Why is Germany 30 years ahead of England?

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Abstract: The question is asked why Germany in the field of water management is 30 years ahead of England? In terms of the delivery of integrated urban water management technologies, Germany is indeed 20 to 30 years in advance of England. The comparison is made on 12 dimensions and illustrates how dramatic the effect of governance can be in the adoption of innovations in water management and hence the shift to sustainable development.

Keywords: integrated urban water management; adaptive management paradigm shift; Germany; UK.

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1 Introduction

Sustainable development means doing more with less and integrated water management is seen as a means to this end. Key questions are therefore; more 'what', 'less' what and 'how'? Conventionally, integration is seen as a necessary part of the answer in water management to the 'how' question in the form of integrated water resource management (GWP, 2000). The focus in integrated water resource management, and its child, integrated urban water management, has been upon the integration of physical systems. The constraints upon integration here are the laws of physics, chemistry and biology. But management is done by people through social relationships. In turn, implementing sustainable development requires actions on the ground; changes in behaviour by

someone, such as an organisation of people or a household. Therefore, the key relationship is the reflective relationship between technologies and social relationships: a technology either reflects an existing set of social relationships or implies a necessary set of social relationships. How we take decisions, what decisions we take, how we implement those decisions, and how we pay for those actions are all social relationship issues (Davies, 2007; Worthington, 2003).

Technologies and social relationships are thus, in this context, dualities in the sense of the Daoist concept of yin and yang. That is, of two conflicting but complementary opposites, each of which contains the seed of the other, which have both to be brought to a unity and equally where each can only be understood in the context of the other.

Social relationships in turn are both chosen, and determined. A key component of that set of social relationships which are labelled as governance (Hooper, 2005; Kooiman, 2003; Moench et al., 2003; UNDP, 1997; World Bank, 1991) is power. Power has both a functional aspect and a normative aspect. Since power is the capacity to induce change (Lukes, 1979), shifting to integrated urban water management requires the appropriate set of powers, appropriately distributed. Conversely, the question of who ought to have what form of power, to what extent, and for what purposes is a political, moral or religious question. In turn, since governance is about who should have what forms of power, definitions of governance (Moretto, 2005) are necessarily and inevitably contested. Claims as to what would constitute 'good' governance are obviously even more so contested and typically confound political or ideological claims with functional ones.

However, a second duality is between power and rules. Institutions have been classically defined (North, 1990) as sets of informal or formal systems of rules. The function of rules is to delimit power but equally a form of power is the ability to set rules for others. Thus, in the traditional sense, a state could be defined as that which had the capacity to make and enforce rules for everyone else and all other bodies within that specified geographical area.

2 Power

Since power is the ability to induce change, anything which can induce change in something or someone is functionally power. Therefore, a condition for an answer to the 'how' question is the existence of an effective set of powers to make the necessary changes to sustainable water management in practice, since change requires actions including changes in behaviour or the adoption of a particular type of technology. There must exist the powers over those who will have to change or that which will have to be changed, and those powers must be sufficiently strong to effect the change. In addition, that those who have those powers are motivated to use those powers and also that these powers are sufficient to outweigh the powers of those who are motivated to oppose the changes. Delivering sustainable water management therefore requires a clear understanding of the nature and limitations of power.

There are many forms of power and anything which has the capacity, in some circumstances to induce change, must be deemed to be a form of power. Thus, knowledge, information and skills are all potentially forms of power along with the obvious forms of power such as physical strength, money and political influence. What differs between the forms of power is their range and strength. The potential domains of

power are over the physical world, the self, and others. It is power to induce change in other people that raises the most difficult political or moral questions.

Power may also positive or negative in effect; some behaviours may be required, or others prohibited. Requirements and prohibitions are the two extremes; in between, other behaviours may be encouraged or discouraged. Notably, regulations tend to require or prohibit, charges and subsidies to encourage or discourage, as may information campaigns. Power can be argued to have three necessary components:

1 a signal as to what change or what behaviour is intended

2 an incentive sufficient to overcome the barriers to making that change or adopting that behaviour

3 a means of establishing compliance with the intentions.

To be effective, the signal must stand out from the background of other stimuli and be interpreted in favour of the desired behavioural change. It must be first recognised as a signal, then interpreted as having a particular meaning, and having a meaning which implies that a particular behaviour would be an appropriate response to that signal. But simply sending a signal does not mean that it will be necessarily be received and if received that it will be either believed or interpreted as having the intended meaning (Hall, 1997).

The strength, the effectiveness, of a form of power is thus a composite of these three components. The traditional naïve assumption of economists has always been that in terms of power, prices always work but nothing else does. This means that economists lack an explanation of how prices work and when they work, and in the case of water, prices have consistently proved to be ineffective at changing behaviour, particularly with respect to household water consumption. That is to say, the price elasticity of water for household usage is typically found to be in the order of –0.1 to –0.3 (Dalhuisen et al., 2001; Schleich and Hillenbrand, 2007); a price increase of 100% being necessary to induce a reduction in demand of 10% to 30%. Thus, to achieve the regulatory standard of 105 l/p/d now required of new social housing in England (Communities and Local Government Department, 2008), a reduction of somewhat over 27% on current average household consumption, would require the cost of water to be increased by 125% to 260%. The average cost of water supply services is now £342 (http://www.ofwat.gov.uk/regulating/reporting/custchgs2009-10/rpt_tar_2009-10household). Conversely, the estimated one off capital cost of reducing consumption to 110 l/p/d for new dwellings is estimated to be £284 (Marshallsay et al., 2007) and the cost to retrofit an existing dwelling to achieve that standard to be £680 (Environment Agency, 2009). Therefore, relying on charging, an annual price increase of £400 to £900, plus the additional costs of metering, would be required to induce the capital expenditure of £284 to £680.

Prices have been found to be weak in some other areas of water management as well. In industry and commerce, where water consumption is metered, it is routine to discover that companies are using more water than would maximise profitability, commonly by a factor of 15% to 30% (Envirowise, 2005).

Similarly, regulation may also be ineffective in practise. The concept of separate sewers ignored both the issues of groundwater infiltration (Weiss and Brombach, 2007) and the rate of improper interconnections between the surface and foul sewers (North Brent Flood Working Group, 2008). Any system which requires 100% compliance is

unlikely to be effective in practise. Whilst cities subject to rapid urbanisation may have land use controls and building regulations, it is often impossible to enforce those regulations when informal development takes place which ignores the land ownership (UNFPA, 2007). Again, a study of sustainable urban drains (SUDS) in Scotland found that a number were constructed in ways inconsistent with the approved design or that no final construction details were available (Jefferies, 2004). Hence, a key question is how effective will each form of power singularly or in combination be in achieving the desired change?

Attempting to exert power also has two costs; to the exerter and on the target. The exerter incurs costs both in reaching the target and in seeking to influence their behaviour. The incentive to the target to make the change has to exceed the costs of so doing, including the costs of determining what is the appropriate action to take. These transaction (Coase, 1988) and information (Stiglitz, 2008) costs can be significant. Thus, Coase (1991) argued that relative transaction costs can determine the best intervention strategy. For example, civil law remedies are notoriously inefficient means of resolving conflicts, the transaction costs frequently precluding the use of courts (Lord Justice Jackson, 2009).

3 Institutions and rules

The conventional definition of institutions is that any institution is a system of rules (North, 1990; Scott, 1995; Uphoff, 1986), be those rules formal, such as law, or informal, like social norms. In turn, organisations are people pursuing some purpose through some formal set of responsibilities and duties. Notably, organisations are governed both by internal rules but more especially by external rules. In North's (1990) words, institutions are the rules of the game and organisations are the players. So, whilst all organisations are simultaneously institutions, not all institutions are manifested as an organisation.

The practical consequences of rules is to create boundaries, notably geographical and functional but also temporal. Rules restrict what an organisation or individual can do and where it can do it: rules delimit power. Rules often also create temporal boundaries; for example, accounting rules define such as practises as depreciation and financial years. So rules partition the world; in turn, one consequence is that water management is always a transboundary problem, it is only the nature of the boundaries that vary from case to case.

The practical question in delivering sustainable urban water management is:

- Which organisations have the necessary powers to promote or inhibit the introduction of the relevant technologies?
- Do they have the incentives to promote those technologies?

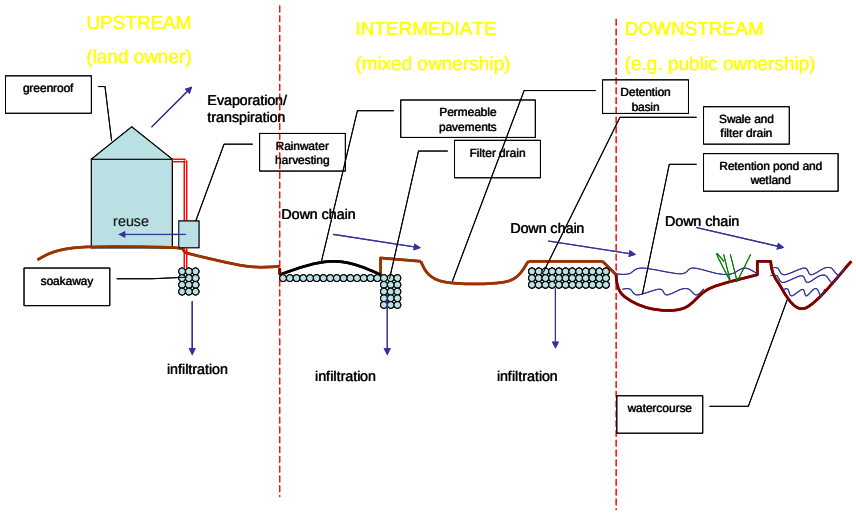
Unless either singularly or collectively some organisations have the necessary powers to either adopt or promote the specific technology then it will not happen. Equally, those organisations must have a sufficient incentive to adopt that technology. Because rules partition the world, these questions are frequently technological specific. For example, water fittings, in the form of low flow shower heads and dual flush toilet cisterns, and water using equipment, notably washing machines and dishwashers, are both part of water demand management. But regulations governing the two different groups may be prepared by different agencies at different levels of government.

Hence a starting point for making change is to map power; institutional mapping (Green et al., 2007). It can be described as a map because it needs to show:

- the boundaries of power
- the relationships between organisations
- the topography of power; how strong is each form of power.

The central concept of integration is of a physical system but rules will create administrative boundaries within that system and the system must then be managed across those boundaries. For example, SUDS is a chain of technologies whose performance as a means of managing both runoff and water quality depends upon the functioning of the system as a whole (Mott MacDonald, 2008). But the ownership of the land on which the different elements of the SUDS chain are found (Figure 1) will typically differ and different patterns will be found within the same society (e.g., for freehold and leasehold land). The system must be managed and operated as a whole even if the components of the system are in different ownerships and different responsibilities.

Figure 1 The SUDS chain (see online version for colours)



Source: After MacDonald (2008)

One form of SUDS is permeable pavements which are being adopted in Japan (Sera, 2006). An obvious issue in this case is; who has the right to open up a road and what are the requirements for restoring that road after having completed excavations? Since utilities are commonly located under roads, utilities require roads to be opened up and excavations undertaken. Both the initial excavations and the restoration of the road surface may have the potential to degrade the performance of the permeable pavement. In turn, if the operation and maintenance of that permeable pavement is the responsibility of the highways authority then the highways authority has an incentive to ensure that excavations and restoration are properly undertaken. However, they may not have the power to ensure that they are. Conversely, if the permeable pavement is operated and

maintained by a wastewater utility, that utility may have no power to control works by other utilities or the highways authority itself.

Such boundaries are commonly found elsewhere; for example, in a block of apartments, when does the water supply pipe ceased to be the responsibility of the water utility and become the responsibility of the owner of the block of apartments, or the owner or occupier of the individual apartment? In this example, across Europe, individual apartments are seldom metered because the responsibility of the utility ends at the property boundary. Some boundaries are accidents of history; for example, in England, under the Public Health Act 1936 a pipe, built prior to 1936, draining two or more properties is a public sewer and the responsibility of the relevant water and sanitation companies (WaSC). But a pipe serving the same function but built after 1936 is legally a private sewer and the responsibility of the relevant property owners.

In addition to finding where the boundaries are, there are two potential problems with those boundaries, namely ambiguities and gaps. Where rules have developed through accretion, ambiguities are not uncommon. In turn, ambiguities often conceal gaps. For example, Sheail (2002) notes that until the Great Ouse Drainage Board replaced some 80 different bodies, it was impossible to determine who had responsibility for remedial works on the tidal Ouse. Similarly, when Hull City Council set out to map responsibilities for different parts of the city's drainage system, it found that it not possible to determine who had responsibility for some parts of the systems (EFRA, 2008).

The big question that follows is: are we free to design institutions (Ostrom, 1990) or are they emergent (Cleaver, 2001), and our institutions are trapped in path dependency as Putnam (1993) argued? The obvious contrast here is between the code-based forms of private law that typify continental Europe and the Common Law approach of England (Zweigert and Kotz 1992).

4 Sustainable water management; what is success?

Integrated water management is a means and not an end in itself. That end is to deliver sustainable water management. If sustainable development is the search for doing more with less, the success is given by how much more we achieve using how much less, expressed as a number of summary statistics. How we can actually measure success is a matter of debate. For example, the EC produced a long list of conditions (Eurosta, 2009), and, for urban areas, 'water neutrality' has been proposed (Environment Agency, 2009; Gerben-Leenes et al., 2007; Therivel et al., 2006). One key area of debate is whether a profile of criteria are necessary or whether it is possible to resolve multiple factors down to a single summary statistic as was the case of the benefit-cost ratio in orthodox economic analyses. A related question is then whether the measures are indicators which can be used to compare performance or whether they can be used as decision criteria to determine which option should be adopted. Benchmarking (Berg, 2010) is now quite widely used to compare the performance of conventional water utilities but a suitable set of benchmarks to assess sustainable water management do not seem to have been developed.

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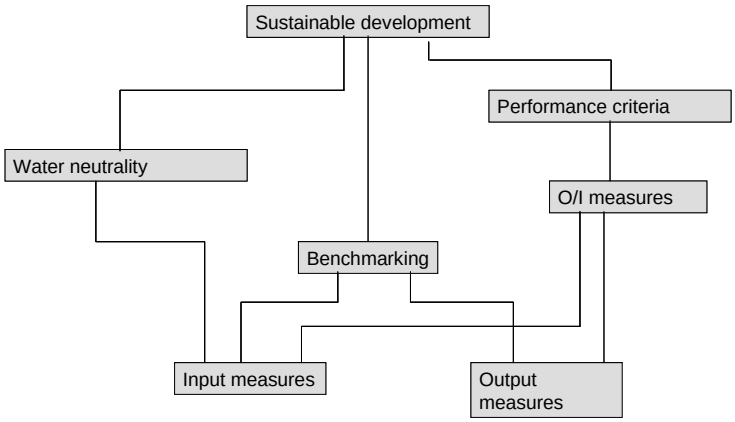
Since any such summary statistic would necessarily relate outputs to inputs, another issue is whether outputs and inputs can be combined, or whether a combination of output and input measures are required. A third is whether it is possible to make meaningful

comparisons across all areas or whether physical and other conditions in different areas are so variable that any comparison is necessarily between conditions rather than performance. For example, there has been a long debate as how rates of 'unaccounted for water' can be meaningfully compared between areas (Lambert, 2003). There ground conditions, climate, traffic loads and the age of the network all significantly affect leakage rates, and comparators of unaccounted for water are also affected by the density of service networks. Overall, the different aspects are related as shown in Figure 2.

Figure 2 Measuring the achievement of sustainable development: different measures that have been adopted



However, there is considerably greater consensus as to the technologies that are needed to deliver sustainable urban water management; what we have to do less of. That is, to import less treated water to the urban areas so that the abstraction of water from the environment is reduced. Secondly, since urban areas are highly efficient mechanisms for rainwater capture and hence net exporters of water, to export less water to the environment; and to export a lower load of pollutants to the environment. In each case, it is not the absolute quantities that are important but the distribution over time since flows in the environment are time varying and urban areas cause significant disturbances to those flows in terms of flows (Beck, 1996). The normal mantra of waste minimisation in turn applies; reduce, reuse, recycle.

Hence, the expectation that sustainable water management requires demand management, rainwater harvesting, green or brown roofs, sustainable urban drainage systems (SUDs) in the reduction phase. Coupled to greywater reuse and localised treatment for reuse and recycling.

From a sustainable development perspective, water obviously cannot be considered in isolation. In some areas, the primary driver for the adoption of green roofs has not been water management but the replacement of habitats (Ngan, 2004), or to combat the heat island effect in urban areas (Sera, 2006), or for energy conservation (Lawlor et al., 2006). Conversely, doubts have been raised about greywater recycling from the perspective of carbon usage (GLA, 2010) and wetlands, both natural and artificial, can be sources of very aggressive greenhouse gases (Mitsch and Gosselink, 2000).

5 England and Germany

In Germany, domestic water consumption has stayed constant at around 130 l/p/d for the last twenty years (ATT/bdew/DBVW/DVGW/DWA/VKU, 2008) and has now fallen to 122 l/p/d (Federal Statistical Office, 2009) on average and only 93 l/p/d in parts of the former eastern Germany (Schleich and Hillenbrand, 2007). Importantly for the wider transition to integrated urban water management, in parts of Germany, the problems of managing a conventional system of water and sewerage when demand falls, as is requires to deliver sustainable water management, are being exposed (Hummel and Lux, 2007; Schiller and Siedentop, 2006).

In England, the aspiration is to reduce per capita household consumption from 150 l/p/d to 130 l/p/d by 2030 (Defra, 2008). However, for new buildings, much tougher standards are being applied. The Code for Sustainable Homes (CLG, 2008) requires that for social housing, per capita water usage does not exceed 105 l/p/d.

If Germany is significantly in advance of England in reducing household water demand to a sustainable level, no judgements can be made about the other components of potable water demand in the absence of data. Globally, there is very limited information to benchmark industrial water consumption in terms of water usage per unit output. In the UK, the Envirowise (2005) programme, a government sponsored waste minimisation programme, and it considers that industry and commerce could cut water demand by 15% to 25% whilst increasing profitability.

Some 30% of municipalities in Germany have now introduced separate charges for foul and surface water (Federal Statistical Office, 2009). Charge rates vary but Cologne charges €1.1 m^2/year; Berlin charges €1.4/m^2/year; Dortmund €0.80/m^2/year, and Munster €0.44/m^2/year (Ngan, 2004). Depending upon whether a fixed charge is also applied, the charges for surface water runoff vary between an average of €0.54/m^2 impermeable area and €0.72/m^2, and constitute 20% to 35% of the average charge for wastewater management (Federal Statistical Office, 2009). Stormwater charges are reduced to varying degrees where different forms of SUDS are adopted; generally by around 50% (Ngan, 2004) but Munster, for example, allows a rebate of 80% to 90% on a basic charge of €0.44/m^2/year (Lawlor et al., 2006). In Berlin, any area not connected to a drain is excluded from the calculations of stormwater charges (Lawlor et al., 2006).

North Rhine-Westphalia has been a particular leader in promoting green roofs, rainwater harvesting and other forms of SUDS. The Ecological and Sustainable Water Management Initiative provided €20 million for storm water management initiatives (Lawlor et al., 2006). A subsidy of €15/m^2 has been provided for both the retrofitting of existing areas and for installations in new developments. Between 1996 and 2004, some 6 million m^2 of surface area was disconnected from the sewer system, including 825,000 m^2 of green roofs (Lawlor et al., 2006).

In England, only four of the WaSCs have yet introduced any form of separate surface water charge and those only for industrial and commercial users (OFWAT, 2009). Pressure is only now mounting for the wider adoption of separate surface and wastewater charges (EFRA, 2009; Walker, 2009).

Green roofs first appeared in Germany about 100 years ago but only in the 1970s did the use of green roofs really expand. The expansion of the use of green roofs is driven partly by the use of surface water charges but also by land use planning requirements (Ngan, 2004). Some 13.5 million m^2 of green roofs (about 14% of the total area of new roofs in the country) were constructed in 2001 alone (Lawlor et al., 2006).

Stuttgart has been requiring green roofs since 1985, with green roofs now required on any roof with a slope of less than 20 degrees (Holzmuller, 2009). In consequence an estimated 22% to 25% roofs in Stuttgart are green (Velazquez, 2003). Since 1986, the municipality has provided 105,000 m^2 of green roofs on public buildings, and the financial incentive programme has produced 55,000 m^2 of green roofs on private buildings (Lawlor et al., 2006).

Similarly, in Dusseldorf, 1.6% of all roof areas and 3% of the extended inner city zone are green roofs and some 350 underground garages are also green roofed, giving a total 730,000 m^2 (Holzmuller, 2009). Berlin subsidised the creation of green roofs between 1983 to 1996 through a 'Courtyard Greening Programme': this provided a subsidy equal to half the installation costs, resulting in nearly 66,000 m^2 of green roofs being constructed (Ngan, 2004).

Green roofs have been variously promoted by different measures in each municipality, including through planning requirements (a given proportion of a site must be green), subsidies for green roof construction, and charging for surface water drainage and providing discounts for green roof adoption (Lawlor et al., 2006). But the primary driver for the adoption of green roofs in Germany has not been water management but compensation for land taken up by development (Ngan, 2004).

Green roofs typically attract rebates on surface water charges; most commonly at a rate of 50% (Ngan, 2004). In addition, many cities also provide subsidies for the construction of green roofs where such roofs are a condition of development consent. North-Rhine Westphalia Land provided subsidies totalling €320 million (Ngan, 2004), funded through the charges on the discharges of wastewater (Lawlor et al., 2006). Subsidies were available for green roofs, SUDS, and rainwater harvesting (Ngan, 2004). Overall, as discussed below, the effect has been to significantly reduce the amount of impermeable area.

No comparable figures exist for England on the area of green roofs; only a current estimate (http://www.livingroofs.org/reslondonaudit.html) of around 92,000 m^2 for London. If the driver for green roofs in Germany has been primarily to compensate for land taken up by development (Ngan, 2004), the primary driver in England, and London in particular, has been the conservation of biodiversity (Grant et al., 2003). London has just announced a target of increasing the area of green roofs in the city by 100,000 m^2 by 2012 (GLA, 2010).

An estimated 35% of new buildings in Germany are now fitted with rainwater harvesting, with some 500,000 buildings so fitted and a further 50,000 systems are built each year (http://www.rainwater-toolkit.net/index.php?id=21). The German rainwater harvesting market is estimated at about €340 million per annum (CIWEM, nd).

The use of the different forms of SUDS is another area where Germany is far ahead of England. Weiss and Brombach (2007) reports that there are over 15,000 retention basins plus more than 2,500 settling tanks in Germany.

In 2005, the 17 municipalities in the Emscher catchment signed the so-called '15 in 15' plan, the 'Future Convention for Storm Water in the Emscher catchment'. This commits them to disconnecting 15% of the impervious area (266 km^2) in the catchment over the next 15 years (Seiker et al., 2006).

In neither country is there major grey water reuse or recycling. Some early pioneering work was undertaken in Germany (Berlin Senatsverwaltung fur Stadtentwicklung, 2007) and some installations have been put in place in England. A problem is that grey water for reuse is competing for the same component of use, toilet flushing, as is rainwater

harvesting, which is considerably cheaper. Hence, greywater reuse is seen as not viable in economic terms in the UK (GLA, 2010).

Table 1 Comparison of England and Germany

	England	*Germany*
Number of tiers of government below national government	Maximum of two; one in large conurbations	Three: Länder, kreise and gemeinden
Number of municipalities	388	12,339
Powers of municipalities	Land use planning, solid waste collection	Land use planning and a wide range of other functions as established either in the Basic Law of the Federal Republic or under the constitutions of the individual Länder
Funding of municipalities	Ring fenced grants from central govt; general rate support grants from central govt; and local property taxes (22% total revenue)	Some tax revenue is guaranteed by the Basic Law; approximately 50% of revenue is locally raised
Duties of municipalities with respect to water management	Now, limited to surface water drainage of less important roads for which the municipality is the Highways Authority and checking private water supplies	Water and wastewater management, urban planning
Provision of water supply	Privatised water companies either stand alone companies (WoCs) or combined water supply and wastewater companies (WaSCs). There are 11 WoCs and 10 WaSCs.	Several thousands in a wide variety of different organisational forms
Surface water drainage	No overall responsibility	Several thousands in a wide variety of different organisational forms
Wastewater provision	Ten privatised WaSCs	Several thousands in a wide variety of different organisational forms
Price and quality regulation	OFWAT five-year plans	Lander and Federal cartel offices
Regulation of abstraction	Environment Agency for surface and groundwater	Lander
Regulation of discharges	For polluted water only; Environment Agency	Lander
Competent authority under WFD	Environment Agency	Land

Given that the technologies involved are relatively mature, and widely adopted in Germany, the difference in the rates of adoption must lie in differences in governance between Germany and England. But superficially, England presents a much more integrated approach of government. Germany is a federal state made up of 16 ‘Länder’

and the Basic Law, the constitution of Germany, reserves water management to the Länder. That Basic Law reserves other powers and guarantees income to levels of government below the Federal level (Department of Transport and Regional Services, 2004). Within each Länder, power is then devolved, variously, to the counties and municipalities; there are some 429 counties (kreise) and 12,141 municipalities (gemeinden) in total.

Conversely, England has no written constitution. Hence, there are no powers or funding reserved to local government and local government has been reduced to one or two tiers below central government. In consequence, in population terms, the average population size of the total of 388 local government units in England is far higher than that for any other country in Europe, 128,000 compared to 6,655 in Germany (CEMR, 2009).

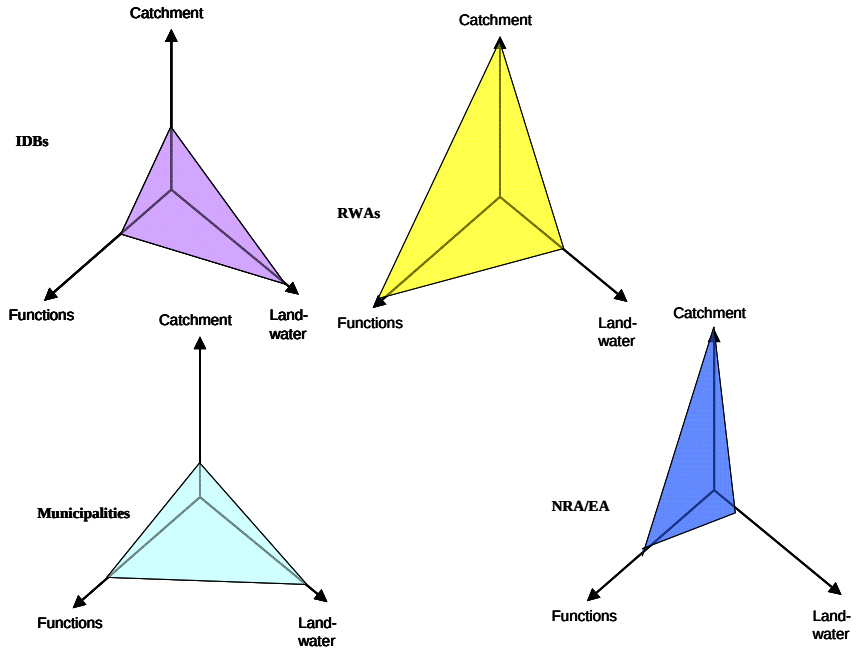
The same picture is apparent in water management. In Germany, there are an estimated 6,400 water supply companies and more than 6,900 wastewater companies (ATT/bdew/DBVW/DVGW/DWA/VKU, 2008), plus an estimated 12,000 to 18,000 water user associations supplying one or another water function such as land drainage (Monsees, 2004; Pant, 2000). Arguments are often made that the water and wastewater companies are too small to provide economies of scale (Zschille et al., 2009) or that privatisation is necessary to drive innovation (Haug, 2007).

Conversely, in England, services are provided by the privatised 11 water supply only companies (WoCs) and ten companies (WaSCs) that provide sewerage services in all areas and water supply services in those areas where there is not a water supply only company. The 170 Internal Drainage Boards (IDBs) that provide surface water drainage in some low lying areas are the nearest equivalent to the water user associations prevalent in Germany. But the IDB have been brought under the direction of central government (JBA Consultants, 2006). Table 1 summarises the institutional differences between England and Germany.

6 Boundaries and incentives in England

Arguably, the lack of progress in England in water management is the consequence of the way of the drive to integrated catchment was implemented and the way in which the industry was privatised in 1989. As with most of Europe (Hietala, 1987), water supply and sanitation services were originally provided by the municipalities (Hasan, 1998), along with solid waste management, roads and other services. But the drive from the 19th century onwards for integrated catchment management pulled water and wastewater services away from the local authorities towards different forms of catchment boards (Sheail, 2002). Taking three dimensions of integration; across catchments as a whole, across all water functions, and between land and water management, we can see the balance of integration changing over time (Figure 3), most dramatically with the privatisation of some water service functions but not others. The early 20th century involved a combination of IDBs for land drainage, in some areas, and the municipalities for all other water management functions. These functions were then largely taken over by the Regional Water Authorities. Finally, with privatisation, the National Rivers Authority, and its successor, the Environment Agency, took over the catchment management responsibilities whilst other functions were scattered amongst the privatised companies and the local authorities.

Figure 3 The evolution of integrated water management in England (see online version for colours)



At the same time, privatisation was undertaken firstly as a short term fix to remove the borrowing, required to fund the massive investment required to implement the different EU directives, from the public sector to the private sector (Green, 2001). In turn, that shift removed the price rises necessary to fund that borrowing from the public to private sector. But the shift was also essentially ideological; privatisation was taken to be a good thing in and of itself rather than as a means to achieving some objectives in water management. Hence, there was no concern with how privatisation was expected to improve water management and delivery, it was simply assumed that it would. There was a lack of interest both in the nature of water management, notably its capital intensity, and in the means by which efficiency might be achieved, e.g., by the introduction of competition.

As an ideologically driven change, the desire was to undertake privatisation as quickly as possible and that resulted in the minimum of thought being given and the minimum of change being made. Hence, the industry was essentially privatised as it stood, with the existing pattern of a mixture in some areas of organisations which supplied only potable water in some areas and others which supplied only wastewater services, and, in other areas, a single organisation which supplied both services. No thought was apparently given as to whether such an arrangement would provide the best economies of scale and scope or, alternatively, competition. Indeed, the form of privatisation adopted was against the advice of the expert advisors to the government (Kinnersley, 1994). Given one driver for privatisation was the recognition that meeting

the directives to which the then government had agreed required the investment of £80 billion, an efficiency-based model would look for institutional arrangements which:

1 Enabled capital to be raised at minimum cost. In reality, loan capital is cheaper than share capital (NERA, 2009) and this criterion boils down to creating organisations with credit ratings of 'AAA' and the capacity to raise the required amounts of capital. In turn, a credit rating of 'AAA' requires that a loan be rated as a very low risk.

2 Provided incentives to minimise the use of capital.

3 Provided incentives to make the most efficient use of capital.

However, on privatisation the price regulation approach which was adopted when the other utilities were privatised was applied to water and sewerage. The then conservative government wanted to avoid the US approach of regulating the return to capital and to provide some set of incentives to promote efficiency (Parker, 1999).

Hence, the adoption of the rpi – x + k price approach in the quinquennial price rounds; prices are allowed to increase at a rate (x) below inflation (rpi) plus k, the allowance for capital investment. The formula obviously provides strong incentives both to drive down O&M costs and to drive up investment. The obvious problems with this approach in a capital intensive industry are:

1 A fundamental trade-off to be made is between capital and O&M costs; the incentive structure in England will drive down O&M costs even if the consequence is to increase capital costs and total costs. Operating and maintenance costs are driven down in the short term, with horrific tales being told in the industry of plant suppliers being advised that plant must thrive on neglect.

2 What constitutes capital expenditure and what constitutes O&M expenditure? Since demand management is defined as O&M expenditure (Waterwise, 2009) whilst supply expansion is a capital cost, it is unrealistic to expect that the water companies will vigorously promote demand management.

3 In a capital intensive industry, it is impossible to avoid regulating the return to capital and consequently the history of price and quality regulation in England has focused upon attempts to determine what is the true cost of capital to the water and wastewater industry (NERA, 2009).

4 The formula is entirely input driven rather than output derived. In turn, extensive use has to be made of comparative performance comparison (OFWAT, 2008) in the rounds of price and quality setting in an attempt to compare the performance of companies. One side-effect of benchmarking has been a number of fraudulent claims by companies as to what they have achieved, e.g., Severn-Trent Water (http://www.ofwat.gov.uk/regulating/enforcement/enforcenotices/not_fne_svt_2006regulatory).

5 There is an inherent assumption built in that the future will always be like the past, that the problem will always be of growth. Whilst government policy is that demand will be driven down in the future (Defra, 2008), none of the industry players have yet recognised that the future is not one of growth. This backwards looking is reflected not only in company forecasts but also in the recent government sponsored reports on competition (Cave, 2009) and affordability (Walker, 2009).

Equally, privatisation created some artificial and ambiguous boundaries which have created problems ever since. For example, the Highway Authority, the local authority, has the responsibility to drain roads. Those highway drains then connect to the Public Sewer, the responsibility of the WaSC. However, originally both highway drains and Public Sewers were built by the local authorities at the time when they had responsibilities for both functions. Now there is the question of where in the integrated system is the boundary in responsibility between the highways Authority and the WaSC (EFRA, 2008). In particular, no institution has responsibility for ensuring the effective drainage of the land but a multiplicity of bodies have responsibilities for different bits of the physical systems which are involved in draining the land (EFRA, 2008).

Finally, the quinquennial price round, where the investments that each company will make in the next five years are set, can be argued to have distorted the whole direction of investment of the industry. The incentive to the companies is obviously to agree to make the maximum possible investment, because it is through those investments that they make a return to their shareholders. They do not care very much in what they are allowed to invest. Deciding what are the priorities for investment is then largely determined by the other stakeholders. The chair of the Consumer Council for Water described the process as having been 'the opening of the sweetie shop' and argued that the process for determining whether investments were justified was much less rigorous than that applied to public investments (EFRA, 2009; Ev30 Q119, Q121). Essentially, the process was captured by the environmental groups, both the official (the Environment Agency) and the environmental NGOs. One result has been the now real concern with the affordability of water services in the country, with, in different parts of the country, between 6% and 72% of the lowest three income deciles paying more than 3% of their household income of water services (Walker, 2009).

7 Conclusions

Any UK politician looking at Germany would argue that Germany was in urgent need of reform; a hopelessly complex system of local government, with far too many levels, and too little scope for central direction. Equally, they would share the views of those German writers in water management who argue that the water and wastewater industry in Germany is far too fragmented for efficiency (Zschille et al., 2009). Yet on balance, this fragmented system has been much more successful in delivering sustainable urban water management than has the highly centralised system in England. Generalising to Germany when there are over 12,000 municipalities is risky so perhaps more usefully questions are:

- Which municipalities in Germany?
- Why have those municipalities been successful?
- How much is the system and how much is Germany?

The first two questions cannot be answered on the basis of present knowledge and there is only suggestive evidence to answer the third question. Here, diversity could be argued to have the same function as in a market; the greater the diversity, the more likely that some successful innovation will be introduced by one organisation and, if successful, adopted by others.

But such diversity and high degree of local autonomy on its own does not appear to be a sufficient condition for the adoption of the practices of sustainable urban water management. In France and the USA, municipalities also have a great detail of autonomy and diversity but neither country can be said to be a front runner in the adoption of sustainable urban water management technologies. In the case of France, the degree of diversity may be simply too great; too many and too small municipalities

The obverse question is: what caused England to lag so far behind? The more useful question is: what realistically can be done for England to catch up Germany? The answer to the first question lies in the differences the yin of power and yang of boundaries between the two countries. The location of the boundaries in England has removed any incentive for either the local authorities or the water and wastewater companies to promote sustainable water management. Nor does the regulatory system provide any incentive to counteract those boundary restrictions. Thus, at a Parliamentary Inquiry into the floods of 2007, the water industry's view of SUDS was that this was a very good idea provided that someone else adopted it (EFRA, 2008, ev86 q284–288). Indeed, as incentives are currently configured, the water industry in England must be seen as a barrier to the adoption of sustainable water management (EFRA, 2009).

A question is whether the rule structure in England is so confusing as to impose a very high transaction cost on any innovation; it is simply cheaper to repeat what has been done than to determine whether a better strategy is permissible. Unlike Germany, English law is divided into statute law and common law. In turn, statute law is created by Acts of Parliament, primary legislation, and the regulations enacted under the powers given by those Acts, secondary legislation. Typically, any Act has three types of provisions: specified clauses of existing legislation are removed; other clauses of existing legislation are modified or amended; and some clauses in the new Act are free-standing. One consequence is to determine what is the statute law at any time requires trawling through all the existing legislation to determine what has not yet been repealed or amended. Secondly, it is necessary to look at all the regulations made under those pieces of primary legislation in order to determine the current statute law. Conversely, in Germany, the Federal Water Law of 1957 has simply been amended seven times to update the legislation. Comparing the Federal Water Law (http://www.elaw.org/node/1495) to the recent Floods and Water Management Act in England (http://www.opsi.gov.uk/acts/acts2010/pdf/ukpga_20100029_en.pdf) demonstrates the greater clarity of the former.

What cannot be changed is the current form of privatisation; legally, there could be deprivatisation but the practical difficulties are so great that no government is likely to feel the costs worth the change, or that it is a sufficiently high priority for reform. Thus, it is noticeable that government action to implement sustainable water management is taking through land use control, building regulation, capital subsidies to consumer, market transformation and waste minimisation programmes (MTP, 2006).

The classic economist's response at this point is to argue that competition must be introduced and that the price incentives to the suppliers need to be changed. Fortunately, there is a way to introduce competition into the industry that does not require major legislation. In the energy field, combined heat and power schemes were a driver for the development of energy service companies – ESCOs (Hopper et al., 2007). There is nothing to stop the parallel of Water Management Companies (WAMCOs) developing to serve either single sites or multi-site companies. For example, a supermarket company could put out to competitive tender the complete water cycle management of different

tranches of its properties. Each successful company would be responsible for maximising the efficiency of water usage for that tranche of properties, some potable water being taken from the mains supply and some wastewater being discharged to sewers.

Introducing an appropriate price and regulatory regime to promote sustainable water management will require primary legislation. In addition to introducing a price structure which provides the appropriate incentives, it is necessary to look at the long term implications for the industry of a shift to sustainable water management: what will be the implications of significant falls in demand in terms of costs and revenues? The effect of the shift to sustainable water management has to be analysed in terms both of the effects on the companies as well as on the consumers. The logic of private equity capital investment in a low return, negative growth industry has already been questioned (Ernst and Young, 1999). Clearly, when demand is falling is the worst possible time to introduce water metering since it adds revenue uncertainty and hence risks so increasing the cost of capital.

One option is a charge on all water abstracted by the water companies but where that charge is based on the per capita amount of water delivered to domestic consumers as that amount deviates from a specified target figure. Conversely, any company achieving better than the target would receive a rebate from the revenue raised from those companies who failed to reach the target. Hence, the overall effect would be revenue neutral whilst providing an incentive on companies to do better than the target consumption figure. The charge rate would be set for revenue neutrality over the medium term rather than annually since the companies need some stability in expected income. However, the target household per capita consumption figure would be ratcheted downwards over time. Thus, for example, the target per capita household figure might be set to fall to 100 l/p/d by 2030, thus be set to fall, on average, by 2.5 l/p/d annually.

Setting a target only for household water consumption avoids the complexities of the different proportions of consumption taken by non-domestic users in different areas. But simultaneously it provides an incentive for the water companies to seek to reduce water consumption in the non-domestic sector when it would be cheaper to reduce consumption in those areas than in the household sector.

As with all other forms of priorities, the issue in integration is what to sacrifice in order to achieve the higher priorities. The implication of comparing Germany and England is that the key form of integration is between land and water management. This form of integration is much more important than catchment management; catchments vary so greatly in size and groundwater, and hence, aquifers may be more important than surface waters. That Germany is highly reliant of groundwater for water supply may be the reason why it was saved from the substitution of land-water integration by catchment integration.

Secondly, given that all water management involves transboundary cooperation, a key requirement is the capacity to deliver integration across boundaries. That in turn requires there to be potential benefits from promote cooperation and the social relationship skills to deliver those benefits through cooperation.

Thirdly, the apparent lesson from the experience in Germany is that to induce the adoption of sustainable behaviours is most effective if a coherent programme of measures is adopted. Those different intervention strategies should be complementary as well as consistent with each other.

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