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Notes

Improving urban water supply in the United Kingdom: A literature review

Mejora del suministro de agua urbana en el Reino Unido: una revisión de la literatura

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Abstract

A key characteristic of the United Kingdom is universal access to water in urban and rural areas across three administrative regions: England and Wales; Scotland; and Northern Ireland. Urban supply has been excellent, but historically, there have been issues with water quality, charges, and efficiency due to ineffective institutional arrangements. This review looks at changes in these arrangements, the improvements made as to the result of new policies and improved oversight of providers – and important literature covering all this. No significant difference in the varying

approaches was noted, recommended improvements are mainly relating to pricing, efficiency, and customer service.

Keywords: England and Wales, Northern Ireland, urban water supply, sanitation services, Scotland, United Kingdom, water services.

Resumen

Una característica clave del Reino Unido es el acceso universal al agua en las zonas urbanas y rurales en tres regiones administrativas: Inglaterra y Gales; Escocia; e Irlanda del norte. El suministro urbano ha sido excelente, pero históricamente ha habido problemas con la calidad del agua, los cargos y la eficiencia debido a arreglos institucionales ineficaces. Esta revisión analiza los cambios en estos arreglos; las mejoras realizadas como resultado de nuevas políticas y una mejor supervisión de los proveedores, y literatura importante que cubre todo esto. No se observaron diferencias significativas en los diferentes enfoques; las mejoras recomendadas se relacionan principalmente con los precios, la eficiencia y el servicio al cliente.

Palabras clave: Inglaterra y Gales, Irlanda del Norte, suministro de agua urbana, servicios de saneamiento, Escocia, Reino Unido, servicios de agua.

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Introduction

This paper is a selective review of the literature existing about the current circumstances around urban water supply in the United Kingdom (UK). The author assesses the steps taken by the UK to improve urban water supply over the years; the results of public policies implemented; past and present administrative, bureaucratic, and policy failures in this respect; past and present problems negatively affecting the best possible supply of water to the public and private buildings in urban areas; and the most important literature available covering these steps.

Both urban and rural public water supply and sanitation (WSS) in the UK are distinguished by universal access and excellent service quality (OECD, 2016). Based on the elaboration of the latest United Nations (UN) data, as of Monday 20th April 2020, the population of the UK is 67 822 849. Of that figure, around 83.2 % (56 495 180) live in urban areas, while 16.8 % (11 327 669) live in rural areas (UN, 2020).

According to the Organisation for Economic Cooperation and Development (OECD) (OECD, 2016), there is no notable difference in WSS services between urban and rural areas in the UK. The high percentage of the population supplied with WSS services, on top of a strong

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regulatory and legislative framework, means that small towns and rural settlements can benefit from the same level of WSS services as urban areas.

Although somewhere very close to 100 % of the urban and rural populations in the UK have access to improved water supply under normal circumstances, some operational issues do surface now and then, so the UK's approach to water supply management doesn't manage to escape criticism completely.

Before moving forwards, it is crucial to note that the UK is a unitary parliamentary democracy, with different constituent parts (or administrative divisions): England and Wales (E&W); Scotland; and Northern Ireland (NI). Bogdanor (2001) states that, while each is ruled by a single entity (a central government), other than England, they all have their devolved governments, each with varying powers delegated by the Parliament of the UK.

For this reason, the UK's water sector differs from that in many other developed countries. Atkinson, Penning-Rowell, and Parker (1985) note that there exists a diversity of institutional arrangements between these distinct divisions, meaning the supply of WSS services in each is handled in varying ways. In E&W, the sector is fully privatized, whereas, in NI and Scotland, a national operator in each country provides water services: Northern Ireland Water for NI and Scottish Water for Scotland (OECD, 2016).

This diversity of institutional arrangements does not amount to a problematic degree of fragmentation, but as will be discussed, it is the

fragmentation of institutional responsibilities which has been most problematic to water supply in the past, thus the need for subsequent improvements in this respect. That said, there has long been a shared regulatory and legislative framework in place concerning WSS services, and cooperation and coordination between different stakeholders within and between regions have always been sufficient (OECD, 2016).

In the case of the UK, the success of the WSS sector has as much to do with its complex history of institutional arrangements as it does the decisions made within those institutions. For that reason, this paper will assess the varying arrangements, changes in those arrangements over the years, and the literature available on such changes, in three defined sections: E&W; Scotland; and NI.

The state of affairs in each is relatively similar, but there are some minor differences, so comparisons will be made between all three countries, followed by an overall assessment of which has developed the most effective approach to date.

Methodology

The difference in institutional arrangements between E&W, Scotland, and NI, in addition to the varying stages of water services and quality

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development within these countries, led the author to define different periods for assessing literature pertinent to each in this selective review. This literature is mostly academic material, including textbooks and journal articles, and official documents, such as whitepapers, reports, and so on.

All three regions are characterized by distinct historic periods, in addition to a contemporary period. This review is concerned with improvements made across both the historical periods and the contemporary periods. However, it should be noted that the contemporary improvements have been made within official frameworks still in place today and are how E&W, Scotland, and NI managed to arrive at the stage of universal access and generally excellent service and water quality they enjoy today.

For E&W, Hassan (2008) outlines the historical period, beginning with the de-fragmentation of the water sector, as 1979-1989, with the contemporary period, beginning with the privatization of water companies, falling between 1989-2002. For Scotland, Agthe, Billings, and Buras (2003) outline the historical period, beginning with the provision of water by local authorities, as 1945-2002, with the contemporary period, beginning with the creation of a single water company (Scottish Water), falling between 2002-2020. And for NI, Brandt, Johnson, Elphinston, and Ratnayaka (2017) outline the historical period, beginning with the transfer of responsibility for providing water services to the Department of the Environment, as 1973 to 2007, with the contemporary period, beginning with the creations of its own government-owned water company (Northern Ireland Water Limited), falling between 2007-2020.

Tools, searches, and data collection

The PRISMA guidelines were used as the framework for this review, with the PRISMA Statement (2017) followed alongside practical suggestions for reporting offered by Liberati *et al*. (2009). All research was sourced during electronic searches on various databases like Web of Science, HERO, and Science Direct, as well as Google Scholar and Google Books, and basic online searches were also conducted to find official government documents. The search terms were: 'water supply,' 'urban water supply,' water access,' 'urban water access' 'water provision' or 'urban water provision' with any of these added on the end: United Kingdom, Northern Ireland, Scotland, England and Wales.

Results

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Using the PRISMA flow chart, a total of 78 documents were identified. 9 were duplicates and were subsequently removed. The titles, keywords, and abstracts of the remaining 69 were screened, and 12 were excluded. The full texts of the remaining 57 documents were assessed for eligibility through a semi-close reading, and a further 16 were excluded. Overall, 41 main documents have been included as seen in Table 1.

Table 1. Literature analyzed.

England and Wales (E&W) (1973-1989)			
Authors	**Title**	**Type**	**Description**
Howsam and Carter (1996)	*Water policy: Allocation and management in practice*	Textbook	Discusses the point at which regulators and the regulated were truly separated in E&W
Bakker (2003)	*An uncooperative commodity: Privatizing water in England and Wales*	Textbook	Looks at the controversial topic of water privatization in E&W, as well as its uniqueness and results
Dore, Kushner, and	*Privatization of water in the UK and*	Journal article	Assesses whether privatization of the water industry in

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Zumer (2004)	*France – What can we learn?*		E&W benefitted supply
Hassan (2008)	*A history of water in modern England and Wales*	Textbook	Details the historical development of the institutional arrangements for water in E&W
England and Wales (E&W) (1989-2020)			
UK Parliament (2006)	*Science and technology – Eighth report*	Report	Discusses the difference in water scarcity across E&W
Herrington (2007)	*Waste not, want not? Water tariffs for sustainability*	Report	Evaluated charging for water in E&W, and also discusses the controversial shift to metering
Ofwat (2008)	*Service and delivery – Performance of the Water Companies in England and Wales 2007-08*	Report	An assessment by the water regulator of the performance of the many water providers in E&W
EA (2008)	*The costs & benefits of moving to*	Report	A report explaining why we should seek

	full water metering		to increase the numbered of households metered in E&W
OECD (2011)	*Water Governance in OECD Countries: A Multilevel Approach*	Report	Lists all the relevant bodies in the water sector in E&W
Kendon, Marsh, and Parry (2013)	*The 2010-2012 drought in England and Wales*	Journal article	Reviews the development, severity, and impacts of the drought
UK Government (2015)	*2010 to 2015 government policy: water and sewerage services*	Policy document	Details, why water systems need to be updated as the population of E&W, grows
Lauruschkus and Rehrberg (2015)	*Comparison of European water and wastewater prices*	Textbook	Looks at the VEWA study comparing water supply in various European Union (EU) countries, including E&W

Brandt *et al*. (2017)	*Twort's water supply*	Textbook	Discusses the fragmentation of the water sector in E&W
OECD (2016)	*Sustainable business models for water supply and sanitation*	Report	Discusses how to finance and maintain better WSS systems in small towns and rural areas
Rieu-Clarke, Allan, and Hendry (2017)	*Routledge handbook of water law and policy*	Textbook	Equates a rise in tariffs with improved WSS service quality
Ofwat (2019)	*Service and delivery report: Ofwat*	Report	Report from the water regulator in E&W of the 2015-2020 price control period
DWI (2020)	*Drinking-water quality in England and Wales as the EU exits from the European Union*	Position paper	Explains water quality won't change once the UK exits the EU, and that it will be under new regulations

Ofwat (2020b)	*Ofwat's forward programme 2020-21*	Report	Report from the water regulator in E&W detailing its ambitions for the next year
Scotland (1945-2002)			
Sewell, Coppock, and Pitkethly (1985)	*Institutional innovation in water management: The Scottish experience*	Textbook	Looks at the Scottish Water experience over the years
Bailey (1995)	*Public sector economics: Theory, policy, and practice*	Textbook	Discusses the refusal of the Scottish people to allow privatization of their water industry
Ironside and Seifert (2000)	*Facing up to Thatcherism: The history of NALGO, 1979-1993*	Textbook	Again, discusses the refusal of the Scottish people to allow privatization of their water industry
Agthe *et al*. (2003)	*Managing Urban Water Supply*	Textbook	Details the historical development of the institutional

			arrangements for water in Scotland
Clarke and Pitelis (2005)	*The political economy of privatization*	Textbook	Once again, discusses the refusal of the Scottish people to allow privatization of their water industry
Oliver, Prosser, and Rawlings (2010)	*The regulatory state: Constitutional implications*	Textbook	Looks at progress in the institutional arrangements for water in Scotland
Hendry (2015)	*Frameworks for water law reform*	Textbook	Again, looks at progress in the institutional arrangements for water in Scotland
Gunawansa and Bhullar (2013)	*Water Governance: An evaluation of alternative architectures*	Textbook	Again, details the historical development of the institutional arrangements for water in Scotland
Scotland (2002-2020)			

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Scottish Water (2015)	*Sustainability report 2015*	Report	Details how many people, households and businesses Scotland's provider supplies water to and the assets it is responsible for
Decker (2015)	*Modern economic regulation: An introduction to theory and practice*	Textbook	Explores the opening up of WSS services in Scotland to competition
Scotland on Tap (2020)	*Competition in the water industry*	Report	Considers the improvements since Scotland opened its WSS services to competition
WICS (2020a)	*Our work*	Website	Sets out the responsibilities of Scotland's water regulator
WICS (2020b)	*Price-setting 2015-2021*	Website	Details the water regulator for Scotland's current plan for price setting

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Northern Ireland (NI) (1973-2007)			
Carter y Parker (1989)	*Contemporary perspectives on a land and its people*	Textbook	Details the historical development of the institutional arrangements for water in NI
Schouten (2009)	*Strategy and performance of water supply and sanitation providers. Effects of two decades of neo-liberalism*	Textbook	Details the historical development of the institutional arrangements for water in NI
Birrell (2012)	*Comparing devolved governance*	Textbook	Details the creation of Northern Ireland Water
Northern Ireland (NI) (2007-2020)			
UREGNI (2008)	*2007/2008 Cost and performance report. An assessment of Northern Ireland water's cost and*	Report	Assesses the improvements made by NI water to close its performance gap with providers in E&W

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	performance in 2007/2008		
Adeyeye (2014)	*Water efficiency in buildings: Theory and practice*	Textbook	Looks at the changes to charging for water in NI
UREGNI (2018)	*Water and sewerage services. Cost and performance report for 2016-17*	Report	Assesses the improvements made by NI water to close its performance gap with providers in E&W
Northern Ireland Water (2019)	*Delivering what matters: annual report & accounts 2018/19*	Report	A strategic report explaining how NI supplies its citizens with water
Northern Ireland Water (2020c)	*Price control*	Website	Discusses the price control process used by NI's provider
NI Government (2018)	*Drinking-water quality remains high across NI*	Website	Looks at the high quality of drinking water in NI, taking into account a report by DWI

Source: Own elaboration.

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Discussion

England and Wales (E&W)

According to Hassan (2008), in E&W, there are three defined periods of water services provision: (1) local government service provision (before 1973); (2) public regional companies (1973-1989); and (3) privatization (1989 onwards). Even though the water supply in the UK has been excellent for a long time, each of these periods has affected the water supply in E&W in varying ways.

Before 1973, the sector was highly fragmented and in need of a considerable overhaul. Water was supplied by organizations known as "water undertakings," which had administrative boundaries comparable to those of local governments (Brandt *et al*., 2017). Until the 1950s, there were over a thousand of these water undertakings, but by the beginning of the 1970s, they were slowly reduced in number to 198 to realize economies of scale (Brandt *et al*., 2017). 64 of these were operated by local authorities (LAs); 101 by the board that was comprised of more than

one LAs; and 33 were statutory water companies in the private sector, many of which had been around since Queen Victoria's reign as the British sovereign (Gourvish & O'Day, 1988). This move had the impact of making rural water supply more consistent across the country.

By way of the Water Act 1973, whose key aim was to reorganize the water, sewage, and river management sector in E&W (UK Government, 2020), the government at the time set up 10 public Regional Water Authorities (RWAs) so they were able to achieve even greater economies of scale than they managed to accomplish by reducing the number of water undertakings previously (Hassan, 2008), and so they could make water supply even more consistent. The 1979 Act also technically allowed for the contracting out of WSS services to LAs.

The statutory water companies in the private sector, which supplied water to a quarter of the population at the time (Foreman-Peck, 2003), escaped a similar reorganization and continued as before (Gourvish & O'Day, 1988). The water sector in E&W saw its biggest change in history when Margaret Thatcher was elected Prime Minister in 1979 – a change that remains today. At that stage, WSS services stayed in the public domain for a while, but it wasn't long before Thatcher's Conservative government pushed them in a more commercial direction, with an increase in tariffs (Dore *et al*., 2004). Other elements of the controversial Prime Minister's strategy simply served to further centralize the sector (Dore *et al*., 2004) – a polarizing outcome.

In 1989, Thatcher's government went one step further, privatizing the 10 public RWAs established in the 70s – although their functions

related to water resources management remained public (Bakker, 2003). At the same time, Ofwat, the Water Services Regulation Authority, was established as the government body responsible for economically regulating the privatized water industry in E&W and comprehensively monitoring water services across the country, creating a clear separation between the regulated and the regulators (Howsam & Carter, 1996).

Ofwat operates independently of several other bodies with differing responsibilities, including: (1) the government's Department of Environment, Food and Rural Affairs (DEFRA), established in 2001 and responsible for policy in WSS; (2) the EA, a non-departmental public body sponsored by DEFRA, established in 1995 and responsible for environmental regulation and the protection and enhancement of the environment in England (and until 2013, also Wales); and (3) the Drinking Water Inspectorate (DWI), a section of DEFRA, established in 1990 and responsible for regulating the public water supply companies in E&W, as well as drinking water quality (OECD, 2011).

In E&W, the following WSS companies now exist Anglian Water; Dŵr Cymru Welsh Water; Northumbrian Water; Severn Trent Water; Southern Water; South West Water; Thames Water; United Utilities; Wessex Water; Yorkshire Water; and Hafren Dyfrdwy). The following mostly smaller "water only" companies also exist: Affinity Water; Albion Water; Bournemouth Water; Bristol Water; Cambridge Water Company; Cholderton and District Water Company; Essex and Suffolk Water; Hartlepool Water; Portsmouth Water; South East Water; Sutton and East Surrey Water; and Youlgrave Waterworks (Ofwat, 2016).

Although privatization acted as the foundation of today's water sector in E&W, since then, there has been a substantial increase in water tariffs in rural areas, and they are now among the highest in the world. Essentially, this means improved access comes at a cost. However, in 2020, it was announced that the average annual WSS bill in E&W would fall by £17 (4 %) in 2020/2021 from £413.33 to £396.60, although this will vary depending on the provider (Water UK, 2020). Taking inflation into account, this means average bills are around the same level they were a decade ago, in contrast with the significant increases in bills in other areas, including electric energy (Water UK, 2020).

Ofwat (2020a) says that in E&W metered connections are charged at a volumetric rate, while unmetered connections are charged at a flat rate based on the rateable value of the property. The rateable value system was intended as a cross-subsidy from wealthier to poorer households, but it failed to work in that way (Ofwat, 2020c). With meters in more highly rated households, flat rates for unmetered customers increase to make up for lost revenue, and so the system develops glaring holes (Ofwat, 2020c). An independent review in 2009 recommended a package of assistance to ensure the switch to metering didn't cause financial hardships to poorer households (Walker, 2009), but in 2011, the Fairness on Tap coalition – comprised of 12 leading environmental organizations – still believed the entire system of water charging remained unfair, with poorer households subsidizing the water bills of the more affluent up to the sum of £400 million each year (WWF, 2011).

Water tariffs are regulated by Ofwat, which sets maximum caps for tariff changes over five-year periods. Different review periods have

featured varying rules. For example, between 2000-2007, Ofwat mandated an average annual reduction of tariffs of 1.6 %, but between 2006–2010, it allowed an average annual increase of 4.2 % (Herrington, 2007). Both tariff and metering rates are uniform in the entire service area, with no difference between rural and urban areas, but there are some differences in rates depending on the zone (OECD, 2016). Tariff increases have meant the cost of water supply in the UK, overall, is considerably higher than in the majority of other key countries in the EU, but according to both the aforementioned water companies and Ofwat, such increases run parallel to improvements in service quality over the same period (Rieu-Clarke *et al*., 2017). Ofwat statistics from 2019 show that, as a result, the past four decades have witnessed a decline in the number of unplanned interruptions, properties suffering from low pressure; and public complaints not being answered with haste (Ofwat, 2019).

In addition to universal access, the quality of drinking water in the UK is also universally high (Ballance & Taylor, 2005). That said, there have been isolated incidents where quality has dropped to unusually low levels, one of which was in June 2008, when around 250 000 people in Northamptonshire (just over 1/3 of the total population of the mostly rural East Midlands county) were told they should boil tap water before drinking (BBC, 2008). The warning followed routine tests by Anglian Water when it found that a bug called *cryptosporidium* – which causes stomach upsets and diarrhea among other symptoms – had contaminated supplies (BBC, 2008).

Before Brexit (the UK's famous exit from the EU), the former's drinking water standards were determined by the latter. While each EU member state is responsible for its water WSS services, union-wide policies are in effect, and each member state has enacted national legislation following these. The Water Supply (Water Quality) Regulations 2016 (England) (as amended) and the Water Supply (Water Quality) Regulations 2018 (Wales), made under the Water Industry Act 1991, set out the regulatory requirements for the quality of public drinking water supplies. These standards were originally transposed from a European Directive, the European Council Directive 98/83/EC (more commonly known as the 'Drinking Water Directive') (European Commission, 2020). In response to concerns as to what might come of drinking water standards in the UK after Brexit, the DWI (2020) states that these standards remain unaffected by the transition. The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019, came into force at the end of January 2020, ensuring that all relevant drinking water legislation continues to operate effectively in the UK (DWI, 2020).

In 2009, the European Environmental Agency (EEA) found that one European in ten suffers a situation of water scarcity. While it is easy to compare UK water tariff prices with those in other EU countries – or any other countries, for that matter – an accurate comparison of service quality between the UK and other countries is, at best, difficult, and at worst, close to impossible. The reason for this is that many countries worldwide do not release water service quality data as thorough as that published by Ofwat (EEA, 2009).

Even though the physical assets of private WSS service companies in E&W are extensive, the availability of water across E&W to satisfy the needs of citizens varies enormously from region to region, season to season, and year to year (UK Parliament, 2006). Parts of the country have plentiful supplies of water, while water is scarce in others, especially Eastern and Southeastern England, prone to seasonal droughts and often be drier than parts of the hottest countries in the world (Kendon *et al*., 2013). This is a situation only worsened by climate change (EA, 2006). Even so, these seasonal droughts do not last long on average, and paired with the most efficient management of water resources, do not pose a substantial threat as they do in other European countries – Italy and Spain, for instance (OECD, 2016). The fact that water is scarce in some regions of the UK is often the basis of arguments for various new measures, one of which is charging water companies more for abstracting water from the rivers and aquifers in drier parts of the country, with cheaper rates where water is more abundant and higher rates during droughts (Kendon *et al*., 2013).

Another measure necessitated by water scarcity is the shift from voluntary to compulsory metering. As mentioned previously, most users in E&W are not billed on a volumetric basis (Ofwat, 2020a), and thus have no financial incentive to conserve water (WWF, 2011). This could explain why over the past three decades efforts have been made to meter an increasing number of households. According to the EA (2008), domestic water metering can lead to a 5-15 % reduction in household water use, with larger peak savings. This is why the Fairness on Tap coalition, for example, requested the government install water meters in a minimum

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of 80 % of households in England by 2020 (WWF, 2011). The EA (2008) also made a similar call, saying they would like to see 75 % of households metered by 2025. By 2014, the number of households with a water meter increased from 30 to 50 % (Christie, 2014), and as of 2020, the target of 80 % has been met (Ofwat, 2020a). Compulsory metering is highly controversial though, and as mentioned previously, many consumer groups have suggested it penalizes poorer families, with lots of children, and the disabled, who use more water (WWF, 2011; Walker, 2009).

A major criticism levied against water companies, often by organizations that oppose water services privatization, is around cutting off services for non-payment of bills – a move that can put public health in jeopardy (Gudorf & Hutchingson, 2010). However, when it was introduced, the Water Industry Act 1999 banned the disconnection of WSS services for non-payment by domestic customers. In 2020, it was announced that, on top of reductions in average bills, customers who find it difficult to pay for WSS services would get more help (Water UK, 2020). Water companies plan to almost double the number of people getting help with their bills every year, up from 760,000 customers now to at least 1.4 million by 2025 (Water UK, 2020). Help for such customers comes in several ways, one of which is through social tariffs. These are special discounts for people on a low income or receiving specific benefits (Water UK, 2020). Each company has its support scheme, and some also run or assist charities that provide additional help, such as Water Sure, which enables water companies to cap bills for low-income customers who use a lot of water for essential family or health reasons (Water UK, 2020).

A key issue around the supply of WSS services in E&W relates to efficiency or, in other words, water losses through leakages. The VEWA study found that average water losses in the distribution network in E&W have been estimated at 19 %, which is lower than in France, Italy, and Germany (Lauruschkus & Rehberg, 2015). Leakages in E&W have declined over the past two decades, albeit with fluctuations. According to the EA (2006), one significant decline, by a third overall, was between 1995 and 2006 alone. Many companies in all parts of the UK, and not just E&W, have reduced their water losses to the economic level of leakage because they managed to detect and address the most obvious causes of leakage (Ofwat, 2008). However, problems in this sense persist. The OECD (2016) states that the condition of the infrastructure in E&W is far from optimal, requiring significant rehabilitation to reduce water losses in small towns, not only in small towns and rural areas but also in many urban areas.

Scotland

Unlike in E&W, WSS services in Scotland were never privatized (Agthe *et al*., 2003). Before 1945, there were 210 separate organizations involved in drinking water supply in Scotland, much of which were rural, but there was no mandatory requirement for such provision until 1946 when LAs

were required to provide a water supply to their communities (Agthe *et al*., 2003).

The first key justification for the shift in the system took place as a result of the Water (Scotland) Act 1967, which created 13 Regional Water Boards, drawing together all the smaller suppliers (Smith, 1972). Although these were successful in technical terms, funding remained a serious issue (Countryside Commission for Scotland, 1971). For this reason, and because the price of supplying potable water in new ways often fell outside of the abilities of LAs, the Central Scotland Water Development Board was also created by the 1967 Act, and they were given this responsibility (Cook, 2017).

When the Local Government (Scotland) Act 1973 was passed, bigger regions in the country were created, and both water supply and a range of other local services were placed under the responsibility of nine regional councils of Highland, Grampian, Tayside, Fife, Lothian, Borders, Central, Strathclyde, and Dumfries and Galloway (Sewell *et al*., 1985). A tenth Island Area included Shetland, Orkney, and the Western Isles, but that region carried on acting on an independent basis (Sewell *et al*., 1985).

Unlike in E&W, the water sector assets were owned by LAs, many of which were not controlled by the government when water was privatized in E&W in 1989 (Gunawansa & Bhullar, 2013). However, when the Local Government etc. (Scotland) Act 1994 came into force, all of the WSS responsibilities of the councils were blended by Thatcher's government into three RWAs – the North of Scotland Water Authority; the

West of Scotland Water Authority; and the East of Scotland Water Authority (Hendry, 2015). The key rationalization of this was preparing for water services to be privatized as they had been in E&W, thus homogenizing the water industries in the UK's different countries (Oliver *et al*., 2010). The proposals were met with initial public bewilderment, and even though subsequent advertising campaigns designed to alter such perceptions attracted a good deal of attention, the general consensus was that privatization had already gone as far as it should across the UK (Clarke & Pitelis, 2005).

According to Bailey (1995), in 1994, Strathclyde Regional Council held an unofficial postal referendum on whether control of WSS services should be privatized, with 97 % of 1.2 million respondents voting against the proposals (Hassan, 2008). On top of this, there was a broader *Save Scotland's Water* campaign, whose slogan was "Turn the Tide (Ironside & Seifert, 2000). Ultimately, in the face of overwhelming public outcry, Scotland's water industry remained in the public sector (Bailey, 1995). Agthe *et al*. (2003) argue the Scots were simply unprepared to go down the same privatization path as their southern neighbour, primarily because they were concerned about the commercialization of a natural monopoly.

In 2002, the Scottish Parliament, which is the legislature of Scotland, passed the Water Industry (Scotland) Act 2002, serving to merge the three providers (the North of Scotland Water Authority, the West of Scotland Water Authority, and the East of Scotland Water Authority) into the one single provider that still exists today: Scottish water (Oliver *et al*., 2010). In their 2015 sustainability report, Scottish

Water stated that it provides drinking water to 2.46 million households and 150 000 businesses in Scotland, supplying 1.34 billion litres of clean and fresh drinking water every day. The company also claims that the quality of drinking water received at customers' taps is at an all-time high and that they delivered one of the largest investments programs in the UK water industry between 2010 and 2015 (Scottish Water, 2015).

The economic water industry regulator, and thus the regulator of Scottish Water, is the WICS, established in 2005 (Marques, 2010). The WICS is under a statutory duty to "promote the interests of WSS customers in Scotland by making sure that householders and businesses receive a high-quality service and value for money by setting prices, monitoring Scottish Water's performance and facilitating competition in the water industry" (WICS, 2020a). According to WICS (2020b), its price-setting process occurs in blocks of six years and involves setting prices for WSS services at "the lowest reasonable overall cost." It does so by benchmarking with the private water companies in E&W listed earlier (WICS, 2020b). WICS gives Scottish Water targets to meet and monitors performance with regards to some factors —such as customer service, costs, and leakage— to ensure the company actively strives to meet its targets (Owen, 2018). It assesses Scottish Water's service quality using an Overall Performance Assessment (OPA) index, considering various things, including unplanned supply interruptions, pressure, drinking water quality, responses to written complaints, and ease of telephone contact (Owen, 2018).

The contemporary legislative setup in Scotland has made Scottish Water much more efficient over the years. For instance, Scottish Water's

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OPA score was increased from a mere 162 in 2003–2004 to an impressive 400 in 2014–2015 (Water Commission, 2015). Moreover, the efforts of WICS have helped to keep Scottish Water's bills low. Average household water bills in lower in Scotland than they are in E&W. In 2019/2020, the average Combined Services charge (the charges covering water supply and wastewater collection services) was £369, or around £1 per day (Scottish Water, 2020). However, as with E&W (and NI, discussed shortly), there is still significant room for improvement in terms of efficiency, but such improvement would require higher water tariff rates, which could be blocked by WICS (OECD, 2016).

While combined services remain in the public sector, unlike in E&W, WICS is also responsible for ensuring the possibility of "retail services," —including metering, billing, and customer service— in Scotland's water sector (Decker, 2015). In 2008, Scotland became the first country in not just the UK, but also the world, to facilitate competition in WSS services for non-household customers —under the Water Services, etc. (Scotland) Act 2005— including public, not-for-profit, and business organizations (Estache, 2011). This means such organizations can select their provider. WICS licenses all participants operating in the retail WSS services market, which purchase water at around three times less than the retail price and then trying to sell it at the retail price to customers (Decker, 2015). Since the introduction of such competition, there have been significant improvements for customers, with more options and better services (Scotland on Tap, 2020).

Northern Ireland (NI)

Before 1973, water services in NI in any urban and rural areas outside the capital city of Belfast were the responsibility of LA's (Schouten, 2009). After that point, responsibility for providing water services in NI was transferred to the Department of the Environment (DOE), which was a department in the Northern Ireland Executive (the devolved government of NI and an administrative branch of the legislature, the Northern Ireland Assembly, referred to in the UK and NI simply as Stormont) (Carter & Parker, 1989). Within the DOE, a new Water Executive was given responsibility for the management and administration of water services, and when water companies were privatized in E&W in 1989, water services remained public in NI just as they did in Scotland (Van-Der-Beken, 2009). In 1996, the Water Executive became an executive agency, the Northern Ireland Water Service, and, in 1999, responsibility for water transferred to the Department for Regional Development, which has been called the Department for Infrastructure (DfI) since May 2016.

Historically, unlike in E&W and Scotland, domestic water services in NI have been provided without charges to customers, with only non-household customers receiving water bills (Adeyeye, 2014). However, in December 2002 it was announced that this would change when NI's water services became self-financing, a move that included significant reforms

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like the introduction of meters in new homes and WSS charges for domestic customers (Adeyeye, 2014). This plan was included in the Water and Sewerage Services (Northern Ireland) Order 2006, but a 2007 campaign against the shift killed it (Adeyeye, 2014).

At the same time, Northern Ireland Water Limited (a public company operating under company legislation) was created (Birrell, 2012). The company now sits as an Agency within the DfI, providing 575 million litres of clean water a day for 680 000 households and businesses across NI, and for over 1.8 million people (Northern Ireland Water, 2020a). Of that 1.8 million, around 37 % (666 000) live in urban areas, while the other 63 % (1 134 000) live in rural areas (NISRA, 2020). Across the entire country, the company is responsible for 27 000 km of water mains, as well as 23 water treatment works and 355 pumping stations (Northern Ireland Water, 2019). It costs around £460 million each year to deliver water services across NI, but Northern Ireland Water has been historically underfunded, resulting in curbs to economic development affecting over 70 towns throughout the province. The organization has stated it requires £2.5 billion for its next funding period from 2021-2027 (Madden, 2020).

In 2007, the same year Northern Ireland water was established as NI's single water provider, a system of economic regulation was set up, similar to the existing system in E&W with Ofwat, and placed under the responsibility of the Northern Ireland Authority for Utility Regulation (Adeyeye, 2014). Performance benchmarking highlighted that there was a considerable gap in performance between NI and E&W in many respects,

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including the quality of drinking water, leakage, customer service, and efficiency (UREGNI, 2008).

In the few years following the report that came after that benchmarking exercise, the quality of drinking water in NI steadily improved, as did levels of efficiency, especially compared to other water utilities, including Scottish Water and the many providers in E&W (Agthe *et al*., 2003). Since then water quality has improved further, and they remain high across NI (NI Government, 2018). According to a recent report by DWI, overall compliance in NI in 2017 was 99.88 %, but because NI still faces significant challenges, good operational practice, risk management and investment in infrastructure must be applied at all stages of water provision (NI Government, 2018). Customer satisfaction has also improved, raising from an OPA of 98 in 2007/2008 to 228 in 2016/17 (UREGNI, 2018). By that point, Northern Ireland Water had invested close to £2 billion in NI's WSS infrastructure since its formation, managing to reduce the efficiency gap with the leading water utilities in E&W by more than half (Northern Ireland Water, 2020a).

Water charges in NI are paid through the domestic rates system (Northern Ireland Water, 2020b), which is the local government's domestic property taxation in the country. Rates, set annually based on the capital value of a residential property, consist of two components – (1) a regional rate set by Stormont, and (2) a district rate set by LAs – which is in contrast to the non-domestic rates on businesses, which are based on rental value (Northern Ireland Water, 2020b).

Northern Ireland Water is now in the fifth year of its six-year price control, PC15 which runs from 2015–2021 (Northern Ireland Water, 2020c). Through this period, the organization's goal has been to build on the progress made since 2007, and 60 % of its investment has been targeted at maintaining and improving high levels of service (Northern Ireland Water, 2020c). Key targets include keeping drinking water quality high, reducing leakage, improving the measurement of customer satisfaction, improving water pressure, and decreasing supply interruptions (Northern Ireland Water, 2020c).

As with E&W and Scotland, efficiency is not yet perfect, but again, getting the infrastructure up to scratch the minimize water losses in both urban and rural areas would entail increased water tariff rates, which would likely be met with criticism from the Northern Ireland Authority for Utility Regulation (OECD, 2016).

Conclusions

The UK enjoys universal access to water, and about access in urban and rural areas, there is no significant distinction between the two. This leaves very little room for improvement in this respect. However, each of the UK's constituting parts (that is, E&W, Scotland, and NI) has its

institutional arrangements for the supply of water to their citizens, and these varying arrangements, both historically and recently, have led to several areas that saw significant improvements over the years, and in which further improvements are required moving into the future.

In E&W, the water industry has been privatized, a move that was met with much public criticism. That said, when compared with the water industries in Scotland and NI, which, by way of public demand, remain in the public sector – although, in NI, the single provider (Northern Ireland water) operates under company legislation – privatization does not appear to have held the industry back. It has led to substantial improvements in many areas, including pricing, efficiency (leakages), and water quality – as is also the case with the public approach in Scotland and NI. This can be explained by the fact that, although the different regions have different providers – just one each in NI and Scotland and several in E&W – they are under similar economic regulation. Despite this, and universal access to water across the UK, there is still scope for improvement in each of these areas across not only E&W but also Scotland and NI.

Water quality

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Water quality across the UK is excellent, affected only by infrequent incidents affecting public health. The majority of these occur in E&W, but there have been some in Scotland and NI. The UK's water quality used to fall under EU legislation, and while there were concerns quality could diminish after Brexit in January 2020, the DWI – referring to Scotland and NI as well as E&W – reassured the public quality will remain unaffected under British responsibility. Water quality in Scotland is at an all-time high, but in NI, although high, there is room for improvement.

Efficiency

Evidence suggests that water efficiency across the UK is also excellent, with fewer leakages in E&W, Scotland, and NI than in many European countries. Leakages in E&W have decreased over the years, despite fluctuations. To get a bigger picture with regards to E&W in specific, it would be ideal to compare efficiency figures between countries with Ofwat figures, but unfortunately, the body does not use percentage figures when it assesses leakage levels, and it assesses only leakage rather than broader losses – thus, it is difficult to make such a comparison. In all three countries, companies have reduced water losses to the economic level of leakage, but water losses do still occur. For that reason, the UK's water infrastructure requires significant rehabilitation, but doing so may

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increase water tariffs, which would be less than ideal. Water meters are widely seen as a measure for increasing efficiency, but they are highly controversial, with many arguing they serve to disadvantage poorer households. They have even been called a tax on family life.

Pricing

Water charges have varied over the years in all three countries, where WSS services are charged together – via the council tax system in E&W and Scotland, and via the equivalent domestic rates system in NI. In E&W, tariffs have increased over the years, but they have remained consistent for years now. They do, however, vary depending on which of the many providers a customer uses. At present, the average WSS bill is lowest in Scotland, amounting to around £1 per day, but this is not significantly lower than in E&W and NI. Providers used to be able to cut off services to those who cannot pay, but this has since become illegal, and there are now various assistance schemes for poorer households.

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