

Implementing the Water Framework Directive – UK water and wastewater service provider response

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1 Introduction

Water and wastewater service providers (WWSPs) have a key role in delivering the environmental objectives (e.g. good ecological status, balancing recharge and abstraction) of the Water Framework Directive (WFD; EC 2000) through their operation at the ‘front line’ of water management in terms of directly managing water abstraction and treated wastewater discharges. They can further influence land management, and hence ecological water parameters, through urban drainage (e.g. sustainable urban drainage systems, separated sewers) and liaising with the agricultural community. It is therefore important to understand the factors that mediate and influence the response of WWSPs as part of the process of implementing environmental legislation such as the WFD. Linstone et al (1981) argue that a combination of technological, organisational and personal aspects and perspectives must be used to adequately understand organisational decision making and response to external stimuli like new legislation. We propose that knowledge of the technological, organisational and personal factors which mediate organisational response will enable policy makers and legislators to better stimulate desired change.

This paper is based on the initial results of part of a research project concerned with understanding the relationships and constraints between UK water company decision making and innovation in the context of

implementing the WFD. The aim is to inform future water policy making about the factors that influence WWSPs implementation and adaptation to environmental legislation. The results of the initial research phase presented here seek to establish (i) how WWSPs perceive the WFD in terms of issues and challenges; (ii) the range of planned responses to these issues, and; (iii) to discuss the potential impact WWSP response on WFD implementation. The analysis presented here will be used to develop the questions and methodology for subsequent research in the project.

First of all the regulatory framework for water companies in the UK will be outlined and features relevant for this research highlighted. Thereafter the research approach and methods used for interviewing, data production and analysis will be presented. Results will be presented as a description of the range of issues that WWSP interviewees see as relevant to their organisation in terms of technological and organisational challenges presented by the WFD, priorities of the WFD in relation to other activities and responses to the WFD by WWSPs. The issues identified will then be discussed with regards to drivers for change, constraints to adaptation and options generated by WWSPs.

1.1 Regulation of WWSPs in the UK

In 1998 the UK government transferred the responsibility for assets and operations of water and wastewater services to private investors. This resulted in the world wide unique model of privatisation. Within England and Wales 10 fully privatised water and wastewater companies and 12 water only companies share the responsibility of supplying potable water and sewerage services. The 9 water and wastewater companies as well as the 12 water only companies in England are commercial businesses committed to return a profit to their shareholders; whereas the single water company in Wales operates as a not for profit organisation (Thomas and Ford 2005).

With fully privatised companies providing vital services and impacting on the natural environment, regulatory mechanisms were required to ensure equity, efficiency and environmental protection.

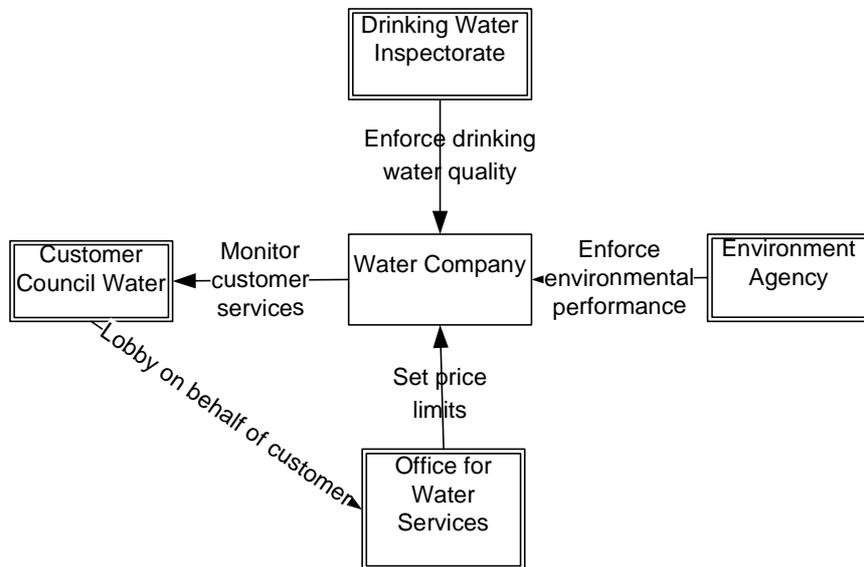


Fig. 1.1. Regulatory framework of WSSPs in England and Wales

Fig. 1.1 sketches the regulatory framework within England and Wales, a summary of this development can be found in Thomas and Ford (2005). The Environment Agency (EA), as the responsible authority for implementing the WFD, has the duty to (EA 2007a):

- carry out the analysis required for characterisation and monitoring,
- prepare draft environmental objectives,
- establish a programme of measures and river basin management plans,
- ensure public participation in preparation of the river basin management plan.

Specifically, the EA directly influences WWSPs through policing and managing of abstraction licenses, discharge consents as well as analysing drought and water resource management plans (Defra 2006a).

The Office for Water Services (Ofwat) is responsible for economic regulation of private water companies. It carries out Price Reviews in a 5 year cycle and sets price limits to the charges Water Companies can make to customers (Bailey 2002). Prices are determined using a Retail Price Index (RPI) +/- K formula, where the K factor is set based on water

company business plans providing a forecast of costs for a set of services (Bailey 2002). Within the Price Review Ofwat also determines the asset expenditure required for maintenance, service improvement and compliance to through Asset Management Plans (AMPs). Water company business plans, which provide an outline of a company's strategy and the costs of meeting regulatory requirements in the next five-year price review period (Bailey 2002), are drafted and redrafted before the final price determination by Ofwat. The next Price Review will be finalized in November 2009, whereas the process of water company business plan submission to Ofwat starts in March 2008 and finishes in August 2009 (Ofwat 2007).

Policing the quality of water delivered by water companies is the duty of the Drinking Water Inspectorate (DWI). It has the right to enforce the adherence to drinking water quality standards.

To ensure water customers interests are represented in the planning process of Ofwat the Consumer Council Water (CCwater) has been established as an independent watchdog.

Within this regulatory framework the ten WWSPs are responsible for compliance with the following statutory duties (WA 2003, Defra 2006b):

- to develop and maintain efficient and economical systems of water service provision
- to ensure a secure service of water in a sufficient quality as regulated in the Water Supply Regulation 2000.
- to adhere to the prescribed discharge of pollution into waters regulated by discharge consents
- to comply with abstraction licenses,
- to draw up 25 year water resource plans and drought management plan

2 Method

2.1 Fieldwork Design

This paper reports on seven semi structured interviews using open ended questions which were conducted to gather responses from 10 personnel from 6 WWSPs. Interviews have continued beyond those analysed here with the aim of collecting a data set to represent all UK WWSPs and their regulators (Ofwat, DWI, EA). The interviews involved three open questions derived after undertaking a review of the WFD, a review of the

literature on how technically based organisations respond to change stimuli and the literature on elicitation of perceptions and attitudes. Within the scope of the paper only the results of questions 1 and 2 will be presented. The three questions are:

1. What are the main challenges posed by the WFD?
2. What priority does the WFD have in relation to other activities?
3. How are responses to the WFD being organised?

Semi structured interviews with open ended question were chosen to collect data as the aim of the research was explorative and inductive, following a grounded theory approach (Strauss and Corbin 1998). Silverman (2001) argues that this interview method is appropriate to enable the interviewee to express his/her views freely and to permit new concepts to emerge, whilst maintaining some degree of comparability.

Each of the interviews lasted between 40 min to 1 hour. Interviewees were identified through River Basin Liaison Panel proceedings published on the internet (EA 2007b), consultation with industry bodies (Water UK, British Water), existing contacts and snowballing. The target population consisted of individuals that were engaged with implementing the WFD into the business of WWSPs. All interviewees were involved in strategic business planning with a varied set of responsibilities which included: producing business plans, estimating regulatory impact, dealing with discharge consents or abstraction license, liaising with regulators, the public or the industrial sector.

2.2 Multiple aspects and perspectives

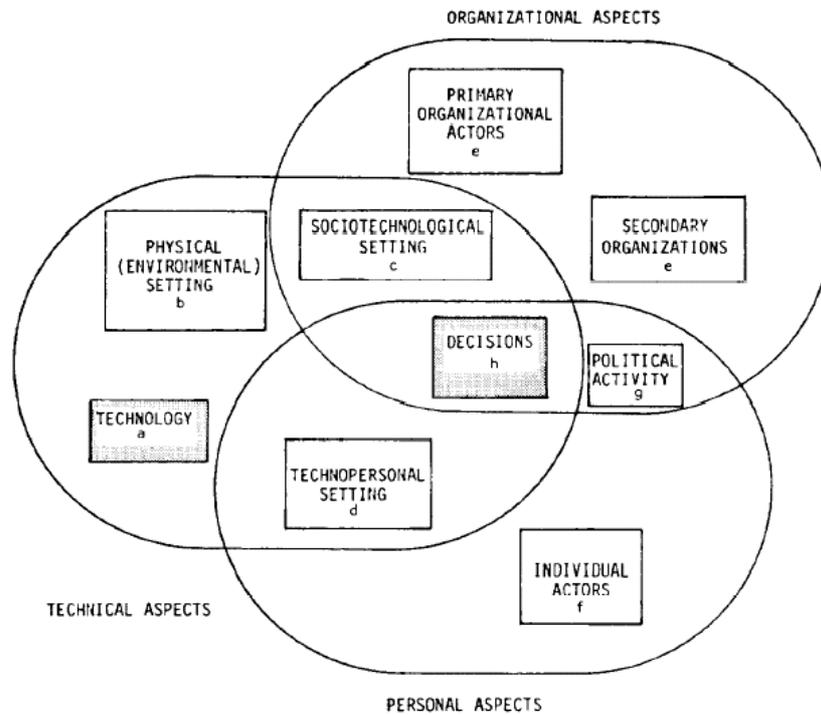


Fig. 2.1: Different aspects of the process of technology assessment by organisations (from Linstone et al 1981)

Linstone et al (1981) argued that it is important to take into account multiple aspects of change ('what is examined') and to view them from multiple perspectives ('how examination is performed') when analysing processes of organisational change involving technology - "Decision making inherently involves organizations and individuals. Their perspectives are very different from those of the rational analyst." In particular Linstone et al (1981) proposed that technical (T), organisational (O) and personal (P) aspects and perspectives should be studied and taken. Fig. 2.1 illustrates these aspects for the context of technology assessment.

For the research reported here we are interested in uncovering the technical and organisational (T and O) aspects of WWSP response to the WFD. Eventually, the aim for the next research stages is to analyse these aspects from both T and O perspectives to better understand the factors which

mediate and influence UK WWSP response to changes in environmental legislation (here the WFD).

2.3 Analysis

The analysis of the interview data was conducted using an inductive, data-driven approach (Braun and Clarke 2006, Strauss and Corbin 1998, Creswell and Clark 2007). However it is important to note that the analysis did aim to identify T and O aspects of WWSP response to the WFD and in this limited sense used a pre-existing coding frame. It further, seeks to identify diversity of responses and variety of response statements. The diversity of responses will inform the research about the number of different types of issues relevant for implementation of the WFD from the perspective of WWSPs. The variety on the other hand shows the number of factors responsible for the difference within each type of response. For instance, assume a population of animals of just one species, but with a large number of animals of different phenotype (colour, size etc). Under our framework this implies a low diversity of animals with a large variety. The diversity was assessed through counting first order issues, while the variety was assessed counting related low order issues.

The analysis was sequential using a combination of thematic analysis (Braun and Clarke 2006) and open and axial coding as developed in grounded theory (Strauss and Corbin 1998).

Table 2.1 outlines the sequence of conducting thematic analysis following Braun and Clarke (2006). Thematic analysis and grounded theory are very much akin in the way they produce a set of codes, but differ as thematic analysis is not bound to theory development. For a thorough discussion of thematic analysis compared to other methods refer to Braun and Clarke (2006).

Table 2.1. Phases of thematic analysis modified following Braun and Clarke (2006)

Phase	Description of process
Familiarizing with the data	Transcription, reading and re-reading the data, noting down initial ideas.
Generating initial codes	Coding features relevant to the research question of the data in a systematic fashion across the entire data set, collating data relevant to each code.
Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme.
Reviewing themes	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
Defining and naming themes	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme
Producing the report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

As categories of response emerged from the methodology describe above, validation was undertaken through method triangulation. For this purpose conceptual maps of individual responses to the interview questions were developed. Fig. 2.2 shows a issue map of a single interview for illustration. Each respondent map shows how the interviewee responded to an interview question in terms of sets of linked responses (issues or challenges posed by the WFD here). The approach was taken from Buzan (2005) and adapted following Bryson et al. (2004). In the process of developing the maps it was aimed to code responses in vivo (label name taken from the words of the respondent - Strauss and Corbin 1998), where this was not possible labels were applied in a semantic rather than in an interpretive fashion. The links between responses, as stated by the interviewee, were maintained and displayed by drawing a line between them. When no relationship to a previous response was expressed a direct link to the central theme (e.g. WFD challenges in the case of Fig. 2.2) was drawn and the above process repeated. The advantage of the mapping approach is that it shows visually how responses are related, providing insight into the problem perception of each individual.

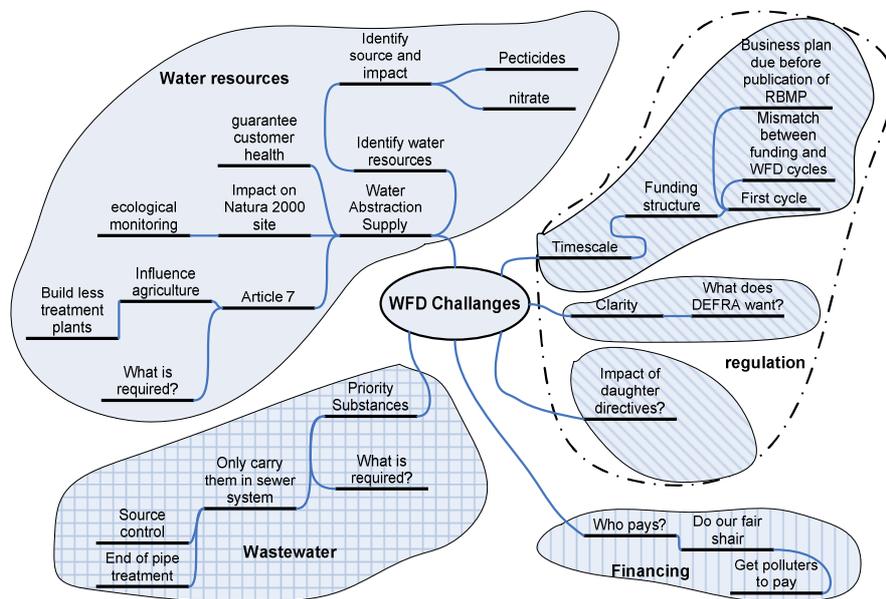


Fig. 2.2. Issue map of an individual interview showing WFD related challenges in clusters

Furthermore, this approach facilitates visual identification of response categories and their classification. Individual respondent maps were aggregated by adding responses and relationships between responses, avoiding duplication of meaning. Recurrence or frequency counts for different responses were calculated and annotated onto the aggregated maps for each interview question.

Common clusters of responses were identified from the aggregate maps and given labels as shown in Fig. 3.1. In this way a general classification of responses for each interview question was developed. For the first question concerning the main challenges posed to WWSPs by the WFD, responses (issues presented by the WFD) were clustered into wastewater, water resource, regulation and financing as shown in Fig. 3.1.

3 Results

3.1 WFD challenges

The two approaches to determine a structure of challenges resulted independently in a similar taxonomy of issues (responses). Fig. 3.1. shows

the merged or aggregated map for all the interviewees for question 1. Four main clusters of response could be identified:

- wastewater with issues from 7 interviewees,
- water resources with issues from 6 interviewees,
- regulation with issues from 7 interviewees and;
- financing with issues from 7 interviewees.

One additional cluster is present, but with issues raised by only two interviewees. In the following sections we will present the results for the identified categories that make up the clusters.

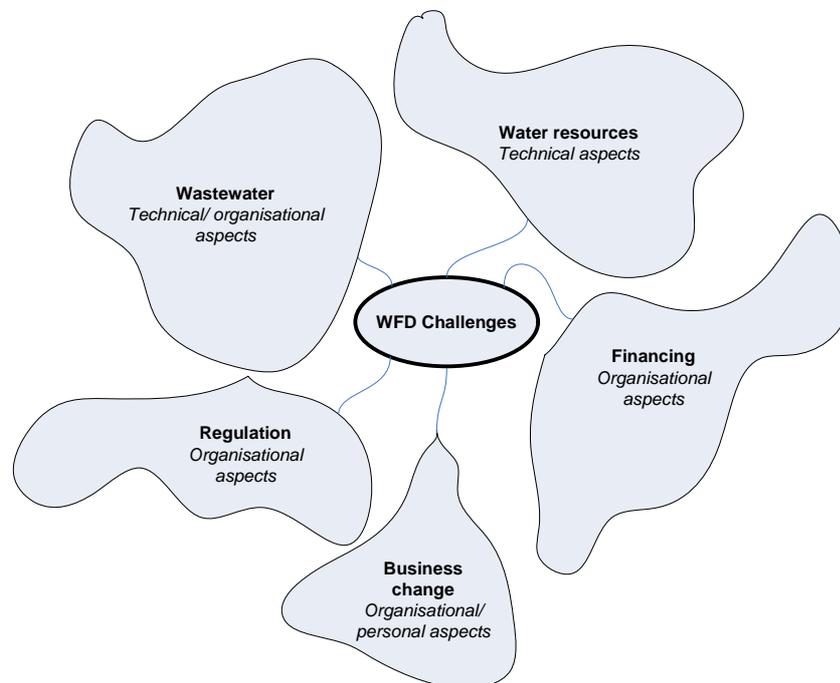


Fig. 3.1. Merged map showing main categories of perceived WFD challenges and where T, O and P aspects are located

All response clusters include both T and O aspects but vary in the predominance of one aspect over another. For example, the wastewater cluster is dominated by T aspects, with exemption of issues about justification and influencing policy.

Likewise, the water resources cluster shows a predominance of T aspects. However, more O aspects occur in terms of issues involving stakeholders and regulators (Fig. 3.2).

The regulation and financing clusters (Fig. 3.3) are very much dominated by O aspects (e.g. funding structure, disproportionality of costs), but also contain some T aspects (understanding of impact and requirement, science).

Finally, the business change cluster includes O and P aspects (Fig. 3.4).

3.1.1 Wastewater

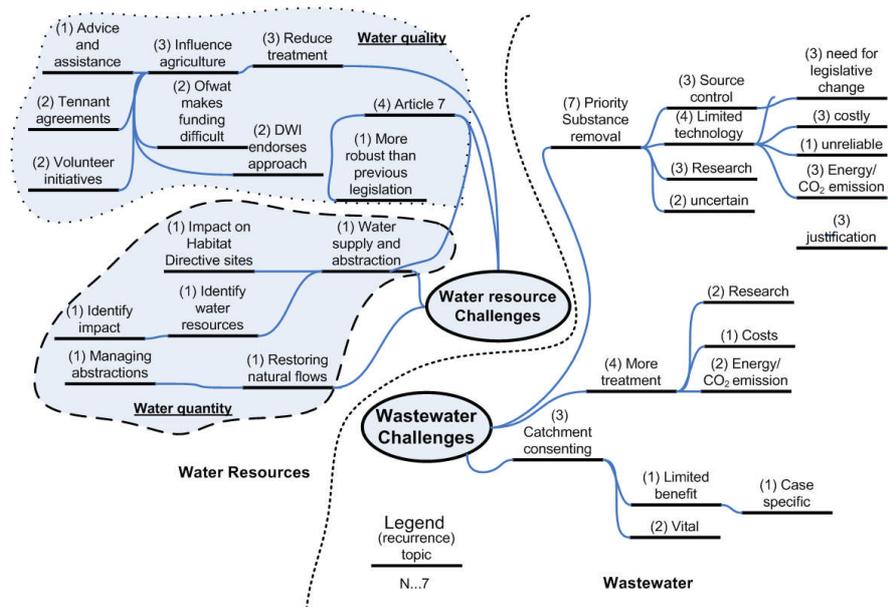


Fig. 3.2. Merged maps for Wastewater and Water Resources issues, the map displays the main categories and associated clusters and issues

All interviewees expressed that the requirement of the WFD to “progressively reduce” Priority Substance (PS) or “phase out discharges, emissions and losses” (EC 2000) of Priority Hazardous Substance (for this paper grouped under PS) is a challenging task (Fig. 3.2). Four of the seven respondents emphasised the technological challenge for complying with the new requirement (“there is no proven method for doing that”). The capital cost and the operational cost associated with these new technologies were an important attribute of this challenge. Operational costs are mainly driven by “hugely energy intense” and CO₂ emitting technologies. In this regard three interviewees expressed concerns whether this strategy can be “justified”. “Does it make sense? So by making a small improvement in water quality we could actually be making a big detrimental impact on the air for example.”

Another viewpoint was expressed during three interviews it was suggested that contamination with PS could be controlled at source, since, as one interviewee expressed it, “we merely carry them in our sewer network”. However, all those individuals saw change in legislation (e.g. trade effluent regulation) or clear policy statements as necessary to make source control happen. “Research” as a challenge was mentioned in three interviews with regards to tackling uncertainty in policy and science.

Following on from PS, anticipation of more demanding performance targets for Phosphorous and Nitrate removal, but also parameters such as BOD₅ and Ammonia were mentioned most frequently (four times) as a challenge of the WFD. The concern and challenges under this category are thematically similar to those expressed for PS, namely CO₂ emissions, costs and research into new scientific approaches and technologies.

Lastly, in three interviews individuals reflected on the concept of catchment consenting (setting discharge levels on a catchment basis rather than on a point basis) which is investigated through a joint water industry research (WRc 2007). Of these interviews two defined catchment consenting as a vital approach to work towards the objectives of the WFD, whereas one interviewee indicated that the benefits might be limited (“saves a bit of capex”), as it is uncertain how it works and context specific.

In summary the challenges perceived by WWSPs under this category show a low diversity as issues are dominantly technical (e.g. PS, more treatment, catchment consenting). However, the variety of issues (including options, constraints and goals) is considerably. In particular for PS a large subset of issues (characteristics of the issue PS) could be identified (Fig. 3.2).

3.1.2 Water resource

Fig. 3.2 shows the merged map for water resources. During most interviews qualitative aspects of water resources are considered (five). Within this reference to Article 7 is most frequent (four). The article seeks to protect waters used for abstraction of drinking water by identifying and protecting them through the establishment of safeguard zones (EC 2000). Influencing agriculture is considered the preferred option to achieve reduced treatment of raw water in the future (three times). Tools such as tenancy agreements, where they own land, or voluntary initiatives where they do not are used to deliver the objective. Further, one interviewee indicated they provided assistance and advice to farmers. Twice it was

suggested that Ofwat constrained this activity by not funding agricultural activities as it contradicts the polluter pays principle through funding the polluter (“Ofwat were not keen on this approach, it was obviously funding the polluter and using customer money to support agriculture”). However, the Drinking Water Inspectorate is supportive: “They [DWI] were really keen that we actually tried this out.” Eventually the one company managed to obtain funding for these activities on a trial basis.

Reducing impact on the environment through activities such as managing abstractions and identification of impacts is a concern with regards to water quantity mentioned by two individuals. The relationship between establishing a balance between flow and abstraction and water quality was expressed in one interview with two water company representatives: “If you have things right in terms of flow and looking after you reservoirs than it helps to achieve consents”.

To sum up, there is some diversity in the perception towards water resources. All but two, respondents refer to water resource as a challenge. Of those, most consider water resources under the aspect of water quality, with only two respondents referring to quantitative aspects (restoring natural flows, supply and abstraction). Quality aspects of water resources were dominated by issues regarding Article 7 and reduction of raw water treatment. Respondents differed in the way they contextualised these issues (as indicated by several links – lines Fig. 3.2 e.g. “I think article 7 is a big opportunity for us. In terms of reducing our water treatment costs in the future” vs. “Article 7 and what does it mean for the upstream catchment”). It is further important to note that issues concerning Article 7 vary, indicating a number of different options and constraints; whereas issues related to quantitative aspects show low recurrence and diversity (Fig. 3.2).

3.1.3 Regulation

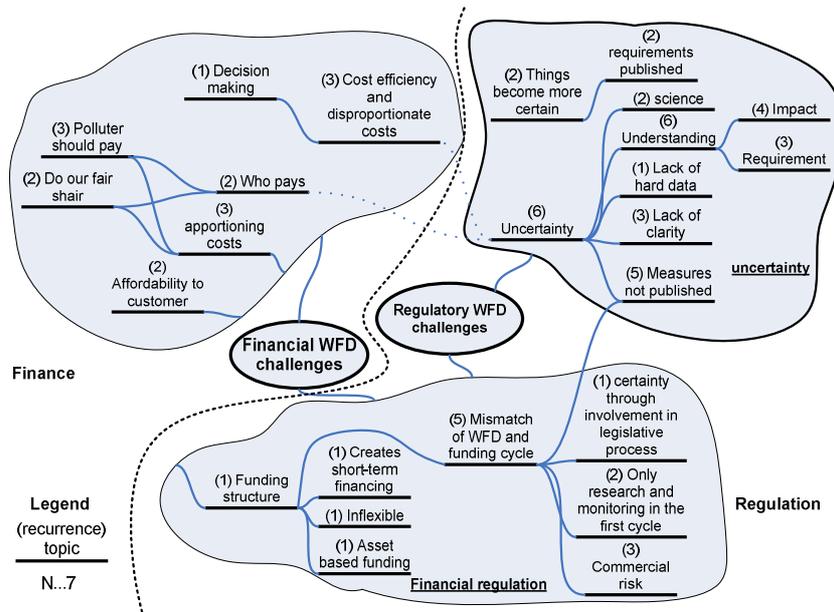


Fig. 3.3. Merged map of regulatory and financial challenges of the WFD displaying the main categories and associated clusters and issues

Throughout the fieldwork regulatory challenges have been mentioned frequently and often first. Two main clusters within the regulatory challenges have been identified here, namely uncertainty and economic regulation (with reference to issues of funding structure generally and the mismatching funding cycles within it). Fig. 3.3 provides more background to what these challenges mean. Uncertainty arises due to “gaps in the science”, “lack of hard data” and most often referred to a lack of clarity in the directive in terms of what is required and how implementing measures might impact on water companies.

A contributing factor to uncertainty is the mismatch between the 5 year funding cycle of private water companies (sec. 1.1) and the 6 year management cycle of the WFD. All interviews in which this problem was mentioned (six) also made specific reference to particular difficulties related to the first cycle. One interviewee gave a good description of this situation: “In particularly the first round [of the WFD], doesn't fit very well with our funding structure...we could be going into AMP 5, without a

clear view of what we're required to do for the Water Framework Directive.” This is because “the Programme of measures doesn't come out until after” water companies have finalise their asset management plans. In three interviews reference was made to the fact that this bears a commercial risk, as investment might be underestimated. However, one interviewee perceived the mismatching cycles as a constraint, but also argued that: “Our engagement with the process [of establishing WFD measures that is carried out by the EA] means that we can get a reasonable insight into the kind of issues that are likely to be addressed.”

As a consequence of uncertainty, two interviewees suggested that the first cycle of the WFD will be dominated by research. “All that we can do in the first cycle, we believe, is do more research.”

The category uncertainty shows a low diversity (Fig. 3.3) as only two main issues could be detected. The variety within the issue of uncertainty is however wide; insufficient scientific knowledge, missing data and concrete information as well as misaligned funding mechanisms, linking uncertainty to the economic regulation, are attributes of uncertainty. WWSPs respond to uncertainty through the desire to understand what is required of them and how it impacts on them. With regards to economic regulation a high degree of diversity can be detected in the responses, many different issues crop up with low recurrence (inflexibility, short-term funding, more certainty trough involvement). However, on one issue respondents have a united view, namely the misalignment of WFD and funding cycle (see above for description).

3.1.4 Financing

Fig. 3.3 shows the financial challenges for the implementation of the WFD as perceived by WWSPs. Issues about “apportioning costs” and “polluter pays principle” are closely related (common issues Fig. 3.3) and together most frequently mentioned (five). Affordability to customers is an issue that came up in two interviews as an isolated statement.

Cost efficiency, with its implication of disproportionate costs, has been mentioned as important to influence the implementation of the WFD. On one occasion it was referred to as important for the decision making process. However, respondents also indicated uncertainty, for instance they are keen to see how it is going to be applied.

In summary, all interviewees expressed views with regards to financial challenges of the WFD implementation. Some diversity of issues within this category exists as three (when grouping who pays and cost apportioning together) unrelated issues could be identified. The variety of issues is however low as Fig. 3.3 shows few lower order issues.

3.1.5 Business change

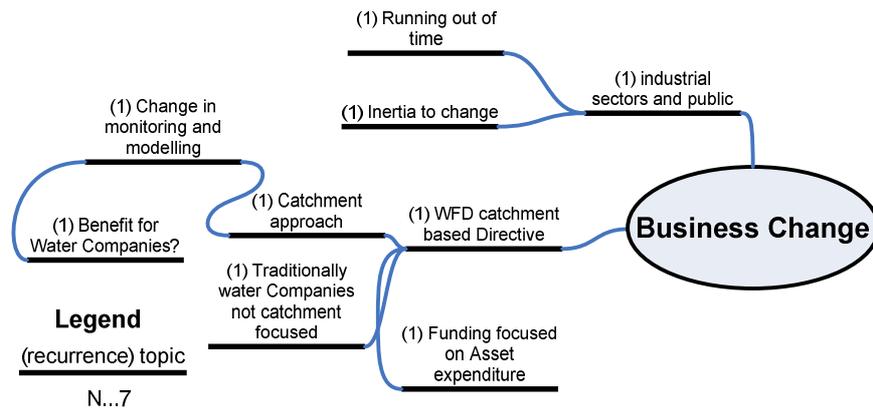


Fig. 3.4. Merged map of challenges to change in the WFD context

The ability to adapt or the ability of others to change was mentioned in two interviews with three water company representatives. One interviewee emphasised that the WFD is a catchment based directive, but the WWSPs operations are traditionally not catchment focused. The interviewee proceeded by underpinning the potential benefits likely to arise from adapting a catchment management approach and, as already mentioned in sec. 3.1.3 asset based funding is considered as a constraint.

The second challenge in this context is the ability of to adapt to new approach changing the way things are done. The interviewees that mentioned this expressed their view in the following way: “There is a big inertia in getting the public and large industrial sectors to change. And we are running out of time at the moment.”

3.2 WFD priority in relation to other activities

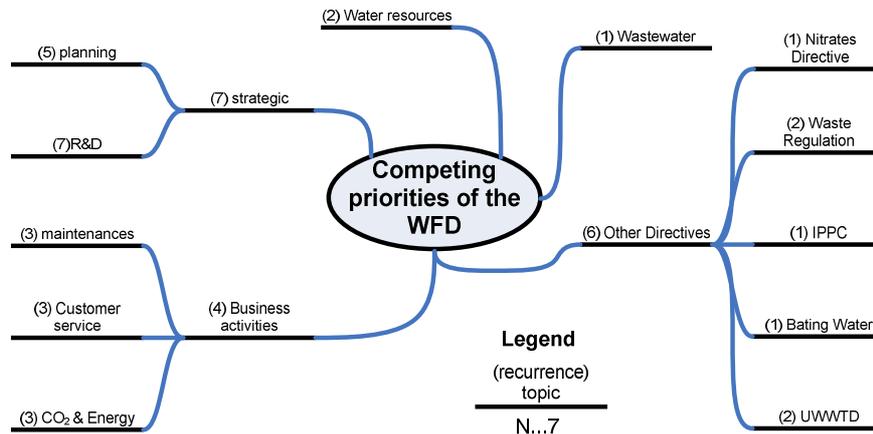


Fig. 3.5 Merged map of competing priorities to implementation of the WFD as perceived by WWSPs

During four of the six interviews a diverse range of business activities that compete for resources with the WFD was mentioned. These activities can be grouped into day to day operation, maintenance, customer service and planning for climate change (Fig. 3.5).

A diverse set of other European directives was mentioned in six interviews as being an important business driver and competing for resources with the WFD (“Some of the older directives like the Urban Wastewater Treatment Directive (UWWTD), you know a lot of the investment beyond 2010 will be driven under those directives rather than immediately by the WFD.”). Individuals also pointed out that, aspects of the different regulations result in mutual excluding or overlapping regulation. For instance the Habitats Directive: “...this should deliver at least good or even excellent under the WFD. But the difference is under the Habitats Directive there is no consideration of cost and cost effectiveness. There is the opportunity to do some very expansive solutions prior to the WFD.” However, two interviewees point out: “It might be another business driver, but actually when you look at it, it does contribute to achieve the directive.”

There is agreement amongst interviewees that the WFD is on the agenda for the strategic planning of the business; whereas it is of little concern for the daily operations (stated by three interviewees). “So it takes a priority

for the business planning side of things. But as far as the operation site goes this is fairly low down.” It is suggested that this situation is due to the fact that “day-to-day activities are very much concerned with complying with existing consents” and nothing in the WFD is “advanced enough yet”.

Two interviews indicated a higher priority of the WFD with regards to water resources. One representative stated: “Certainly on the waste side, it's [WFD] a fairly low priority at the moment. It is slightly higher priority for water resources”. This is supported by another respondent:” I'd say that a lot of this is on the clean water side of things”. However, two interviews indicated the opposite (wastewater higher priority). One of the interviewees suggested further that the prioritisation will depend on the location within the UK: “For us, it's a lot bigger of the wastewater side, but in the UK there are about 10 water only companies. So for them it's the other way round. And the south and east of the country where the water is short, then the Article 7 work is more important that it is for us.”

4 Discussion

In the following the main driving and the constraining factors and their influences on WWSPs implementation of the WFD will be discussed. At a later stage of the research it can then be deduced what constitutes drivers and constraints. Eventually, assisting in the achieving the overall objective to inform future environmental policy making. Fig. 3.6 presents a force field diagram showing the spectrum of driving and constraining forces to implementation of the WFD. It is not desired to present a two-sided picture through this way of presentation, on the contrary. As Craig (2000) argues the same reason can exist on both sides of the diagram. For instance, uncertainty can be seen as a constraint as it complicates decision making. Equally, uncertainty is a threat, driving research activities that eventually lead to business change. The diagram in Fig. 3.6 is therefore supposed to act as a presentation of the perceived drivers and constraints as expressed by WWSPs representatives.

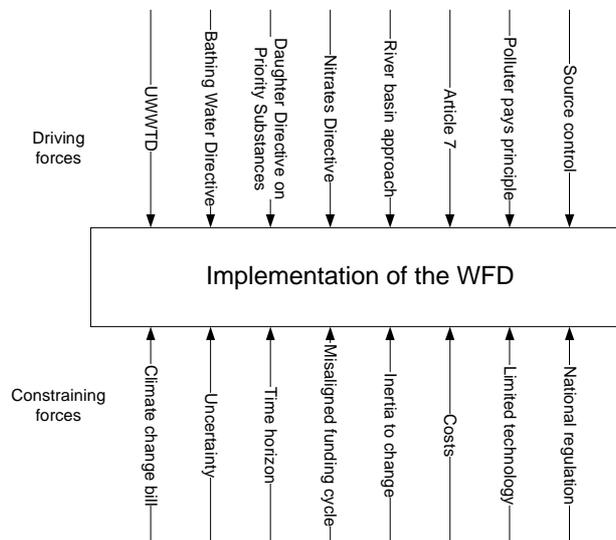


Fig. 3.6. Force field diagram of selected driving and constraining forces for implementation the WFD as perceived by WWSPs

4.1 Drivers

The WFD is widely regarded as the most important (Crane 2003; Kallis and Butler 2001) and significant piece of water legislation (Chave 2000). Despite of this importance, it is not the WFD, as published in 2000, which takes over as a driver for business change. To a considerable degree it is previous EU directive or the daughter directives that are perceived as business drivers (Fig. 3.6).

“And the thing is the Habitats Directive, the UWWTD, the new Groundwater Directive and the new bathing water directive. You know are all seen key...they sit under the WFD. So at the moment the main improvement that is happening in the immediate future is driven by those directives rather than the WFD itself.”

As these pieces of EU legislation are, or will be, integrated into the WFD as basic measures in annex VI (EC 2000) or annex X (for the 'daughter directive' on PS which is still in the proposal stage EC 2006) they contribute in their specific field towards achieving the WFD.

However, the water and environmental management principles the WFD is introducing (river basin management, polluter pays principle, source

principle and the principle of cost efficiency) stimulate change of WWSPs towards a higher degree of integration. The majority of interviewees welcomes these principles, but individuals also highlighted the challenge for business to adapt to the principles (sec. 3.1.5) while another indicated scepticism (“I am a bit sceptical [about catchment consenting]. But it is going to happen.”). In comparison to older or daughter directives, the findings outlined in sec. 3.2 suggest the water management principles impact mainly on strategic planning level. Indeed, as will be outlined in the following sec. (4.2), WWSPs representative do not consider it straight forward for their business to adapt to these new principles.

Lastly, Article 7 of the WFD is the single article referred to frequently. It is implemented locally and handed down to operations responsible for monitoring of agricultural impacts on water resources and providing catchment management advice to stakeholders (sec. 3.1.2). The potential benefits arising from the control of pesticides and nutrients at source appear to be an incentive to implementation this article more rapidly than other aspects of the WFD. If successful the measures can reduce levels of agrochemicals or nitrates at the point of abstraction, overriding the need to build and run costly systems to treat to required minimum standards. In addition, successful implementation of this article potentially avoids further increase in energy demand for compliance with drinking water standards, an increasingly important consideration as energy prices rise and CO₂ emission targets tighten.

4.2 Constraints

Fig. 3.6 presents some of the constraining force of WWSPs to work towards achieving the WFD. Uncertainty with regards to the WFD has been described in sec. 3.1.3. It adds up form a wide set of factors and is an attribute of many of the other challenges discussed. As Ison et al (2007) argues resource dilemmas, such as that of WWSPs abstraction from and discharge into a common pool resource, are complex in that a great many factors biophysical, social, economic and political, interact in a process that is usually unpredictable. Hence, the ability of WWSPs to deal with uncertainty will be a crucial factor for a successful implementation of the WFD. It is further interesting to note that the economic regulator itself has not implemented the rational of uncertainty (“Ofwat is saying we will not fund uncertainty. And we say well it is all uncertain.”) hence posing another constraint to adapt to new paradigms.

As sec. 3.1.3 shows the misalignment between WWSPs funding cycle and WFD cycle is, although just minimal in terms of time, perceived as an important constraint. It increases uncertainty, bears a financial risk and evidence suggest that it contributes with other factors of uncertainty to a first WFD management cycle dominated by research and monitoring.

Technological constraints arise from inappropriate technologies to achieve compliance to anticipated standards, which is further constraint by regulation. The forthcoming Climate Change Bill (HMGovernment (2007) - aiming to reduce the CO₂ emissions by 60% until 2050) factors CO₂ emissions into every new development, hence constraining the implementation of new technologies such as reverse osmosis or membrane bioreactors.

Costs, very similar, to uncertainty are an attribute of many of the challenges, as they constrain asset investment and research expenditure. However, costs are also a factor linking into the tight deadline of the WFD to deliver good ecological status by 2015. Due to this WWSPs will make as much use of derogations based on the argumentation of disproportionate costs, technical feasibility or natural conditions to spread the investment over several management cycles.

Finally, considering the discussion above, it can be concluded, that overcoming “inertia to change” and adapting an integrated business view will be crucial to generate opportunities to cope with the technological and organisational changes required under the WFD.

5 Concluding consideration

Presently, WWSPs responses to the WFD are predominantly strategic, focussing on assessment of impact and research, while previous directives influence the daily operations (e.g. treating discharges). However, Article 7 is an exception as it affects daily business operations and drives integration with stakeholders.

T aspects such as limited technology, constraint scientific knowledge and O aspects such as the mismatching funding cycle as well as inappropriate WWSPs culture are factors responsible for a stagnation of WFD implementation at the strategic level. Uncertainty is an important factor too, although the degree of uncertainty is likely to reduce in the future as the last aspects of the WFD are finalised, probability based decision

making is unavoidable in complex natural systems (Ison 2007). This suggests that WWSPs need to adapt technologically as well as organisationally to successfully contribute towards achieving the WFD.

6 Reference

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