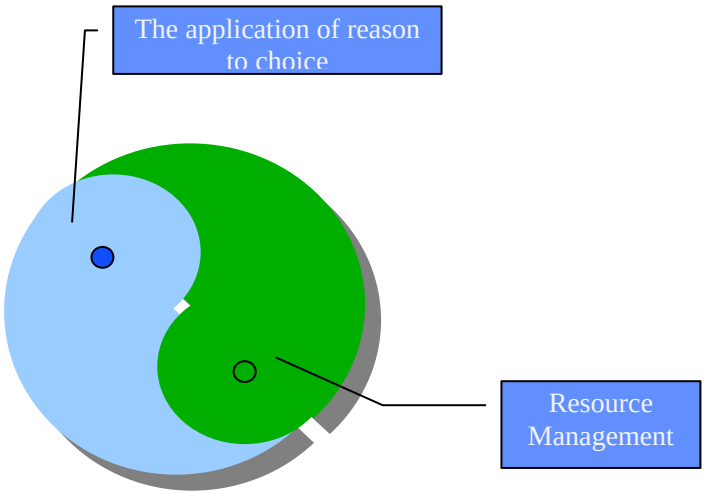
What is water 'governance', and why does it matter?

What is it?

Governance is most commonly defined as: "*The exercise of political, economic and administrative authority in the management of a country's affairs at all levels. Governance comprises the complex mechanisms, processes, and institutions through which citizens and groups articulate their interests, mediate their differences, and exercise their legal rights and obligations*" (UNDP 1997).

Thus, governance is concerned with how we manage and create the appropriate social relationships where these relationships both have a purpose and are an end in themselves. In particular, sustainable development requires that we do more with less. The three questions that logically follow are: more 'what', less 'what', and 'how' do we do more with less? Sustainable development can be conceptualised in the form of a Taiji or Yin-Yang figure; a duality of two complementary and completing, but opposing components, which transform each other (**Figure 1**). The two must be balanced although each contains the seed of the other. In the instance of sustainable development, one element is the achievement of societal objectives; the other, is the efficient and sustainable use of resources. In turn, any technology is an expression of social relations or implies or requires a change in those social relationships. Hence, governance is embedded at the heart of sustainable development. Conversely, the nature of social relationships determines the nature of the technologies that can be adopted. Thus, social relations and technologies are a second form of Yin-Yang figure.

Figure 1 Yin-Yang



Why is governance important?

Because governance is the bridge between technology and social relationships, it makes the difference between invention and innovation. Invention may occur in any social context,

although it may be more likely to occur in a social context favourable to the adoption of that invention, innovation (there is a long argument as to whether technological change is endogenous or exogenous). It is the social context which determines whether innovation will take place. This is true both at the large scale and at the small scale. Hence, a key question in technological and economic history has been (e.g. Landes 1998): why did a group of small, constantly warring countries in Europe come to overtake China which, until at least as late as the C17th, was far in advance in scientific and technological (Needham 1969), as well as in economic terms (Maddison 1998)?

At the small scale, there are basic questions such as:

- Why is North Rhine Westphalia (Lawlor et al 2006) so far in advance of England and Wales in adopting the techniques of sustainable urban water management?
- Why did it take until the start of the twentieth century for London to have a near universal water supply system when such a system had been achieved in Rome some 2000 years earlier?
- Why were municipalities so successful in Europe and North America in delivering water and sanitation in the C19th (Hietala 1987) but apparently much less so in Asia, South America and Africa?
- Why were cooperative strategies for delivering water services so dominant in the history of water management (Wagret 1967)? Why, for example, are there still some 12,000 to 18,000 Water User Associations in Germany (Monsees 2004), and rather more in the USA (US Census Bureau 2002)?
- Conversely, why has there been so little use of market based approaches in the history of water management and why, in particular, were the private water companies in the nineteenth century generally seen to have failed (Hietala 1987)?
- Why has Belo Horizonte been so successful in delivering water and sanitation services to the urban poor (de Oliveira and Heller 2007), including to informal settlements, when this has proved so difficult elsewhere?
- How has Copenhagen cut per capita domestic water consumption from 167 l/p/d in 1989 to 127 l/p/d in 2003 (www.miljoe.kk.de)?

Figure 2 Rainwater harvesting, Venice

As several of these examples illustrate, many of the technologies required to deliver sustainable urban water management already exist; Venice, for example, relied upon

rainwater harvesting for all of its water supply for most of its history (**Figure 2**). Again, in Germany, North Rhine-Westphalia has extensive practical experience in promoting greenroofs, rainwater harvesting and other forms of SUDS, such as the Ecological and Sustainable Water Management Initiative which provided €20 million for stormwater management initiatives. 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).

It is estimated that some 13.5 million m^2 of green roofs were constructed in Germany during 2001, some 14% of the total area of roof (Lawlor et al 2006). There has been a similarly widespread adoption of rainwater harvesting. There are now thought to be 100,000 rainwater harvesting systems in Germany with annual new build of 20,000 to 50,000, a market of €350 million/year (the UK market is estimated as around £1 million/year and largely uses German equipment). Again, in 2005, the 17 municipalities in the Emscher catchment signed the so-called '15 in15' 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).

Since the technology is equally applicable in both countries, the key question is: why has takeup been so much faster in Germany than in England and Wales? The obvious answer is that it is some aspect of the differences in governance in the two countries.

Social relations

From the Sustainable Development perspective, the societal objectives are concerned with what social relations ought to be. Secondly, the nature of those social relations partly determines the efficiency by which resources can be converted into the delivery of objectives.

Social relations are essentially concerned with what ought to be the relations between the individual and the community. The nature of those relations has been the subject of philosophical and religious debate for several thousand years, with that argument ranging between the ethical humanism of Confucius, the utilitarianism of Bentham, to the libertarianism of Hayek. In turn, different cultures define the nature of collective decision making in quite different ways. Thus, traditionally, the expressed aim in societal decision making in the UK was to determine what course of action was in the national or public interest. This was to assume that there is a consensus that this is the aim, that the national interest exists above and beyond individual interest, and that the national interest is objectively determinable. Conversely, in mainland Europe, there has always been a greater focus upon national or social solidarity, whilst in China and parts of Africa, the locus of concern has been upon social harmony. These different aims would seem logically to lead in different directions. Equally, different labels have been used to discuss the process through which groups make choices. For example:

- Negotiation
- Consensus building
- Conflict resolution
- Mediation

Either these are different words for the same thing, or, as the words imply, quite different means of approaching the problem. In the latter case, is any one approach more appropriate and effective in a given context? Moreover, are the approaches culturally dependent? For example, in a society that puts weight on social harmony (e.g. China, some African cultures), Consensus Building might seem a more appropriate technique than Negotiation, which might seem more appropriate in highly individualistic societies such as the USA.

What ought to be the social relations is the concept of justice, what is 'right'. In the same way that the nature of what social relations ought to be has been argued over the millennia, so has the nature of justice. Indeed, there is a complex nexus of concepts involved of justice, fairness, equality and power. Abstracting from this vast literature, it can be argued (Green 2003) that: "*Justice is the consistent application of a moral principle.*" Thus, there are two issues: what is the appropriate moral principle to apply in a particular case, and since consistency essentially requires treating like cases alike (Lloyd 1991), what constitutes 'alike', in what sense are they equal? Unfortunately, different moral principles can lead to different outcomes and there is frequently no agreement as to what should be the appropriate moral principle to apply in a particular case. A distinction must therefore be drawn between equality in treatment, equality in outcome of equal cases, and equality in outcome across the board. For example, equal opportunities legislation seeks to ensure that the first two forms of equality are achieved but not that everyone will be paid the same. As Sen (1992) pointed out, achieving one form of equality necessarily precludes achieving another form of equality. Like the use of resources, the achievement of different forms of justice and equality also have their opportunity costs both in terms of resources but also in terms of other forms of justice and equality which were necessarily precluded.

In turn, delivering equality runs into the problem of starting inequalities. Those inequalities are:

- Differences in supply characteristics: it requires less resources to deliver a given standard of service in some areas than in others.
- Differences in demand characteristics: some people use more water than others.
- Differences in individual characteristics: some people have more power than others, and specifically more money.

Concepts of justice consequently usually differentiate between substantive justice, outcome or distributive justice, and procedural justice. I have argued (Green 2008) that in any single decision, it is likely to be impossible to deliver universal agreement as to what constitutes substantive justice. This is a variation of Arrow's Impossibility Theorem which appears to show that collective decision making is impossible (Arrow 1963). What I have argued is that substantive justice may be achievable by across a bundle of different interventions. Such a bundling together of decisions allows each participant to negotiate across the bundle of interventions so that they can make a sacrifice in one choice in the expectation of making a corresponding gain in another choice. But for this to work, the participants have to have the expectation that a sacrifice in one choice will be taken into account by others in making subsequent decisions. Procedural justice is then the glue which allows decisions to be bundled together so that the participants have a reasonable expectation that they can negotiate across the bundle. Hence, procedural justice is that which is critical and substantive justice is simply the product of procedural justice. Procedural justice determines whether substantive justice occurs.

What then is procedural justice? It is the treating of like cases alike, according to the same moral principles. 'Like' cases are those where there are no substantive differences which ought to be taken into account, as opposed to differences which either should not be taken into account or which are not substantive. For example, many cultures differentiate between actions which result in the death of an individual, differentiating between accidents, negligence, intent to harm but not to kill, and different forms of intentions to kill. In so doing, those cultures argue that differences in intentionality, and causation (Hart and Honore 1985), and not simply the consequences are relevant differences which should be taken into account. Conversely, the Roman goddess of justice, Justicia, is often shown wearing a blindfold to demonstrate that such differences as wealth, status, and power are not substantive differences which should be taken into account in reaching judgements (**Figure 3**). Equally, she is shown with a set of balancing scales in her hand to show that the judgements will be made by balancing the weight of evidence. That is, it is the evidence that is argued to determine the outcome. Since power is the ability to influence what happens either in the physical world or the behaviour of other people (Weber 1968), what is being asserted here is that the only acceptable forms of power in the court decision are those of argument or reasoning, and evidence. All other forms of power (Lukes 1974), any other means of influencing others (e.g. through money or social position) is excluded (any thing which has the capacity to influence others is a form of power). In effect, "*Procedural justice is concerned with the proper use of power: the nature of the form of power used, by whom, over whom, and to what ends* (Green 2008)."

Figure 3 Justicia

The 'how' question, the transformation of resources to achieve objectives, is:

1. Governed by the physical and chemical laws. For example, an engine cannot be more efficient than a Carnot engine. Those laws thus define what is theoretically possible.
2. The current state of technology determines how close we might get to this theoretical limit at any given moment at time.

3. But to achieve that technological possibility requires organising the required resources in the right place, in the right quantities, at the right time. This is an organisational and spatial problem.

If the first two questions are ones of science and technology, the third question is partly a social question, not least because one of the resources is people, their time, energy, skills and knowledge. The organisational question is also the classic argument for the superiority of a market as a means of bringing the right resources together in the right quantities at the right place and time. A perfectively competitive market it is argued is the most efficient way of achieving such combinations. Thus, the neoclassical economist argues that the problems of achieving societal objectives whilst making the most efficient uses of resources is resolvable through perfectly competitive markets.

Unfortunately, the expectation that perfectly competitive markets could resolve all problems is no longer tenable for two reasons:

1. There are considerable frictional costs, notably transaction costs (Coase 1991; North 1990), information costs (Stiglitz 2008) and geographical costs (e.g. transport costs) which have to be taken into account. The superiority of the perfectly competitive market further rests on the assumption that changes are costless and instanteous.
2. The perfectly competitive market model also assumes that values are given by individual preference and have been determined before any single choice is made. We have instead to help stakeholders make choices, a necessarily social process during which values are debated, argued and negotiated. Choices become a process through which values are created rather than being pre-determined.

Thus, social relations are central to the 'how' question: what is the best organisational means of bringing the resources together. There are four possible ways of bringing the resources together:

- Competition: as Pareto observed, for greed to result in the collective good, a controlling framework must first be established.
- Cooperation: where individuals or groups work together to achieve a single common goal in the short term.
- Collaboration: where individuals or groups work together to achieve what they believe in the long run will be beneficial to all.
- Coordination by hierarchy; the 'king' who commands model.

In water management, there has historically been little use of the competitive model with the exception of water sellers (Flaxman and Jackson 2004) and small scale entrepreneurs (Solo 1998). In part, this probably because of the nature of water as a natural monopoly so that attempts to create competition result in a market without competition, a monopoly, and these are expected to be inherently inefficient (Frank 2006). The various attempts at water supply through private companies in the nineteenth century essentially failed, being replaced by more efficient municipal supply (Hietala 1987).

In water management, the cooperative model has been widely adopted in the past, and was probably the dominant model, of water management in the form of Water User Associations. Such single purpose bodies are found across the world from the Waterschappen of the Netherlands (Huisman et al 1998), to the Subak of Java (Lansing 1980), and the Water Districts of the USA (US Census Bureau 2002). One driver of the cooperative model is the economies of scale available through collective action as opposed to private provision

(Green 2003). But these cooperative solutions have characterised by being single purpose (e.g. water supply, irrigation, drainage) and each covering a relatively small area. Thus, the cooperative approach created a fragmented mosaic of organisations, directly colliding with the idea of integration across functions and catchments.

The collaborative model is where a group of people come together and undertake several different activities together rather than a single function. The historic municipalities were of this form and it was these municipalities who very largely delivered water and sanitation to the urban areas of Europe in the nineteenth and early twentieth century (Hietala 1987). This collaborative approach also characterises the modern state, and corresponds to the Lockean idea of a 'Commonwealth'.

Finally, there is the hierarchical model. Wittfogel (1957) argued that dictatorial states were essential to the creation of the hydraulic civilisations dependent upon irrigation. This theory has not stood up to subsequent analysis either in terms of the examination of the societies from which he claimed to base his theory (Glick 2005; Masubuchi 2007) or consideration of a wider range of societies (Lewellen 2003). Much writing on the 'state' also seems to suggest that it is an imposition by aliens from outer space rather than being a human creation and hence created for some purpose.

From the economist's perspective, the problem is, as North observed, that we have an economics of competition but no theoretical explanations of either cooperation or collaboration: "*The theory employed, based on the assumption of scarcity and hence competition, is not up to the task. To put it simply, what has been missing is an understanding of the nature of human coordination and cooperation*" (North 1990). Thus, the first challenge is to determine why cooperation or collaboration may be preferable to competition, and the conditions under which each approach is likely to be superior (Green 2007).

Because water management is, depending upon conditions, to varying degrees capital intensive, the applicability of each system may depend upon the capital requirement and thus conditions. When capital requirements are relatively low, such as the abstraction of groundwater via low lift pumps, both entrepreneurial and cooperative solutions are seen to exist. When capital requirements are higher then it is the capacity to minimize capital requirements or the cost of capital that may determine the appropriate organizational form. Loan capital is generally cheaper than equity capital (Alexander and Mayer 1997), because the risk is, by definition, lower, and the lower the risk, the lower the cost of loan capital. The traditional advantage of municipalities in delivering water and wastewater services may then have been a consequence of their ability to raise loans at very low rates over long periods (Wilson et al 2003).

If there are theoretically gains from acting collaboratively or cooperatively, the challenge is then to create the conditions under which they will be realised. Although Ridley (1997) has shown that both animals and humans have an apparent propensity to act collaboratively or cooperatively, this is not to say that it will be achieved in any particular instance and the task is establish those mechanisms which are most likely to deliver the potential gains.

Social relations are also central to the allocation and management of resources. The economy itself can be defined as: "*The social organisation whereby resources are converted to intermediate products, capital stock and final consumption* (Green 2003)*.*"

Thus, the argued superiority of a market economy over a centrally planned economy is about social organisation and social relationships mediated through money rather than administrative power. What we generally treat as abstract things are in practice often better recognised in terms of social relationships. Thus, as Marx (1981) observed: "*…. Capital is not a thing, but a social relation between persons, established by the instrumentality of things."* That 'property rights' actually refer to relations between people leads logically to the argument made by Ronald Coase (1991) that what is involved are entitlements and obligations with respect to actions rather with regard to things: "… *what are traded in the market are not …. physical entities but the rights to perform certain actions."*

'Private property' simply means that I can enforce some claims upon other people in terms of a particular resource. In English law, Worthington (2003) has asserted: *"Thus, 'property' in law is simply shorthand for a special relationship between an individual and a thing."* Similarly, "*…. Property concerns individuals and communities: how they are formed, how they live together, and how they use their resources*" (Davies 2007). 'Property' in its various forms is not a thing but a constructed social relationship. Only if the 'natural law' argument (D'Entreves 1970) is accepted, that there are necessarily and naturally some entitlements with the possession of something, which an argument Bentham described as 'nonsense on stilts', can the idea of property be abstracted from social relationships.

Finally, a problem in economics (and other disciplines) is the absence of any theory of money: what it is, why it is, and what it does. Schumpeter, for example, spent 30 years trying to develop such a theory (Ingham 2004). A partial theory, I would suggest, is that "*money is transferable trust.*" It is trust transferable both between individuals and over time; it is this trust, an aspect of social capital which has been argued to make market transactions possible. Rather than trust between individuals known to each other, or trust extended to others who are known to those already trusted, as in early forms of trading (Morgan 1965), money is a link of trust between those who are unknown. That money is trust is exemplified by the statement on British banknotes: "I promise to pay the bearer on demand the sum of …". In the financial crisis over the last few months we have seen what happens when that trust proves to be unfounded, and trust is consequently lost.

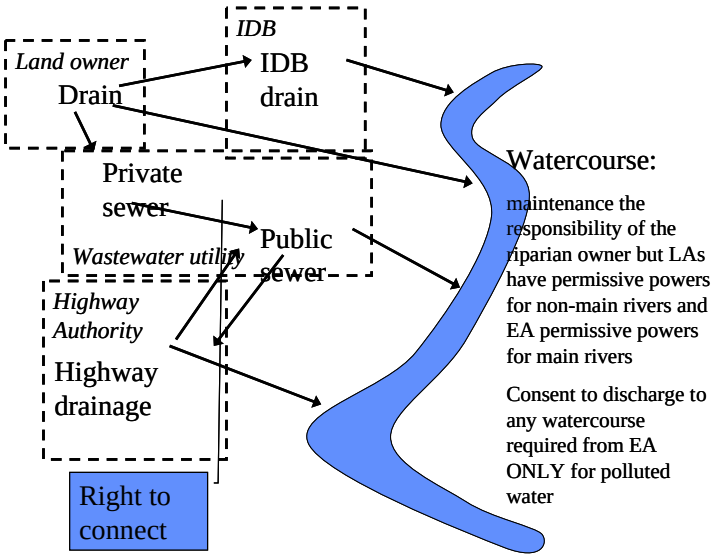
Social relationships as structure

Social relations are governed by systems of formal or informal rules. Formal systems of rules include laws and regulations, but Fox's (2005) book 'Watching the English' is a entertaining analysis of how informal rule structures also govern social relationships. Rules have a reciprocal relationship with power: a rule creates power, and a particularly useful form of power is that to create rules. In turn, institutions are classically defined as the existence of systems of rules (North 1990; Scott 1995; Uphoff 1986). Any organisation is therefore an institution, being governed both internal rules but more especially by the external matrix of rules within which it has to operate.

A critical characteristic of rules in terms of organisations is that they create both functional and geographical boundaries for the operation of that organisation. Thus, rules fragment the world. In doing so, the rules may create gaps between the boundaries of different institutions, areas of overlap, or simply areas of confusion. Thus, Sheail (2002) notes that prior to the Land Drainage Act 1918, it was impossible to determine who had responsibility for remedial works on the tidal Ouse. Similarly, when the EFRA Select Committee (2008)

held hearings into the summer floods of 2007, it found that no organisation had responsibility for managing surface water runoff, rather that different organisation had responsibility for different physical components in the system with ill-defined, at best, demarcation lines between those components (**Figure 4**).

Figure 4 EFRA



Source: EFRA 2008

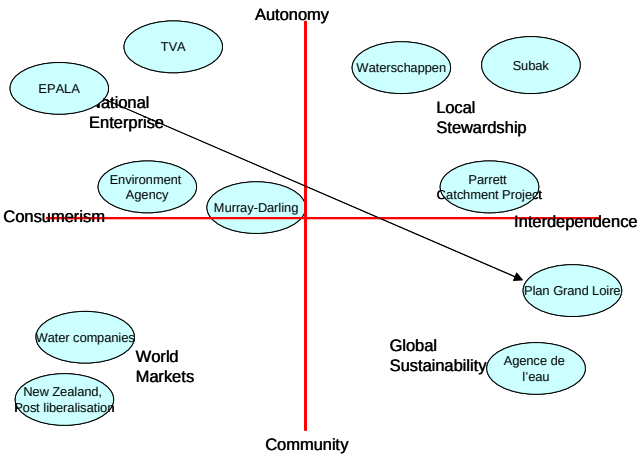
By creating functional and geographical boundaries, institutions also risk creating other forms of inequalities. For example, in England and Wales, the responsibility for managing the risk of flooding, and expenditure, depends upon the nature of the flood. Thus, flooding from surface water, groundwater, sewers and rivers are managed in completely different ways.

So, institutions create an ontology (Smith and Welty 2001) – means of categorising the world, they are representation of the world as it is conceived which must be managed. This is most clearly seen when the Ministry in which water management is located is examined. In various countries, water management will be found as part of a Ministry concerned with the environment, agriculture, forestry or transport (amongst others). In other cases, different aspects of water are split between different Ministries. Locating water within a Ministry for the Environment implies that water is part of the environment whilst locating within a Ministry of Agriculture implies that the importance of water is in supporting agriculture.

As representations of the world, institutions should therefore bear some useful relationship to that which must be managed. We can therefore ask: does a particular institutional structure work? Young and Underdal (1996) has discussed the problem of institutional fit: the matching of the boundaries of the institution to the boundaries of the environmental problem. Consequently, Bazalgette's construction of trunk and collector sewers for London (Halliday 2001) had to be preceded by the creation of the Metropolitan Board of Works, which replaced the existing Commissioners for Sewers at Parish level (Darlington 1970; Sunderland 1999), in order to have the capacity to finance the works.

So, institutions are a representation of the world. But simultaneously, in yet another duality, they are a representation of social relationships. The same reality can be constructed in quite different ways. **Figure 5** illustrates some different forms of water management set within the four different scenarios of future worlds adopted in the UK 'Foresight' studies (Berkhout and Hertin 2001). Those studies of the future of society and technologies in turn derived from the Shell scenario approach in which alternative courses of action are compared against maximally different alternative futures (van der Heijden 1996), and not against alternative predictions. In the UK Foresight study, it was argued that the two dimensions which would distinguish between maximally different futures were: "autonomy – community" and "consumerism – interdependence". In **Figure 5**, I argue that different institutional forms are appropriate to each of those alternative futures. Thus, water management institutions such as the Tennessee Valley Authority, the French EPALA, and the Environment Agency in England and Wales are all forms of scientific bureaucracy appropriate to National Enterprise scenario. Privatisation is instead appropriate to the World Market scenario, whilst traditional WUAs are consistent with the Local Stewardship scenario. Of particular interest is the transformation of EPALA as responsible for the river Loire to the Plan Grand Loire, a shift from a scientific bureaucracy to a process based upon stakeholder engagement (http://www.plan-loire.fr/). Management of the Murray-Darling Basin has also changed in institutional form over time, first shifting towards the Global Sustainability domain but now shifting back into the National Enterprise domain. In turn, the Environment Agency would have to be radically transformed to fit within a Global Sustainability scenario and, in theory, should not exist at all in the World Markets model.

Figure 5 Institutions and society



This leads to two questions:
1. can institutions be invented?
2. how should institutions be matched to the problem?

Ostrom (Ostrom and Crawford 1995) takes the approach that institutions can be invented and provides rules for the design of institutions. Conversely, Putnam (1993) argues for path dependency; that the form and success of any institution depends upon history. Others (Cleaver 2000) have argued that institutions are emergent rather than designed.

Even assuming that institutions could be designed, I argue that seeking to fit institutions to the boundaries of the problem is a misguided approach. It is misguided because it has no answer; in a highly connected system, no institution can fit the entire system. Instead, the useful approach is to decide first instead where are the weakest links and hence where to create the boundaries. The problem is then to decide what are the priorities for integration, knowing that we cannot integrate everything. My current view is that, in general, integrating land and water planning is the most important form of integration; cross-functional integration is the second most important form; and integration across catchments the least important. Integration across the catchment is least important in part because catchments are of such varying size and in large catchments, integration at the catchment level can only be achieved by sacrificing other forms of integration. Thus, I would argue that a reason why North-Rhine Westphalia has been so much more successful than England and Wales in delivering sustainable urban water management is that water and land management are both the responsibility of local government in Germany, and thus the conflicts between them are internalised. In turn, North-Rhine Westphalia has used land and building management for water management purposes. Conversely, water management and land management are performed by quite separate organisations.

One consequence is that all water management is a transboundary problem; national boundaries are simply one example of those boundaries. In turn, it should not be assumed that integration across national boundaries is necessarily more difficult than across local boundaries, particularly in those countries where water management is constitutionally reserved to regional or local government. Thirdly, if we cannot integrate by setting the boundaries, we have to become good at delivering integration across boundaries.

Social relationships as process

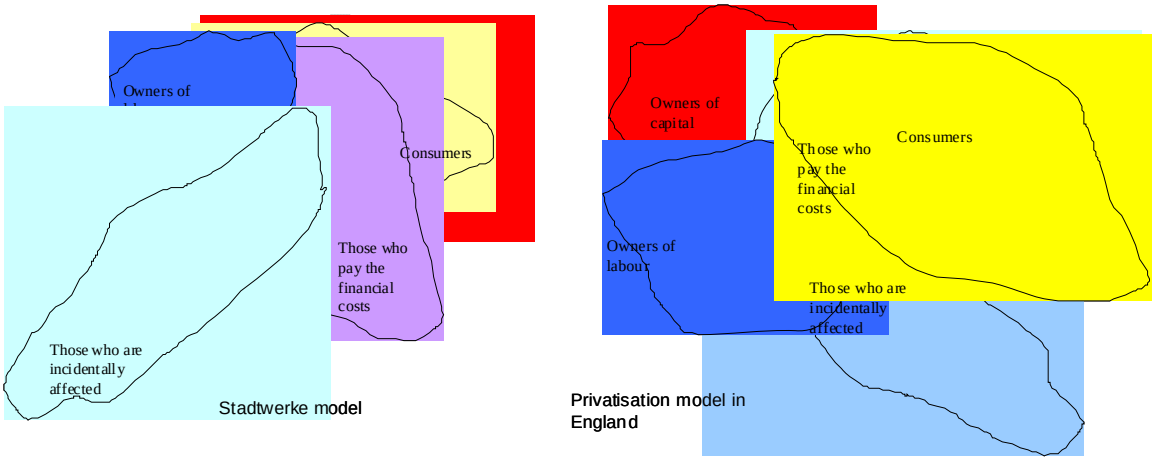
Institutional mapping is about who has the power now (Green et al 2007); if stakeholder engagement is to mean anything then it is about who ought to have power to influence the decision, including those, such as women, who have traditionally been denied such power. Since power is a zero-sum game, increased access to power by any one party necessarily reduces the power available to others. Hence, any claim to have power in a decision, to be a stakeholder, has to be justified by some moral claim; any stakeholder has to address the question: why should I have power rather than any others? A basic rationale for an entitlement to engagement is that an individual or community interest may be affected by the decision. But both the nature and extent of those interests may vary. How those interests interplay depend upon the institutional form. **Figure 6** illustrates two forms of potable water delivery: the Stadtwerke model characteristic of much of Germany and the Netherlands, and the form of privatisation that currently exists in England. In each case, it is assumed that the primary forms of interest that can exist are:

- the ownership of capital
- the ownership of labour (the employees)
- the consumers of the service
- those who pay the costs of providing the service
- those who are indirectly affected by the means of service provision (e.g. the externalities created by that mode of service provision)

These interests are in conflict; an owner of capital wants some combination of a high return on capital and a secure return whereas those who pay the costs of the provision of service

wish to pay the lowest possible costs and hence to minimise the return to capital. In practice, there are different subgroups within each of these broad interest groups; the interests of shareholders are not identical to those of bond holders or those who provide loans for example. What this diagram does show is the degree to the conflicts between interests are internalised to the institutional form. In the Stadtwerke model, there is a substantial overlap between those who provide the capital, the consumers, and those who bear the costs. Conversely, in the English model, whilst the consumers and those who bear the costs are identical, the providers of capital have only an incidental relationship to these groups (and then largely indirectly through such institutional investors as Pension funds and Insurance companies). In Water User Associations, there is close to an identicality of involvement with one community sharing multiple interests: the consumers, those who pay, those who provide capital, and through the use corvée labour to maintain the project, with the owners of labour. Where there is no such an identicality of interest then the problem is to balance the interests.

Figure 6 Interests and organisational form

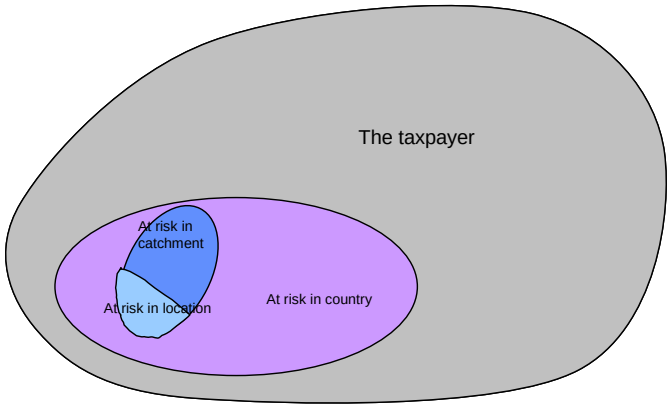


The extent of the interest of any individual party often also varies; where there are a few who may gain or lose substantially, they have a much greater interest in being involved than any many who may individually only gain or lose to a small extent but collectively the total gain or lose would be substantial. For example, **Figure 7** represents some of the interests in flood alleviation. Obviously those at risk in a particular area have a substantial interest in the provision of flood alleviation where, as in the UK, all the costs of such provision are paid by the general taxpayer. Any individual taxpayer has, however, an essentially trivial interest in any individual flood alleviation scheme although in total the taxpayers are contributing a substantial sum each year to reduce the risk to others. In this case, those at risk are likely to be enthusiastic participants and to seek to spend other people's money; the problem instead is to represent the interests of the taxpayers in the decision. This asymmetry of interest has historically led to 'pork-barrelling'; for example, in most of the investments by the US Bureau of Reclamation in irrigation schemes in the USA (Reisner 1993). Here, large amounts of taxpayers' money have been spent for the local financial benefit of a few. In turn, the introduction of cost-benefit analysis was largely intended to, on the one hand, stop engineers undertaking projects simply because they could, and to reduce the likelihood of pork-barrelling projects (Howe 1971).

But, there are two other groups who have a claim to an interest in the decision about any individual scheme for a particular area. These are firstly those are at risk elsewhere in the

catchment and hence may be directly affected by any other local flood alleviation scheme, and, secondly, all those at risk from flooding elsewhere in the country. Given limited resources for flood alleviation, then the resources invested in one area are not available to be used in another area; hence, a necessary result of investment in one area is to delay or preclude works in another area. Therefore, those for whom works are likely to be delayed by action in another area have an interest in the action taken in that area.

Figure 7 Flood alleviation



Stakeholders may be individuals or those individuals may band together in a form of cooperative action to advance their interests. In addition, NGOs may set out to represent some interest. There are now an estimated 40,000 international NGOs, some one million in India, and around 2100 in Brazil. The claim to an entitlement to involvement by an NGO can arise from being affected by the decision or indirectly as a claim to represent the interests either of a wider group (e.g. taxpayers), or some other group (e.g. ethnic minorities), or a general interest (e.g. the environment). Such indirect claims require that the bodies in question demonstrate accountability to the wider group or interest which they claim to represent. The President of Uganda's question at the Johannesburg summit (Museveni 2002) as to by what right did international NGOs to decide whether or not Uganda built a dam is a real one if the answer is not to be a form of neo-colonialism.

In turn, it is possible then to define accountability (Lloyd et al 2007) as the demonstration that those powers are being used appropriately. The obvious form of accountability is democratic election and hence a clash of legitimacy can occur between elected bodies and unelected community groups and NGOs. Lloyd (2005) argues that NGOs should have the following forms of accountability:

1. Upward to donors, govts and foundations
2. Downwardly to beneficiaries
3. Inwardly accountable to their organisational mission, values and staff
4. Horizontally accountable to peers

Thus people orientated NGOs clearly should be accountable to the intended beneficiaries (Lloyd 2005) but NGOs who claim to stand for the environment lack a clear line of accountability beyond to their members. It may be that different claims may give rise to different forms of entitlement to engagement in the decision process both in terms of share

and level of engagement: the entitlement may, in some cases, be limited to the right to be heard rather than to participate in the decision making process itself.

Procedural equity is also about the use of power: what power may be used by what party for what ends? This means that there are obligations on the stakeholders as to what forms of power they may use in the decision process and for what purposes they may use that power. But the distinction drawn here is that procedural equity is the assessment of the stakeholders engaged in the process itself; legitimacy is assessment of that process from the perspective of wider society. That wider society has an interest in the actions of any single sub-group because their actions will either diminish or increase social capital (Bourdieu 1980; Coleman 1988).

Doing 'Better'

If Sustainable Development is about doing more with less, it is about doing better than we are now. How do we do this? I would argue that there are six steps we can take.

Recognition as systems

We have to recognise that we are managing systems. Thus, we cannot, for example, manage the urban water system without simultaneously managing solid waste disposal because otherwise the water system will be used to dispose of all forms of solid waste (**Figure 8**). Before we can manage a system as a system, we have to recognise that it is a system.

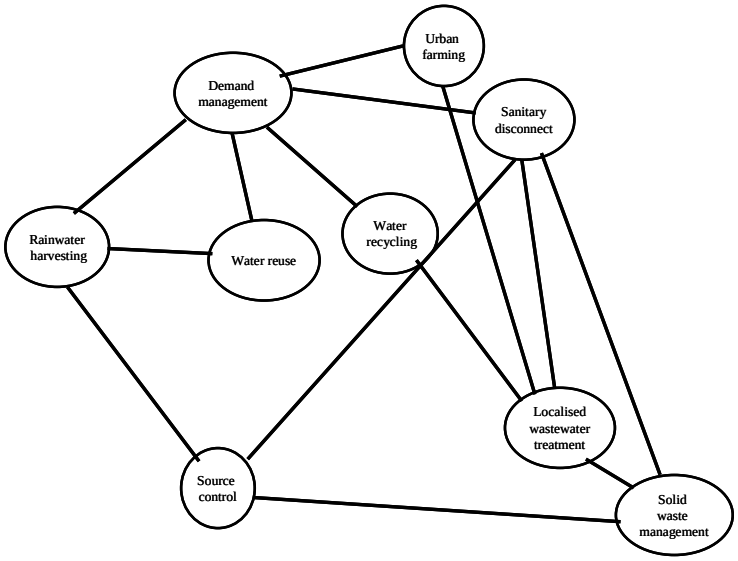
The key characteristics of a system are that the interconnections which link the different components of the system, and their dynamic behaviour. Complex systems (Capra 1997) are characterised by non-linear behaviour and so part of adopting a system management approach involves abandoning a number of cosy assumptions. Notably, we have to abandon thinking in terms of:

- Static models
- Linear responses (e.g. $y = ax + c$)
- Additive function forms ($y = ax + bz + c$)
- Of an equilibrium
- Symmetrical distributions, such as the normal distribution
- Optimality

Instead, we need to recognise that we dealing with complex, non-linear systems, with multiple stability domains rather than single point equilibrium. Concepts such as resilience (Holling 1973) then become central concerns to the management of such systems. It also means recognising the future is inherently unknowable and hence we must confront the questions of:

- How to choose when we cannot know the future?
- What to choose when the future is unknowable (Holling 1978; van der Heijden 1996)?

Figure 8 Urban water system



Nature of choice

What we do has to address the nature of choice itself. The two preconditions for the existence of choice it has been argued (Green 2003) are:

- conflict
- uncertainty

Choice only exists if there are at least two mutually exclusive options and at least one reason to prefer one option and at least one other reason to prefer an alternative. It is different forms of conflict which create mutual exclusivity (Green and Penning-Rowsell 1999); it is the doubt about which option should be chosen which is uncertainty. If all can agree that one option should be preferred above all others then the choice has been made. It is the inability to resolve the conflicts which make the choice necessary which is the fundamental characteristic of uncertainty. Whilst imperfect knowledge may create doubt as to which option should be preferred, it is possible to be rationally uncertain whilst having perfect knowledge about the options. Thus, if you like two types of beer equally as much, and they do not differ in price, you will be rationally uncertain which to choose and the only possible further knowledge that will reduce this uncertainty is material indicating that you should not prefer each beer equally. Indeed, the classic definition, from communications theory, is that information is that which allows differentiation (Shannon 1948).

We have therefore to recognise that choices are inevitably about conflict, and hence it is the way in which we go about resolving the conflicts that make the choice necessary that is central. In turn, this makes concerns such as justice, power, legitimacy and accountability central issues. We also have to embrace uncertainty as a necessary condition for the existence of choice and avoid pretending that uncertainty is no more than probability in disguise. Quantum physics teach us not only are that there things we don't know that we don't know, but also that there are things which we cannot know.

Institutional mapping

If we want to make change then that change can only be made by those who have the power to induce others to make that change or who can undertake that change themselves. Equally, there will be others who have the power to resist that change being introduced. Hence, a key first step in innovating is to prepare an institutional map for that particular technology showing who has what powers over whom in what regard (Green et al 2007). An institutional map is about who has power and an institutional map is generally technologically specific.

Constitutions can make institutional change is impossible and force reliance on work arounds. In the USA, the National Flood Insurance Program (NFIP) is one such work around: historically, the Federal government has had created a tradition of compensating victims of natural disasters (Dauber 2005) but at the same time the police power, including the power to make building and land use regulations is reserved to the States. Thus, the NFIP is a means for the Federal government to limit the amount of compensation for which it is liable by introducing building regulations, but notably not land use regulations, in exchange for subsidised insurance (Hartwig and Wilkinson 2005). Other countries have been able instead to introduce both land and building controls in flood plains. Similarly, tradable water rights (Howe et al 1986) are a work around to the problem of the 'first in time, first in right' private property rights created under the Prior Appropriation Doctrine in the western States (Wright 1990), a system of water allocation which has failed after only 150 years.

If the institutions are to collaborate or cooperate, then there have to be the appropriate incentives to each institution. In England, there are no incentives for the privatised wastewater and water companies to deliver sustainable urban water management because of the way in which the industry was privatised. The industry was privatised as local monopolies on the basis that very large scale investment was required in order to meet the requirements of the various European Directives which the Government had agreed (Green 2001). The price regime seeks to induce efficiency gains on O & M costs but rewards investment. Conversely, sustainable urban water management may increase O & M costs, almost certainly in the case of SUDS, drive down water consumption (and thus revenue), and reduce both the investment required and the asset base upon which the appropriate capital return is calculated. Indeed, it is not known what are the cost and revenue implications for the companies of the shift to sustainable urban water management prefigured in such government plans as the Code for Sustainable Homes (DCLG 2006).

Learning

Doing better means changing to do better; this is the definition of learning:

'An organism is said to have learnt when it has increased its options for applying, to a specific set of circumstances, new or different behaviour which the organism believes will be to its benefit.'

Learning is change; the expectation is that it is a change which benefits the organism which is said to have learnt; equally, learning can only be seen to have taken place through a change in behaviour on at least one occasion. What is learnt may be repeatable, it may

even become a habit, but it may not be transferable to other conditions and so may apply only on a single occasion. Thus, Adaptive Management (Holling 1978) is a form of learning. Although learning can only be observed through a change in behaviour, much of learning is cognitive: it is about changing the way in which we think about something. A distinction is therefore often drawn between 'declarative knowledge' (thought) and 'procedural knowledge' (action).

From this definition, some learning is an invention: it has not, to the organism's knowledge, been previous known. Other learning, the form of learning upon which schools traditionally focused, is innovation: it is the transfer of existing knowledge, learning from others. Secondly, it can be either an individual who learns or a group who learns (**Figure 9**). A group learning as a whole is Social Learning (Ellerman 2001; Ison et al 2004) – as contrasted to the other use of the term 'Social Learning' as learning from others. Equally, within organisations, there is a whole field of work on 'learning organisations' (Argyris and Schon 1996; Hitt 1995; Rashman et al 2008) where it is the performance of the organisation rather than simply the individuals within the organisation which is improved.

The question of technological innovation diffusion has been quite widely studied (Young nd), with networks of potential adopters playing an important role (Bandiera and Rasul 2002; Hildreth and Kimble 2002; Nesta and Mangematin 2004). The aim in innovation diffusion is short-circuit the need for the potential adopters to go through the same invention process that the inventors had to experience. So, learning can be as the result of experience or the experience of others but it can also be in advance of experience. This last form of learning is the difference between learning and evolution; evolution is a form of learning from experience but one where the unsuccessful adaptations become extinct. Thus, Ormerod (2005) pointed out that 48 of the major 100 US companies in 1912 had become extinct by 1995, and only 19 remained within the top 100 companies. Confronted by a changing environment, particularly one which can change faster than it is possible to adapt to it, we want to be able change behaviour in advance of the change in the environment. We want to learn without having to have the experience.

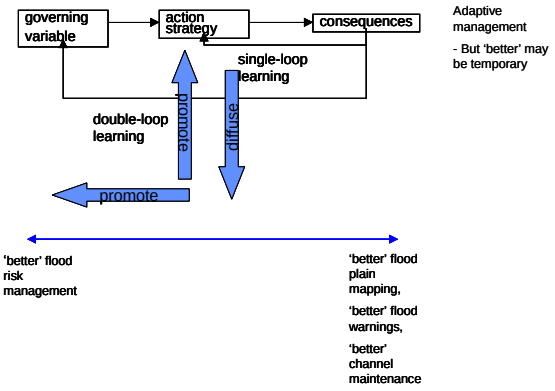
Figure 9 Forms of learning

	Learning for the first time (invention)	Learning from others (innovation)
Individual learning		
Group learning	Social learning	

We have to consider the obstacles to change; the concept of a learning organisation can appear to be an oxymoron, a contradiction in terms. Piaget (Scott and Spencer 1998) drew a distinction between 'assimilative' learning, that which simply broadens or deepens, an existing knowledge, and 'accommodative' learning, which implies a change to the understanding of the world. He argued that accommodative learning was much more difficult to achieve. Kuhn's (1962) distinction between 'conventional science' and 'paradigm' shifts is essentially the same point, and Kuhn emphasises the resistance in science to adopting a revolutionary new theory, such as the Copenician or Einsteinian revolutions. Piaget's distinction between assimilative and accommodative learning is also similar to Argyris' (1999) concept of single and double loop learning (**Figure 10**). Single

loop learning involves learning to do something better; double-loop learning involves changing in a more fundamental way so as to change what is done.

Figure 10 Single and double loop learning



Organisations are, as already noted, bound by rules. Where those rules are externally established, an organisation has very little scope for change, it can learn what would enable it to perform better, but is prohibited from taking that action. The external rules instead have to be changed.

Interdisciplinarity

One reason for stakeholder engagement and interdisciplinary working in particular is that knowledge is fragmented; no single person, group or discipline having access to the whole of human knowledge. This in turn raises questions as to the nature of knowledge: is the knowledge produced by the different disciplines essentially a jigsaw puzzle in which the problem is simply to put the pieces together? Or, are there both gaps between the pieces provided by each discipline, and perhaps also overlaps between the pieces? Are they are even all working on the same jigsaw?

Interdisciplinary working is still something which is rarely actually delivered (Russell 2008), and knowledge of how to do it is still limited (Chettiparamb 2007; Mansilla et al 1978; National Academy of Sciences nd). What seems to be required is propinquity and time: the members of the different groups have to be physically mixed together and it then requires time for them to be able to work together by relating the knowledge and techniques of the different disciplines.

What is clear from interdisciplinary working is that it is also an exercise in inter-cultural working (Lewis 2006; Lustig and Koester 1993): the different disciplines have, and use, language in quite different ways, and apply quite different methodologies. Each discipline then tends to define other disciplines in terms of itself, the zone of concern of each of those disciplines in the defining discipline's own terms, and expect the same tools and techniques to be applicable in that other area. For example, on another project, the engineers proposed a 'definitive glossary of terms'; within the physical sciences, such systems where a single term corresponds to a single meaning are standard. Unfortunately, it is not the way in which languages in general work (Gumpertz 1982); there the capacity of words to

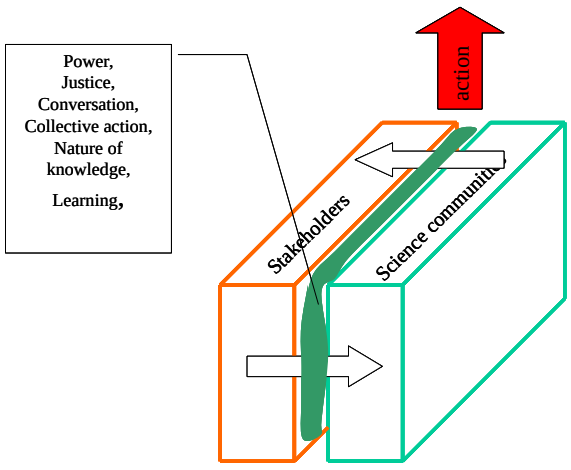
communication is as metaphors, analogies and making connections. In fact, if words had to have an agreed meaning before they could be used, then it would be impossible to communicate because we would have to use a means outside of language to establish the meaning of words within that language.

Conversation not communication

A threat to successful cooperation or collaboration is the Californian 'happy-clappy' concept where if people only sit down together, we will all be friends and a consensus will emerge. We have to recognise that the problem is difficult and that it even more difficult to do it well: for more than a lowest common denominator outcome to be achieved. That it is difficult both as a task, because choices are inherently difficult, and as a social process. We need therefore to become good at both the social process and at providing means of supporting the process. In the much simpler task of juries in criminal trials, it has been found that the way in which a jury goes about reaching its verdict has a significant effect upon the degree to which the jury's verdict reflects the evidence it has heard (Wrightsman 1978). Equally, that different forms of support tool can improve the quality of the jury's deliberations (Young et al 1999).

I deliberately use the term 'conversation' rather than communication to emphasis that it is not about information exchange. It also is a social act, embedded in social relationships (Hargie et al 1994), whose purpose is to change either others or the self. It is about power in the technical sense of influencing others and the different forms of power, of which information is only one, may all be employed. To do better we have to become better at having conversations (Stone et al 1999; Wilson and Warnock 2007). The oldest definition of conversation given in the Oxford English Dictionary is: "*The action of living or having one's being in a place or amongst people*." The same dictionary defines a community as people in communion, in conversation.

Figure 11 Conversation



As a social process, it is largely articulated through language use. Therefore, it is necessary to understand both the nature of language (both verbal and symbolic) and the social use of language. Hence, the problem here is therefore: how to enable more effective

conversations which lead to more productive outcomes? In particular, whereas science used to be based upon a conveyor belt analogy (pure science, strategic applied science, tactical applied science, consultancy), in the stakeholder driven approach the role of the science communities is not to produce 'science' and then expect the stakeholders to adopt it. The problem with this model is that rather a lot of inventions thus turned out not to meet user needs and thus never became innovations (Moerman 1968). Instead, diagrammatically (**Figure 11**), the problem is to create the interface between the stakeholders and the science communities: an interface which both glues the two together and promotes the most effective interchange between the two groups. Out of this combination will emerge inventions and innovations.

The science community has to address what the stakeholders say they want to know. In addition, it has a duty to tell them what they ought to want to know. This is particularly true when the particular scientific group has a specific socially constructed role e.g. a lawyer should be expected to tell the stakeholders when a particular course of action would be illegal. Similarly, groups who have been given the role of identifying the needs of the environment may be argued to have a socially constructed advocacy role for the environment. Defra (2006) argued the need for specially trained interlocutors to at as intermediaries between the stakeholders and the science communities.

Conclusions

Governance is about what social relationships ought to be in three senses:
1. what morally those relationships should be;
2. what is the most effective way of converting resources into that which will support those relationships; and
3. it is itself a form of social relationships.

Governance therefore raises fundamental questions about justice, accountability, legitimacy and power, and very practical questions as to when cooperation or collaboration will be more effective than competition. Ultimately, our success at becoming 'better' at governance will determine how successful we are in achieving sustainable development.

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