to enhance (a) economic efficiency, (b) performance, (c) professionalization, (d) environmental benefits, and (e) equity.

Chapter 3 What Can Be Learned from "Cousin" Literature? Agglomeration of Municipalities

Consolidation of municipal government has been studied broadly and is a major area of interest to control the costs of local government in many countries. Policy makers explore consolidating municipalities so that the areas might deliver more efficiently the costly services they provide, and that line of literature yields interesting insights when extrapolated to WSS.

Bish (1996), in a conceptual discussion on British Columbia's municipalities, proposes strategies to reform local governments' organization of services in a way that recognizes diversity and the need of a multiorganizational system to deal with that diversity. Also, Bish (2002) studies how to determine which institutional arrangements and boundaries should be used to provide public goods and services to meet the preferences of different publics or the needs of different production characteristics.

In other latitudes, similar problems are present. Mitchell and Campbell (2004) explore synergies between water, wastewater, and stormwater with a sustainability perspective in Australia. The report yields conceptual aids for analysis and policy intervention. Moreover, Juuti and Katko (2005) explore the history of WSS services in many European cities and the configuration of the provision of the services. The document alerts readers to the danger of inertia in decision making that limits future options.

Perrin, Thorau and Associates (2005) discuss what regulation is and how it imposes costs and provides benefits. Particular emphasis is placed on the costs of duplication and overlap as the rationale for regulatory harmonization. The paper also discusses how those concepts can apply to government services and economic development policy. In the same vein, Bel and Fageda (2006) analyze the use of intermunicipal cooperation to exploit scale economies as an alternative to privatization in Spain. The study concludes that production costs are lower when municipalities cooperate.

Urban Systems Limited (2005) examines the delivery of local government services on a regional basis and the use of service delivery models other than direct provision and production of local government services by local government staff—called alternative service delivery in Canada (British Columbia). Fox and Gurley (2006) review theoretical arguments and empirical findings on the amalgamation of subnational governments. They find that success depends on many factors, including institutional ones, and is specific for each sector and its conditions.

Mitchell and others (2008) discuss the points of decentralization and its drivers and enablers and then compare tendencies in the United States and Australia. The paper makes recommendations on steps Australia might take concerning institutional arrangements for decentralizing. Bel and Fageda (2008) examine the influence of transaction costs and political factors on local choices through new variables instead of those traditionally analyzed in the literature.

In a literature review, Holzer and others (2009) indicate that there is no compelling evidence for consolidation, except as warranted on a case-by-case basis. However, they conclude that the interest in consolidation has often triggered a review of other mechanisms to provide government services efficiently and effectively. Puga (2009) reviews the magnitude and causes of the productive advantages of cities and also tries to identify the knowledge gaps on agglomeration economies.

Bleese and Baskaran (2013) study the fiscal consequences of municipal mergers by making use of a large-scale merger reform in the German federal state of Brandenburg. The paper finds substantial and immediate reductions in total, administrative, and current expenditures after compulsory mergers. Voluntary mergers, on the other hand, have smaller and less robust effects. Similarly, Allers and Geertsema (2014) study how municipal amalgamation affects local government spending and the level of public services in the Netherlands. They find that although amalgamation reduces spending on administration, no corresponding spending increase occurs in public services. Also, amalgamation does not increase home prices, used as a proxy indicator of better services.

Aulich, Sansom, and McKinlay (2014) study 15 cases of different forms of municipal consolidation, including amalgamation, and conduct a series of interviews with senior practitioners from the local government sector in Australia and New Zealand. The data reveal little evidence of consistent economies of scale from consolidation. However, both case studies and interviews indicate that consolidation generated economies of scope and what may be termed "strategic capacity." Dawson and others (2014) present priorities for future research and development and offer a generic framework for urban integrated assessment to analyze the potential benefits and trade-offs of sustainability policies and interventions.

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Chapter 4 Why Aggregate Water Supply and Sanitation Utilities?

Several advantages are expected from aggregation of WSS services, including improved efficiency of service delivery through economies of scale and cost-sharing, as well as enhanced human capacity. Economies of scale in aggregation and regionalization relate to management overheads, operating costs and billing, enhanced professional capacity and exchange of knowledge, integrated water resources management, greater access to financing, and ability to attract private sector investment (ERM and Kingdom 2005; Ferro and Lentini 2010; Frone 2008).

The optimal size of service is difficult to determine. The most appropriate level of aggregation depends on a number of factors, including the availability of water resources in the area to supply the aggregated providers and the local political situation, including tariff setting and the regulatory framework regarding an aggregated service provider (Trémolet and Binder 2010).

An ample empirical literature shows that agglomeration leads to economies of scale in the WSS industry, at least up to a certain level. Furthermore, it seems that large utilities tend to operate at a lower unit cost and perform better than smaller ones do. Yet there are also counter examples that show that sometimes scale is beyond the optimal efficiency size. An exhaustive examination of empirical literature on economies of scale is presented next.

Empirical studies indicate that economies of scale are prevalent in small-size providers and diseconomies of scale appear in very large ones. In the middle, there seems to be a continuum of possible minimum efficient scale. A classic argument for the existence of diseconomies of scale is related to the limit of enterprise capacity that makes management inefficient at some point (Church and Ware 2000). If the firm turns bureaucratic at some level, it is possible to extend economies of scale by reengineering processes.

The providers are not standard because they are normally structured on administrative boundaries and more rarely along river basins. The institutional setting depends on political organization (a federal or unitary state, a place where municipalities have some degree of autonomy or have been entitled to the service throughout decentralization processes); history (prerogatives given to different levels of jurisdictions); geography (river basins, boundaries between jurisdictions, localization of fresh water sources and points of wastewater discharge); demographic and social characteristics (differences in wealth between jurisdiction, ethnic or regional rivalries, growth of metropolitan areas); and political characteristics (such as control of the works and services by municipalities, procurement and employment policies, tariffs and subsidies) (Ferro and Lentini 2010).

The main economic driver for aggregation in WSS is the potential for economies of scale. Aggregation enables utilities to save costs through rationalization in operational

areas but mainly in supporting functions, such as finance, human resources, research and development, regulation, planning, procurement, accountancy and legal issues, corporate buildings, call centers, and best management practices (Tynan and Kingdom 2005).

In terms of scale, the increased monopsonistic power of the aggregated utility could be made to improve bargaining power against providers and contractors. Nevertheless, the aggregated utilities might face the development of powerful unions and the need for bargaining contracts with more powerful counterparts. Sometimes a reason invoked for aggregation is the possibility of attracting private capital to the sector: to create a more attractive unit for private capital, for example or to avoid "cherry picking" by aggregating poor areas to others more attractive to private capital, opening room for cross-subsidization into the aggregated utility (Frone 2008).

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Chapter 5 What Economic Issues Are Considered?

The consolidation of WSS services involves many dimensions, such as the volume of distributed water and the number of customers and towns served by an integrated utility. Consolidation leaves the basic structure of the network intact and does not affect the geographical location of customers. Sometimes consolidation adds small towns or rural systems to larger urban providers. The studies show that the type and design of aggregation may matter greatly. Two dimensions appear critical: (a) the initial large size of the utility may already be too large and its operation might be characterized by diseconomies of scale and (b) the merger could be detrimental to cost efficiency if the absorbed systems are characterized by low density (Klien and Michaud 2016; Mercadier, Cont, and Ferro 2016).

In the empirical study of economies of scale (and scope) in the WSS sector, some difficulties appear. First, strong and complex correlations exist among the scales, ages, and qualities of the plants and networks, between the scales and levels of service for water and in wastewater treatment, and in the effect of geographical and historical conditions for the access to raw water and discharges of wastewater. Further, studies need to account for the financial assets and liabilities of the providers (service of past debts, pension obligations of the utility) and expense commitments (legal protection to staff against layoffs; free provision to municipalities, churches, or other nonprofit community organizations; and so on) (Vergès 2010).

Saal and others (2013) underline that the expected benefits (costs) of consolidation, unbundling, vertical integration, or horizontal diversification strategies on productive efficiency have to be compared with the potential offsetting costs (benefits) related to the emergence of regulatory complications and the negative (positive) impact on competition.

Because economies of scale are the more compelling (but not the only) reason for aggregation, this chapter reviews the extended empirical literature on scale economies. Some surveys of the literature are available. These surveys complement one another because they were written at different times and with slightly different objectives, sometimes discussing economies of scale, sometimes concentrated on comparative efficiency: Ashton (1999); Stone and Webster Consultants (2004); ACIL Tasman (2007); IPART (2007); Saal, Parker, and Weyman-Jones (2007); Ferro and others (2011); Carvalho, Marques, and Berg (2012); Pollit and Steer (2012); and Saal and others (2013). Also, in their studies SCL Econometrics (2009) and Revollo and Londoño (2010) develop synthethic surveys of the empirical literature.

Ashton (1999) estimates a variable cost model of the U.K. water industry and reviews the previous literature on scale and scope economies. From this variable cost function, estimates of economies of scale and economies of capital utilization and capacity utilization are made. The results indicate that if the water industry has not been in long-term

equilibrium (in terms of capital) neither merger nor acquisition among water companies is justified in terms of cost efficiency. A low level of capital utilization is indicated for the water industry.

ACIL Tasman (2007) seeks to investigate economies of size and scope associated with different configurations of the Water Corporation's operations in Australia. The discussion is conceptual and includes a comparison with other infrastructure sectors that had been unbundled. There appears to be some support for the view that system-size economies have been obtained with a much less aggregated system for water than for electricity. Also, IPART (2007) analyzes cost structures and industrial organization of the WSS industry. In an international literature review, the authors find mixed evidence on economies of scale, scope, and concentration.

Abbot and Cohen (2009) briefly review the various measures that have been used to gauge productivity and efficiency in the water sector. The article, in a review of the literature, discusses input and output data requirements of productivity and efficiency measures; findings related with scale and scope, public versus private ownership, and the impact of regulation; and lines for future environmental and other research. Ferro, Lentini, and Mercadier (2011) synthetisize the abundant empirical work of economies of scale and scope in the WSS sector through a survey of empirical studies. Some evidence is derived from increasing economies of scale in smaller services, constant economies of scale in medium-size utilities, and diseconomies in very large ones. Some methodological issues are clarified concerning economies of scale measurement in WSS utilities.

Carvalho, Marques, and Berg (2012) update the literature on water utility benchmarking studies developed worldwide, focusing on scale and scope economies. Using meta-regression analysis, the study investigates which variables from published studies influence these economies. The results indicate that there is a higher probability of finding diseconomies of scale and scope in large utilities; however, only the results for scale economies are significant. Diseconomies of scale and scope are more likely to be found in publicly owned utilities than when the ownership is private; as would be expected, multiutilities are more likely to have scale and scope economies.

Many studies on water and sewerage industries place significant importance on the benefits of economies of scale and scope and how these relate to vertically integrated firms. A reexamination of the early literature on scale and scope economies finds that these studies do not implicitly preclude nonintegrated firms from fully using assets for multiproduct activities (Pollitt and Steer 2012). Such firms might still reap scope economies through trading in the open market. The article suggests difficulties in separating these types of economies when assessing performance.

Saal and others (2013) survey the literature on scale and scope economies in the water and sewerage industry. There is considerable evidence of vertical scope economies between upstream water production and distribution. Only mixed evidence indicates the existence of (dis)economies of scope between water and sewerage activities. Economies of scale exist

up to a certain output level, and diseconomies of scale arise if the company increases its size beyond this level. The optimal scale of utilities varies considerably between countries. Vertical unbundling is costly compared with providing water services with a fully integrated water company.

Besides econometric studies, there is also a strand of the literature specially devoted to efficiency comparisons. Such studies use mathematical programming methods, mainly data envelopment analysis (DEA). The studies do not estimate functions nor elasticities, because they build an envelopment of the database and compare efficiency between peers, but the shape of the envelopment is different if constant or variable economies of scale are present. Carvalho and Marques (2014) account for the achievements and limitations of this line of work in WSS. The approach is useful for working with small databases and does not constrain the data to any particular functional form, whereas econometric methods need more data and demand to run a regression with a particular functional form, which cannot be the underlying one. Also, DEA is very sensitive to outliers, which permits the detection of strange values in the database. The main advantage of econometric methods is the possibility of testing an hypothesis with statistical tests that inform the error margin.

England and Wales is the most referred WSS consolidation process, because a river basin-based aggregation was made in the early 1970s. Thus, some studies are dedicated to that case. There is no consensus on the dimension of the economies of scale in England and Wales. Part of the discordance is related to the definition of economies of scale adopted in each study. The United States has an important representation in the literature; its sector is reputed to be very fragmented, with more than 54,000 utilities. Italy, Japan, the Netherlands, and Portugal had important reforms, consolidating their sectors in different forms. The other countries of the list of study have interesting features to analyze. Brazil and Italy had an uncompleted consolidation process in regional utilities and Colombia, which has a very fragmented sector, intends to agglomerate in search of economies of scale. The rest of the countries provide interest for different reasons.

United States and Canada

The oldest identified study is by Feigenbaum and Teeples (1983), who explain the relative cost performance of publicly owned versus privately owned water utilities. All estimated models suggest that there is no difference in cost-of-service equations for government versus private companies. Following that study, many papers were devoted to the American case. Hayes (1987) makes an analysis of vertical integration between retail and wholesale water supply in the United States in order to determine economies of scope. The study suggests evidence of economies of scope in selected periods. Kim and Clark (1988) seek to estimate economies of scale and scope in the United States for a cross-section of 1973. The paper finds evidence of constant returns to scale for the average firm producing for both residential and nonresidential customers, diseconomies of scale in supplying water to residential customers, economies of scale in providing nonresidential customers, and economies of

scope for the average utility supplying services for residential and nonresidential customers. Renzetti (1999) studies municipal water supply and sewage treatment utilities in Ontario, Canada, to establish their costs of supply and to evaluate their pricing practices.

Bhattacharyya, Parker, and Raffiee (1994) analyze the relative efficiency of WSS utilities, in a cross-section of private and public companies, in an effort to compare the effect of ownership on performance. The econometric estimation for the United States finds evidence of significant economies of scale for both public and private companies. The empirical results provide evidence that public water utilities are more efficient than private utilities on average, but are more widely dispersed between best and worst practice. Bhattacharyya and others (1995) use a stochastic frontier cost function to specify the cost of inefficiency of publicly and privately owned urban water utilities in terms of their different ownership structures and firm-specific characteristics in the United States. Results show that when the operation is small, privately owned water utilities are comparatively more efficient. Public water utilities are comparatively more efficient when the scale of operation is large. Houtsma (2003) provides evidence of significant economies of scale in California water supply industry.

Small water systems face increasingly stringent environmental regulations, and the question is whether they can afford to meet the regulations without amalgamation. Shih and others (2006) evaluate costs in the United States. Smaller systems tend to face higher unit production costs across the full range of production. Size only explains a part of the cost differences; inefficiency is important to explaining the rest. More empirical work points to the same direction in the U.S. market. Torres and Morrison-Paul (2006) analyze the structure of the U.S. water industry. The estimates reveal considerable scale economies in terms of volume, particularly for small utilities with less output density. These economies are counteracted by simultaneous increases in customers and service area for large utilities.

Garcia, Moreaux, and Reynaud (2007) seek to distinguish technological economies of vertical integration from the economies resulting from market imperfections. The economies of vertical integration are important only in small utilities following this econometric study of North American utilities. Destandau and Garcia (2014) show in their study that for the United States, including the quality level of the delivered services has a significant impact on scale economies and ownership effects. Significant economies of scope confirm the existence of trade-offs between water production and service quality.

England and Wales

The pioneer study on England and Wales is by Hunt and Lynk (1995), who perform an analysis of regional water authorities before privatization. The research finds evidence of economies of scope between water and wastewater services and between water supply activities and environmental activities.

Saal and Parker (2001) analyze the extent of economies of scale and scope as well as the effect of privatization and economic regulation on economic efficiency in England and Wales.

There is evidence that the mean WSS company has diseconomies of scale. Economies of scope between water and sanitation are not found. Strategic Management Consultants (2002) discuss technical and organizational factors underlying economies of scale in England and Wales. This report concludes that technical economies of scale are exhausted at about 400,000 connections. Bottasso and Conti (2003) analyze the evolution of operating cost inefficiency for the English and Welsh WSS sector over the period 1995-2001. The main results are that operating cost inefficiency decreased over the sample period and that inefficiency differentials among firms steadily narrowed.

Stone and Webster Consultants (2004) estimate models of WSS costs for both water and sewerage companies and water-only companies after their privatization in England and Wales. The report finds evidence of diseconomies of scale for the average-sized water and sewerage company, declining over the period of analysis. Also, it finds small or negligible economies of scale for the average-sized water-only companies. Saal, Parker, and Weyman-Jones (2007) estimate the productivity performance of WSS in England and Wales before and after privatization using a quality-adjusted input distance function. There is evidence that the average water and sanitation company is characterized by diseconomies of scale. Estimates developed by Bottasso and Conti (2009) suggest the existence of unexploited economies of output and customer density and small-scale economies that appear to be increasing with population density. These findings suggest that moderate cost savings from cautious mergers could be expected, in contrast with other studies previously mentioned. The divergence partly is due to the definition of scale economies (whether including density or not).

Wenban-Smith (2009) studies the interaction between production costs and distribution costs at settlement level with data from England and Wales and the United States. Plant-level economies of scale in water production are confirmed and quantified. Water distribution costs are analyzed using a new measure of water distribution output (which combines volume and distance), and modeling distribution areas as monocentric settlements. Unit distribution costs are characterized by scale economies with respect to volume but diseconomies with respect to average distance to properties. It follows that higher densities reduce unit distribution costs, whereas lower densities increase them.

Far East and Other Asian Countries

Kim and Lee (1998) estimate economies of scale in water supply for a panel of municipal WSS companies in South Korea. This article finds economies of scale given the average size of the firms in the relevant study period, but decomposing the results, the study finds evidence of diseconomies of scale in 4 cities, constant economies of scale in 12 cities, and economies of scale in another 12 cities.

Mizutani and Urakami (2001) estimate three different cost functions for the WSS utilities in Japan. The study finds diseconomies of scale at the sample mean. The study also determines the optimal size of a utility in terms of network length, volume of distributed water, and

population supplied. Iimi (2008) quantifies the optimal size of public-private partnerships in the sector in Japan by estimating a cost function. Economies of scale exist but tend to diminish quickly as production increases and there is no rationale to auction contracts beyond a certain size. Utilities with different degrees of vertical integration are studied, and scale economies for each type of water supply organization using translog cost function are estimated for Japan by Urakami (2005). The results suggest that economies of vertical integration exist between upstream production activities and water delivery, thus water supply systems can achieve cost-efficiency from vertical integration.

Tynan and Kingdom (2005) estimate economies of scale in WSS in different countries (African countries, Indonesia, and Vietnam as well as for Peru and the United States). The study finds mixed results but in general, economies of scale are present at least until a population served reaches 125,000.

Italy and France

Italy made a reform in 1994 to consolidate its atomized WSS sector. Antonioli and Filippini (2001) indicate the existence of economies of output and customer density and the presence of small diseconomies of scale. Fraquelli, Piacenza, and Vannoni (2002) investigate the cost properties of a sample of Italian public mutiutilities. The study accounts for the presence of global scale and scope economies only for multiutilities with output levels lower than the ones characterizing the median firm. Aggregation is recommended on the grounds of efficiency for small nonintegrated utilities, but it is not suggested for large multiutilities. Fraquelli and Moiso (2005) analyze the Italian WSS, with particular attention to the industry cost efficiency and to the assessment of scale economies at optimal territorial areas level. There is evidence of economics of output density for all firm sizes (but higher for smaller firms than for larger ones). Scale economies suggest that the situation could be improved by a reduced fragmentation at the local level. Another atomized sector is in France. Results from the work of Garcia and Thomas (2001) reveal a positive degree of economies of scope and no short-run economies of production density and customer density in France. Significant economies of scale indicate that local communities may benefit from merging into water districts.

The Netherlands

According to De Witte and Dijkgraaf (2007), the Dutch drinking water sector experienced two drastic changes: in 1997, the sector association started with voluntary benchmarking and then merger activity began. The authors detect a significant efficiency enhancing effect from benchmarking, but they find insignificant merger economies because of the absence of scale economies and the absence of increased incentives to fight inefficiencies. Wolters (2013) analyzes the Dutch experience of cooperation and consolidation in WSS services. The presentation recommends mergers to achieve synergies, to create economies of scale in specific areas, and to form ad hoc partnerships to address specific challenges and make joint purchases.

Portugal and Spain

Martins, Fortunato, and Coelho (2006) and Martins, Coelho, and Fortunato (2008) focus on the consequences of water loss reduction and the management of water resources based on their availability at an integrated river basin level. Major findings indicate that (a) it would be better in terms of costs to maintain some level of water losses than to repair all leaks and (b) there are advantages to be gained from more concentration in the Portuguese water industry. Monteiro (2009) finds diseconomies of scale and scope for the average water utility in Portugal. Both types of economies are more likely to occur for utilities with a large customer base.

Carvalho and Marques (2014) compute economies of vertical integration, economies of scope, and economies of scale using partial frontier nonparametric methods in Portugal. They find evidence of economies of vertical integration and economies of scale in drinking water supply utilities and in water and wastewater utilities operating mainly in the retail segment. Economies of scale were found in water and wastewater utilities operating exclusively in the wholesale sector, and diseconomies of scope were also found in some of these utilities. The proposed methodology also enabled the authors to conclude that the existence of small utilities makes the minimum optimal scales go down. In spite of several reforms, the Portuguese water sector still reveals significant levels of inefficiency, partially caused by an inappropriate operating scale as pointed out by Pinto, Simões, Marques (2016). For Spain, Prieto, Zofío, and Álvarez (2009) find significant economies of scale and density but no evidence of economies of scope. Only 10 percent of the municipalities of the analyzed region have optimal size, thus there is considerable room for aggregation.

Central and Eastern Europe

After 1989, in different parts of Central and Eastern Europe WSS utilities were decentralized, motivating a diversity of studies on scale and scope economies in those countries. Filippini, Hrovatin, and Zorić (2008) estimate cost inefficiency and economies of scale of Slovenian water distribution utilities from 1997 to 2003. The optimal size of a company is found to closely correspond to the sample median. Economies of scale are found in small-sized utilities, whereas large companies exhibit diseconomies of scale.

Frone (2008) investigates general issues related to regionalization of WSS, in particular in Romania. The paper concludes with which elements should be present in regionalization of services in Romania and elsewhere. Nauges and van den Berg (2008) use panel data to seek to detect the presence of economies of scale in four countries (Moldova and Romania, and also Brazil and Vietnam). The study finds economies of scale in Moldova, Romania, and Vietnam and cannot reject constant economies of scale in Brazil. Cost structures vary significantly between and within countries.

Kommunalkredit Public Consulting (2009) analyzes the process of overfragmentation in WSS sectors in Eastern Europe after the 1990s. The article points out the undesirable consequences of the decentralization processes. It suggests taking advantage of the experience

accumulated in intermunicipal cooperation in Western Europe. Frone and Florin Frone (2012) discuss factors related to efficiency in WSS (regionalization, pricing, demand elasticity), applied to the Romanian context. Gjebrea and Zoto (2013) discuss regionalization in Albania to achieve efficiency gains, and they find a potential for economies of scale in Albania.

Klien and Michaud (2016) analyze the consolidation processes of WSS services in 14 Eastern European countries. The paper yields that merging utilities will not necessarily result in lower unit costs. Consolidation not only increases the volume of water delivered or the number of customers, but also implies adding areas (municipalities, systems, or sparsed territories). The results show economies of scale but cost increases as well.

African Countries

Tsegai, Linz, and Kloos (2009) examine the structure of the water supply costs and tariffs of water service authorities (WSAs) in the Middle Olifants sub-basin of South Africa. As evidenced by estimation results of returns to scale (greater than one), merger of WSAs would be economically advantageous. Mbuvi (2012), in a doctoral dissertation, analyzes governance, reforms, and efficiency in West African countries. Private utilities seem to be more efficient. Key governance issues are indentified and analyzed.

Latin America

Chile privatized its water and sanitation sector and a wave of mergers concentrated the regionalized market in a small number of groups. SCL Econometrics (2009) seeks to analyze quantitatively the magnitude of economies of scale for water and wastewater stages in Chile. In the production stage there are economies of scale, whereas there are no economies of scale in water distribution and wastewater collection. There are economies of scale in wastewater treatment and in the administrative stage in the whole period of analysis. Economies of density are found for the largest and medium-size providers but not for the small ones. In a data panel, economies of scale are found at the industry level.

Revollo and Londoño (2010) test the presence of economies of scale and scope in Colombia, where WSS is very fragmented. The study finds economies of scale and scope for water and sewerage services in Colombia. Medium and small companies have greater economies of scale than do large companies. Ferro and Lentini (2010) systematize concepts and relevant experiences of economies of scale and scope in the WSS in Latin America and in the rest of the world. They find that economies of scale and scope are present in WSS, in works and services and in different stages of the productive process. The empirical results have some case specificity. Ferro and others (2011) measure returns to scale in Latin America using a common regional database. A 2005 cross-section of 90 providers in 14 countries provides evidence of increasing returns to scale in Latin American water provision.

Corton (2011) analyzes the structure of the water industry in Peru for the existence of economies of scale and cost inefficiency. Findings indicate the presence of economies of scope.

Villaverde Hernández and Cadillo La Torre (2014) estimate economies of scale and minimum efficient scale from a sample of Peruvian WSS utilities. The study finds that only one-fifth of the sample have output levels equal or superior to the minimum efficient scale. Diaz and Flores (2015) make a review of the evidence of economies of scale in Latin America, based on IBNET data.

Mercadier, Cont, and Ferro (2016) quantify economies of scale in the WSS sector in Peru. No economies of scale in the Peruvian WSS sector as a whole are found. Nevertheless, there are economies of production density (volume) and customer density (connections) and some agglomerations that are potentially cost saving. Ferro (2017) analyzes the institutional reforms in WSS in Latin America during the first 15 years since the launching of the Millenium Development Goals. The study identifies advances in the institutionalization of WSS services in various issues in a subset of Latin American countries. Some of these advances in view of economies of scale achievement are related to consolidations.

Germany and Switzerland

Sauer (2005) models and analyzes the cost structure of water supply companies in Germany. The findings deliver evidence for the hypothesis that the legally set supplying areas are economically inefficient.

Zschille (2012), focusing on a hypothetical restructuring of the industry, analyzes the potential efficiency gains from mergers between water utilities at the county level in Germany. The results suggest improving incentives for efficient operations in water supply by a consolidation of the industry structure. Zschille and Walter (2012) determine the utilities' technical efficiency (TE) scores using cross-sectional data from public and private water utilities in Germany. The study finds large differences in TE scores even after accounting for significant structural variables such as network density, share of groundwater usage, and water losses.

Farsi, Fetz, and Filippini (2007) explore the economies of scale and scope in multiutilities and test the convenience of unbundling in Switzerland. The study finds considerable economies of scale but, at the same time, great variation between utilities because of unobserved heterogeneity. Baranzini and Faust (2010) estimate economies of product density, consumer density, and scale for Swiss WSS services. The study finds moderate returns to production density that decrease with the size of the utility.

Beyond Economies of Scale and Scope: Basin and Equity Externalities

Other compelling arguments for aggregation, besides economies of scale and scope, are river basin management and social equity. In the first case, the problem, from the economic point of view, consists in the internalization of environmental externality. In the second case, poverty issues are addressed through cross-subsidized redistribution.

In different areas of the world, the water sector is municipalized, even when that is not the most efficient configuration for service delivery. Mayors in some places are interested in

maintaining the service in the hands of the municipality, sometimes directly as a department, sometimes as a corporatized entity with greater managerial autonomy. One form of amalgamation of services beyond the limits of municipalities is to follow some river basin criteria. Downstream pollution issues induce a need for collaboration between upstream and downstream services. The lack of consistency of abduction and discharge policies is one of the main drawbacks of the municipalization of services. In the absence of integration of upstream and downstream services or cooperation between them, externalities appear (Vergès 2010). The internalization of the externality involves some attribution of costs and benefits: the upstream utility responsible for the discharge absorbs all or some of the costs otherwise externalized (that is, transferred downstream) or the downstream utility with a deteriorated source is compensated for all or some of the costs the externality generates.

Income inequalities between urban areas, and between rural and urban portions of the same municipalities or regions, provoke the need for some social collaboration to increase coverage or subsidize consumption in poor areas (Vergès 2010). WSS subsidies could be aimed at coverage expansion (infrastructure) or consumption. The latter could be universal (when costs are not totally recovered and the deficit is faced by some authority maintaining lower tariffs for all consumers than those of sustainable services) or targeted to certain social groups (such as the poor), geographic area (such as depressed zones), categories of users (such as residential, pensioneers, veterans), or implicit beneficiaries (for example, arrears or clandestine connections are tolerated without sanctioning) (Komives and others 2005).

Considering both coverage and consumption subsidies, there can be direct or cross-subsidies. With direct subsidies, some authority provides funds to subsidize services in addition to the fees consumers pay. Direct subsidies can be transferred to utilities (supply-side subsidies) or to the consumers themselves (demand-side subsidies). In the cross-subsidy type, some consumers pay less than the direct cost of service provision while others pay more. Thus, one group subsidizes the other one (some geographical region subsidizes another or some social group subsidizes another social group) (Komives and others 2005).

Cross-subsidization has advantages and drawbacks when compared with direct subsidization. The former does not demand budget resources and has political attractiveness and administrative simplicity. The latter demands administrative efforts and resources (to target the subsidy if it is not universal, sometimes by means testing) and it is reputed to be more transparent but less politically attractive (because beneficiaries and subsidy payers become evident). The practice of cross-subsidization demands that regions or social groups be heterogeneous. Aggregation is one way to build those heterogeneous collectives (Ferro and Lentini 2012).

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Chapter 6 What Institutional Issues Are Considered if Institutions Are Supposed Exogenous? (The Normative Approach)

Inadequate accountability was the argument underlying past decentralization trends (World Bank 2003). Being accountable means that some parties are answerable to other parties for policy decisions, for the use of resources, and for performance. A "short route" of accountability is identified between citizens or clients and providers, and a "long route" of accountability is identified between the state as representative of citizens' interests and providers. Providing services to a larger customer base (scaling) increases the distance between the utility management and the final customer, making the utility less demand-responsive. Since the *World Development Report 2004* was issued (World Bank 2003), a strand of the literature developed to provide advice to policy makers. These studies implicitly suppose exogneity of institutions and explore normative proposals on how to implement proper reforms. They focus on maintaining the right policies.

Increasing accountability directly to the consumer can help depoliticize the provision of services. It can create a "counter-weight to the power of the owner" and help prevent political capture (van Ginneken and Kingdom 2008). The implementation of aggregation needs to address key issues: (a) defining the institutional form; (b) setting governance arrangements; (c) determining whether asset ownership should be transferred to the aggregated structure, for which type of assets, and under which rules; (d) determining whether staff should be transferred and under which conditions; (e) establishing entry and exit conditions to encourage entry and to make exit possible; and (f) establishing whether tariff and service-level harmonization should be introduced and, if so, in which ways and over which transition period (ERM and Kingdom 2005).

ERM and Kingdom (2005) investigate issues related with aggregation of WSS utilities and define and classify processes by scale, scope, and character of the utlities. In a conceptual discussion derived from seven international case studies, the report detects economic opportunities and institutional obstacles to aggregation. Baietti and Curiel (2005) examine the applicability of conventional formulas to determine revenue requirements for average tariffs. They discuss the impact of capitalization issues on revenue requirements, and they also highlight the impact on intangibles.

Berg and Vargas (2008) explore the problems that political polarization poses with regard to technical regulation of WSS in a case study for Bolivia. The study reinforces the arguments for key performance indicators and the use of benchmarking, and it discusses the evolution of regulatory institutions. Van Ginneken and Kingdom (2008) present a framework of attributes of well-functioning utilities and discuss how they have introduced key institutional changes. Well-functioning utilities share common

characteristics: autonomy—being independent to manage professionally without arbitrary interference; accountability for the use of resources and for performance; and reporting and listening to clients and working to better meet their needs.

Water and sanitation services, which qualify as essential public services, need to be regulated from an economic, environmental, and public health perspective. Economic regulation includes tariff regulation, service quality, competition, and, in some cases, consumer protection (Trémolet and Binder 2010). Institutional models for carrying out such regulation include self-regulation, regulation by contract, regulation by agency, and some hybrid models that combine regulation by contract and by agency and that rely on external expert panels or user participation. There is no one-size-fits-all model; each of these systems has its advantages and limitations.

Changes occurred from old monolithic local monopolies and new complex services. Baietti, Kingdom, and van Ginneken (2006) study WSS utilities and their sustainability. The paper constitutes a bundle of case studies in search of commonalities of well-run public utilities in Mexico. Kingdom, Baietti, and van Ginneken (2006) explore the need for public utilities reforms, and in 11 international case studies they identify characteristics of well-performing water utilites. Browder and others (2007) present a strategic framework and a set of recommendations to address the challenges faced by China's urban WSS utilities and the utilities' need to accelerate improvements. Drapa (2009) illustrates how European Union funding incentivized aggregation in Romania. The presentation highlights the importance of gaining access to foreign financing to incentivize agglomeration in Romania.

Asia has been the arena of several interventions to improve WSS results. Locussol, Fall, and Dickson (2009) provide practical guidance to World Bank teams advising on the design and implementation of reforms of urban WSS sectors. The report summarizes recommendations for designing and implementing reforms of WSS sectors. Agrawal (2009) analyzes performance agreements that could help bring about a change in the way services are delivered in a sustainable manner, through a change in the institutional arrangements and associated incentives, for the Indian context. Chiplunkar, Seetharam, and Tan edit a study (2012) that searches for concrete strategies for utilities to translate good principles into practice. Studying eight Asian cities, the study finds common elements for success in management, investment, human capital recruitment, and community engagement. Kayaga, Mugabi, and Kingdom (2013) examine institutional sustainability for urban water utilities and explore how its progress could be tracked in a conceptual discussion, applied to two cases in Southeast Asia. Ehrhardt, Ghandi and others (2015) present alternative public-private partnership models to meet the needs of infrastructure and management of WSS in middle-size cities in India. Also, Ehrhardt, Mugabi and Kingdom (2015) propose professionalization contracts to improve WSS management, including corporatization and pecuniary incentives for both staff and contractors in charge of training and systems in India.

In Latin America and Eastern Europe, decentralization processes have been implemented in recent decades, and they are examined now because of concerns about the result

of those reforms. The evolution of WSS in Latin America has been tracked for at least the last 100 years in order to identify and understand the drivers for urban sanitation and to learn the pertinent lessons for application elsewhere (Ringskog 2012). Danube Water Program (2013) describes the collaboration program for Cental and Eastern European countries and its activities, shares some early results of collaboration, presents findings and lessons derived from those activities, and describes its longer-term vision. Janssens (2013) makes a comprehensive presentation on aggregation that includes economic and institutional aspects. The presentation distinguishes pros and cons of aggregation, including the governance aspects. Danilenko and others (2014), using the global IBNET database, summarize water sector development in 2006-11. They conclude that municipal water coverage and performance have improved and withstood accelerated urbanization and the impacts of the triple crisis (fuel, food, and finance). Danube Water Program (2015) works with a subsample of 14 Central and Eastern European countries and calculates WUPI, which is an aggregate utility performance index based on 10 indicators. WUPI is calculated on the basis of the IBNET database. Looking at the subcomponents of WUPI, aggregations typically have a positive effect on management efficiency, which improves rather quickly after the aggregation. In contrast, coverage indicators seem to worsen a few years after aggregations.

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Chapter 7 What Institutional Issues Are Considered if Institutions Are Supposed Endogenous? (The Political Economy Approach)

The other strand of the institutional literature concerned with aggregation in WSS is related to institutions when they are obstacles to achieving policy goals. In other words, when institutions are supposed endogenous or when a political economy approach is adopted, some explanations of the difficulties to reforming WSS are identified. Therefore, to explore the transaction costs and the limits to aggregation, it is necessary to connect to the *new institutional economics* or *modern political economy*, which is the study of both politics and economics and specifically the interactions between them. This theoretical approach focuses on political power, how economic resources are distributed, and the resulting implications for development outcomes. Political economy analysis also considers interests, incentives, rent distribution, historical legacies, prior experiences with reforms, social trends, and how all of these factors affect or impede change (ECA 2016). As a body of knowledge, it has developed in two complementary parts, the first dealing predominantly with background conditions, the second with the mechanisms of governance.

The background conditions or institutional environment is the set of fundamental political, social, and legal ground rules that established the basis for activities of production, exchange, and distribution. Institutions can be defined as the rules of the game that structure incentives in human interaction. They encompass both informal constraints—such as sanctions, taboos, customs, traditions, and codes of conduct—and formal rules (North 1990).

An institutional arrangement between economic units, in turn, governs the ways in which these units can cooperate, compete, or both. Institutional arrangements are the mechanisms of governance (how the game is played) and they are what transaction cost economics has been predominantly concerned with (Williamson 1995, 2014). Governance is the means to infuse order, thereby to mitigate conflict and realize mutual gains. Transaction costs economics is an ex post governance construction, with emphasis on those transactions for which continuity (or breakdown) of the exchange relation is of special importance (Williamson 2009).

Water sector governance comprises the political, social, economic, and administrative systems to manage water resources and the delivery of water services (ECA 2016). Berg and Vargas (2008) suggest that there are three types or levels of institutions that are relevant in the governance framework: broad social structures (reflecting norms and customs), formal organizations (such as regulatory agencies and utilities), and support systems (like the civil service).

According to ECA (2016), good governance includes predictable, open, and enlightened policy-making, a professional and noncorrupt bureaucracy, the rule of law, transparency, and a strong civil society. Poor governance is characterized by arbitrary policy making, unaccountable bureaucracies, defective legal systems, abusive power, and corruption.

However, critics have noted that the concept of "good governance" is highly normative, a desirable but idealized state. A useful subsidiary concept is "good enough governance," comprising the minimal conditions needed or political development to occur (ECA 2016). To Grindle (2004), it means that interventions need to be questioned, prioritized, and made relevant to the conditions of individual countries. They need to be assessed in light of historical evidence, sequence, and timing. Because all feasible modes of organization are flawed, the feasibility stipulation precludes all appeals to the fiction of zero transaction costs (in any sector whatsoever—public, private, nonprofit, or other) from the very outset (Williamson 2009).

Transaction costs are those incurred in making an economic exchange of some sort (including search and information, bargaining, or policing and enforcement). The concept is useful to determine which particular institutions minimize the transaction costs of producing and distributing some good or service. From the perspective of institutional economics, one barrier to aggregation is transaction costs.

The vertical realm of the firm refers to the amount of stages or processes in the productive chain. The horizontal reach is related to how much of each good or service the (aggregated) firm produces, with respect to the whole market or how geographical markets are covered (Church and Ware 2000). Vertical integration is the sum of successive stages of one productive process. Some stages can be completed in house (aggregating) or can be subcontracted. The decision between in-house production, instead of subcontracting, relates to the benefits of the control into a hierarchy, against the enforcement of contracts in the market. In-house production implies investing in relationships and knowledge (Williamson 1995).

When it is relatively expensive to govern a contractual network between individual suppliers, each one satisfying a part of the whole—that is, when there are high transaction costs—activities are aggregated under hierarchies. In practice, there are different levels of vertical integration, founded in decisions of saving one or the other type of costs (productive, such as scale economies, or control) (Williamson 2009).

There are limits to economies of scale, given the nature of the firm as a place in which governance rests in hierarchies more than in transactions. That is a powerful fact that explains the coexistence of horizontal and vertical disintegrated industries, when pure considerations of economies of scale demand aggregation instead (Coase 1937, Williamson 1995). Although transaction costs demand attribution of responsibilities to the market (disaggregation), scale considerations suggest horizontal and vertical integration (aggregation). But each form of organization implies a different trade-off. An integrated firm can gain scale economies, but it increases the resort to hierarchies by opposition to market, and

transaction costs increase. On the contrary, a set of vertical and horizontally disintegrated firms can exchange between themsevles in the market without resorting to hierarchies at the cost of losing economies of scale.

Grossman and Hart (1986) argue that the relevant comparison is not between the nonintegrated outcome and the complete contract outcome but instead between a contract that allocates residual rights to one party and a contract that allocates them to another. Aggregation shifts the incentives for opportunistic and distortionary behavior, but it does not remove these incentives. Asset specificity is the transaction attribute that most determines the mode of economic organization (Williamson 1995).

Then, transaction cost economics involves a trade-off between the governance costs of aggregated vertically integrated firms and the transactions costs of nonintegrated ones. If an asset is highly specific in its functions, there is a tendency for its market to be small, therefore leading to limited competition and allowing one firm to take advantage and exploit another. This situation raises transaction costs and can favor the integration of firms whose internal governance costs are lower (Pollit and Steer 2012). Aggregation seems a matter of balance between external transaction costs and internal ones.

Fritz, Kaiser, and Levy (2009) systematize approaches to governance and political economy analysis and provide readily available orientation for World Bank task team leaders and teams. Politics and political economy influence whether and how reforms happen. The emphasis of the discussion is in good diagnosis and in a problem-driven approach. Andrews, Pritchett, and Woolcock (2012) point out that many reform initiatives in developing countries fail because they are merely "isomorphic mimicry," pretending to replicate in substance the institutions while they are simply facades.

Berg (2013) examines the key issue in designing an institutional system that reduces the likelihood of capture, corruption, and low levels of performance in the WSS utilities of developing countries. Sector regulation has to be embedded in an adequate and consistent institutional framework in order to have a positive impact on performance. Sector regulation by itself is no guarantee of performance improvements. O'Meally (2013) focuses on the issue of social accountability and context, arising out of a growing recognition that context is critical in shaping, making, and breaking social accountability interventions.

Batley and Harris (2014) do a comparative analysis that indicates the possibility of sharing experience and practices. They find that specific clusters of characteristics may influence the incentives and accountability of the actors in service provision. ECA (2016) seeks to establish the relationship between performance and institutions, policies and regulatory incentives. The study, an international literature review, points to the importance of issues addressed by the new institutional economy (importance of governance mechanisms, incentives, and the like) and the study forms caveats with respect to purely technocratic (normative) policy recommendations.

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