



# Defining and applying 'triangulation' in the water sector

How water companies can use different  
sources of customer evidence in  
business planning

07 July 2017

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# Defining and applying 'triangulation' in the water sector

How water companies can use different sources of customer evidence in business planning

A report submitted by [ICF Consulting Limited](#)

Date: 07 July 2017

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## Document Control

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## Executive summary

CCWater commissioned this study to help identify how water companies can use triangulation across multiple sources of research and data to build a wider and more in-depth customer evidence base. Water companies improved their evidence gathering for the last periodic review (PR14), but some were overly reliant on willingness-to-pay (WTP) research to inform their business planning. Ofwat and other stakeholders in the water sector, recognise that there is significant potential to draw evidence from a wider range of sources in order to supplement existing estimates, and generate new perspectives and insights to help water companies to understand their customers better.

In practice, triangulation simply means using multiple and independent measures to examine a hypothesis or conclusion being investigated, with the intent of using multiple perspectives to minimise bias and maximise validity. An extensive review of literature and online resources, as well as interviews with 17 stakeholders from the water sector and others, identified a number of types of triangulation. These capture the possibility of triangulating methods, time periods, data sources, geographical location, individual investigators (researchers) and theories or hypotheses.

There is no current guidance that describes approaches that companies could take to mitigate these challenges. Nonetheless, it is important that any company seeking to triangulate sources is aware of these challenges. Indeed, this could lead to greater awareness of the strengths and opportunities associated with triangulation. In particular:

- triangulation can be applied in a wide variety of ways, to many sources, including qualitative and quantitative evidence; and
- contradictory evidence can be an opportunity to learn about different perspectives that have not been previously revealed.

The evidence set out in this chapter also leads to the following conclusions about how triangulation should be applied:

- triangulation cannot be a 'black box'. It must be a transparent process that demonstrates the approach used and the rationale for the weight applied to each evidence source in any final reasoning;
- triangulation must be flexible to different needs and different situations;
- it must also be explicit when evidence is contradictory and to explain what can be learned from those contradictions; and
- deliberate steps must be taken to avoid confirmation bias; favouring sources that agree with an already-established hypothesis.

This study researched examples of theoretical and practical triangulation in the water sector and in other sectors with similar regulatory contexts. In response to the broad nature of the desk research, the study took a two-stage approach to prioritising sources. The first stage identified potential sources, which were reviewed against criteria determining which were most relevant. The prioritised shortlist of sources were then reviewed in detail and analysed for stage 2.

In practice, this basic principle of triangulation is widely used across the water sector and in other sectors too. Water companies recognise the potential benefits of triangulating customer evidence on an ongoing basis. However, the application of triangulation in the water industry is not matched by an appropriate level of guidance on how it can be implemented, in practice. Nor does the sector have any clear framework for how it can be applied to the specific challenges of business planning in a price-review context.

This study therefore created a framework for the application of triangulation to the specific needs and context of the water sector. This framework sought to address some specific challenges associated with water companies' requirements for applying triangulation. The most significant of these is the necessary task of attributing relative weight and importance to different evidence sources. This study identifies three key recommendations:

- stakeholders from across the water sector, including Ofwat, should use the framework set out in this study as the basis for exploring how triangulation can be applied in the next periodic review (PR19);
- water companies should consider the full variety of triangulation methods; and
- at a strategic level, water companies should use triangulation as an ongoing process, rather than a one-off 'check' on results. This would help them to utilise all potential evidence sources to validate findings, but also generate new insights into customer values and preferences.

The framework for triangulation created in this study sets out practical steps that water companies can take to implement these recommendations. Before taking these steps, water companies should set their strategic objectives for customer evidence gathering. These should describe what they want to know about their customers and why, including how the information would influence their business planning. It can also include an assessment of the level of assurance required for evidence supporting each objective, based on how strongly the evidence could influence their investment decisions set out in their business plans.

Once strategic objectives have been put in place, the framework described in this report can be applied (described in further detail in the main body of this report). This framework should not be seen as a linear process, but as a series of stages, each of which can be iteratively developed with an ongoing research programme.

- **Specify research objectives for individual areas and describe existing hypotheses or questions.** Companies should take stock of what they already know, so that new research truly builds on what has been done before. Clearly identifying research objectives and questions also provides an opportunity to make sure that the search for sources to triangulate focuses on areas that are most productive.
- **Identify possible data sources and analyse the data.** Evidence might come from a wide range of internal and external sources. This step should first be approached without considering research questions closely. Once sources have been identified, they can be mapped onto hypotheses or research questions which they may be able to inform.
- **Identify key findings from each evidence source.** Each source is analysed to identify ways that they could inform or provide evidence on the research questions. This stage seeks to capture the full value of all information by considering each source separately against each question. This is intended to provide a fresh perspective to avoid new evidence simply being viewed as a 'check' on existing information. This may also identify evidence gaps or raise new questions or hypotheses too.
- **Weigh-up evidence and compare and contrast findings.** To help water companies navigate this stage, this study identified three principles that could be used, developed from HM Treasury's 'Magenta Book' guidance developed for evaluation. These principles also seek to span the divide between qualitative and quantitative evidence, by applying to both. Briefly, these principles are:
  - *contributory evidence* – favouring sources that contribute to water companies' understanding;
  - *methodological soundness* and *rigorous data gathering* – favouring sources that are demonstrably collected using well-justified methods and applied in a rigorous manner; and

- *credible interpretation* – favouring sources that generate credible and well-supported conclusions from the evidence.

Against each of these principles, this study sets out a series of practical analytical questions that researchers could use, to qualitatively or quantitatively weigh up their sources.

- **Assess existing hypotheses and research questions against the weighted evidence.** Returning to each hypothesis, assess the strength of analysis of research questions or the strength of each hypothesis. By doing so, this stage aims to capture the full value of any new evidence.
- **Communicate and test findings, coordinate with business planning.** These two stages involve engagement with a wide range of external stakeholders to test the outputs of the process as a whole, as well as internally ensuring that outputs and evidence are intrinsically incorporated into business planning.

This study also identified findings in relation to several research questions specified by CCWater. It includes details of possible sources that companies could explore, identifies practical steps for weighing-up alternative data sources and explains how water companies can compare different evidence sources.

This study concludes that shared development of the framework set out in this report could benefit the sector, by testing the recommendations and practical measures identified here. Ofwat may provide some indication of the importance of triangulation in its forthcoming publication on the methodology for PR19. Any such indication of its expectations for the role of triangulation would be welcome. Ofwat's further engagement in any ongoing sector-led work on triangulating would be welcome, but in keeping with its risk-based approach to periodic reviews, it is likely to leave stakeholders to develop further detail on how to apply triangulation. Finally, industry cooperation in this area may also create new opportunities for sharing data sources and insights into where public data can be found, for the benefit of all water companies and their customers.



# 1 Introduction

The Consumer Council for Water (CCWater) commissioned ICF, with Accent, to identify how water companies can use 'triangulation' to bring together different sources of customer evidence in business planning. This chapter presents the background to the study and its objectives. It provides a description of the methodology for this study and sets out the structure of this report.

## 1.1 Background to this work

Water companies gather evidence on their customers' preferences in many ways, so that they have the information they need to align their business planning with their customers' preferences. Ofwat has emphasised the importance for water companies of "understanding what their customers want, and that customers have trust and confidence that this will be reflected in the decisions that companies take on an ongoing basis"<sup>1</sup>, given their position as regulated monopolies.

The UK water industry 2014 periodic review (PR14) represented a step change in fostering deeper and stronger customer engagement in water companies' planning for the future. Companies increased the amount and quality of research and evidence on customer preferences used to underpin business planning.

Today, however, stakeholders across the sector increasingly recognise that water companies have significant scope to improve their research into their customers' preferences. One key area of water company research establishes the value that customers place on their services through various research methods to estimate customers' willingness-to-pay (WTP). At PR14, WTP estimates were sometimes insufficiently accurate or robust, to reflect the value that customers place on service improvement. WTP estimates can be used to identify detailed information about customer preferences, but equally can be a blunt tool if used in a simplistic manner. WTP methods must also be carefully applied, so as not to attempt to measure too many aspects of customer preferences at once. Recognising the need to consider alternative approaches to Stated-Preference (SP) research, Ofwat has called for greater consideration of a wider set of methods for informing estimates of the value that customers place on certain outcomes.<sup>2</sup> In this context, the idea of 'triangulating' different sources of customer evidence has been promoted within the industry to gain a more accurate and detailed picture of the priorities, needs and wants of different customer groups.

Interviews conducted during this study revealed that some water companies are making steps to refine and improve their approaches to customer evidence gathering. Other companies indicated they are currently working on methods that enable them to determine the robustness of a wider 'pool' of customer evidence. However, given the relative lack of guidance on how this should be done, it can be difficult to understand good practice approaches to triangulating different sources of customer evidence to generate consistent information on customer priorities and values. Furthermore, different interpretations of triangulation can be found across water companies. These seem to be heavily dependent on the type of data collected, the objectives pursued, the context and the company involved.

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<sup>1</sup> Ofwat (October 2015), *Towards Water2020 – policy issues: customer engagement and outcomes*, accessed 13 December at: [http://www.ofwat.gov.uk/wp-content/uploads/2015/10/pap\\_tec201507engagement.pdf](http://www.ofwat.gov.uk/wp-content/uploads/2015/10/pap_tec201507engagement.pdf), p.2.

<sup>2</sup> Ofwat (October 2015). Ibid.

In commissioning this study, CCWater is helping to address the questions about triangulation raised by companies and other stakeholders (such as Customer Challenge Groups, CCGs) that remain largely unanswered. It aims to contribute to the evidence base that water companies can use to refine and improve their approaches to collecting and analysing different sources of customer data as part of their business planning for PR19, the next periodic review.

## 1.2 Meeting study objectives

This study aims to support CCWater in its objective to explore how to define and apply the concept of 'triangulation' as an approach to assess and compare evidence of water customers' preferences taken from various customer engagement activities. It aims to develop a detailed definition of 'triangulation', what it means in the water sector and whether/how it differs from simply complementing SP data with qualitative data and other evidence/information. The overarching aim of this study is to develop practical guidance on how companies can use various sources of customer engagement evidence.

To meet these objectives, this study sought to find working definitions of triangulation and how the concept has been applied in practice. This was based on a three-stage approach. The first evidence-gathering stage involved desk research to identify relevant sources, based on a set of research questions that aimed to ensure all relevant information was gathered (see Section A2.1 in Annex 2). This stage involved a brief review of a large range of potential sources identified, then a more detailed review of those most relevant. In total, 55 sources were examined, of which 30 were reviewed in detail. Evidence-gathering also included interviewing a wide range of stakeholders in the water sector and in other, similar regulated sectors. The second stage of this study identified approaches for assessing and weighting different sources of evidence across that evidence base. Finally, this evidence base was analysed to generate the conclusions and recommendations set out in this report.

CCWater set specific research objectives to answer the questions set out in Table 1.1 below, which also indicates where in this document these questions have been answered.

**Table 1.1 Answering specific research questions**

Research question	Where in this report
What sources of evidence should companies take into account?	Section 5.3 & Section A1.2
How should different sources be weighted (e.g. does a customer research survey carry more weight than evidence from customer complaints and enquiries, and to what extent)?	Section 5.3
How can water companies 'sense check' different sources of customer evidence (e.g. does research on specific groups of customers reveal evidence of different views than evidence from other sources - and how should companies deal with this scenario)?	Section 5.3

The overarching aim of this study (to provide practical guidance for water companies and other water-sector stakeholders) is met in Section 5.3, which outlines a framework for applying triangulation to customer evidence-gathering in the sector.

## 1.3 Structure of this report

The remainder of this report is structured as follows:

- Chapter 2 explores how to define triangulation, types of triangulation and how triangulation applies to the water sector;
- Chapter 3 describes findings in relation to current triangulation practices both within and external to the water sector;
- Chapter 4 describes known challenges in triangulation and outlines implications for how triangulation should be carried out;
- Chapter 5 describes recommendations for how triangulation could be carried out in the water sector; and
- Chapter 6 brings together conclusions from this study.

Annex 1 outlines potential data sources for water companies which could be used as part of their business planning purposes. Annex 2 provides a detailed description of the method for this study.

## 2 Defining triangulation

This chapter explores perspectives on what triangulation is generally, and more specifically in the water sector. It outlines a basic definition of triangulation and explores how this definition can be expanded to apply in the context of the water sector and the periodic review process.

### Chapter summary

This chapter finds that there are many types of triangulation, many of which are often not termed as triangulation. This chapter concludes that the relatively simple definition of triangulation found in the literature can be expanded to allow it to be practically applied in the water sector.

### 2.1 What is triangulation?

Put simply, triangulation involves using two or more methods of data collection when researching, investigating and analysing a hypothesis, as described by Cohen et al (2000).<sup>3</sup> Farquhar and Michels (2016)<sup>4</sup> describe a classical view of triangulation in social sciences as below.

***Triangulation:*** using “multiple and independent measures” to improve the certainty of conclusions about a hypothesis being investigated, by obtaining a fix on the phenomenon under investigation from two known points.

This definition captures the intent behind triangulation, which is to use multiple perspectives to minimise bias and establish the validity of estimates.<sup>5</sup> Several stakeholders consulted for this study expressed similar views on the purpose and intent of triangulation, including explaining that triangulation can be used to support hypotheses to make evidence more robust.

In practice, the principle behind this definition is widely used in research in the water sector and other sectors, and was described by many stakeholders interviewed for this study, without making explicit reference to triangulation.

### 2.2 Different types of triangulation

This study found several definitions of triangulation in the literature<sup>6</sup>, as set out in the box below. Many of these are already used and applied in the water sector and beyond, without specifically being called triangulation.

<sup>3</sup> Cohen, L., Manion, L., and Morrison, K. (2000) *Research Methods In Education*. London: Croom Helm, [https://research-srttu.wikispaces.com/file/view/Research+Methods+in+Education\\_ertu.pdf](https://research-srttu.wikispaces.com/file/view/Research+Methods+in+Education_ertu.pdf)

<sup>4</sup> Farquhar, J. and Michels, N. (2016), Ibid.

<sup>5</sup> Farquhar, J. and Michels, N. (2016), Ibid and similarly in Olson (2004), *Triangulation in Social Research: Qualitative and quantitative methods can really be mixed*. <http://www.federica.eu/users/9/docs/amaturo-39571-01-Triangulation.pdf>

<sup>6</sup> This is not an exhaustive list of definitions identified in the literature research. Rather it intends to identify mutually exclusive types of triangulation.

### Types of triangulation

This study identified several types of triangulation.

- **Methodological triangulation** – combining two or more methods to gather multiple datasets relating to the same subject matter.
- **Temporal/time triangulation** – collecting longitudinal data (over time) in an attempt to identify external influences on what is being measured.
- **Data / source triangulation** – collecting data using the same method, but from alternative sources.
- **Geographical triangulation** – collecting evidence in different geographical locations to compare evidence across different groups.
- **Investigator triangulation** – based on different observers / researchers gathering evidence to investigate the same research questions or objectives, possibly using the same methods.
- **Theoretical triangulation** – drawing on different theories in the analysis phase to identify alternative interpretations of evidence.

Sources: ICF analysis and adaptation from Cohen, L. et. al (2000)<sup>7</sup> and Farquhar and Michels (2016)<sup>8</sup>

This demonstrates the breadth of practices that can be considered triangulation, and also highlights that water companies are already implementing many practices that can be classed as triangulation.

## 2.3 A definition for the water sector?

This study also considers whether a water sector-specific definition of triangulation is appropriate. At a recent water industry workshop<sup>9</sup>, the general consensus among participants was that triangulation ought not to be a “set of prescriptive guidelines”. Water companies generally were able to describe a broad understanding of the concept of triangulation, with one typical description being ‘collating/summarising a broader set of evidence on which to base business planning’. One water company’s view of triangulation was typical of water-sector stakeholders’ views. It reported that triangulation captures a range of practices that aim to understand the strengths and weaknesses of evidence and coming up with a reasonable conclusion based on that evidence. It noted that, in practical terms, triangulation might be ‘mechanistic’, but can also involve a degree of subjective judgment.

This study found no evidence to suggest that the basic definition of triangulation stated above should be different for the water sector. However, applying this in the context of water-sector evidence gathering (and periodic reviews) requires triangulation to be applied in a variety of ways, because of the nature of the price-review process. This is explored further in Chapter 5. This does not imply that a new definition is required. But it does imply that water companies may well benefit from further guidance around this process. This finding informed the analysis carried out for this study and is explored further below in chapter 5.

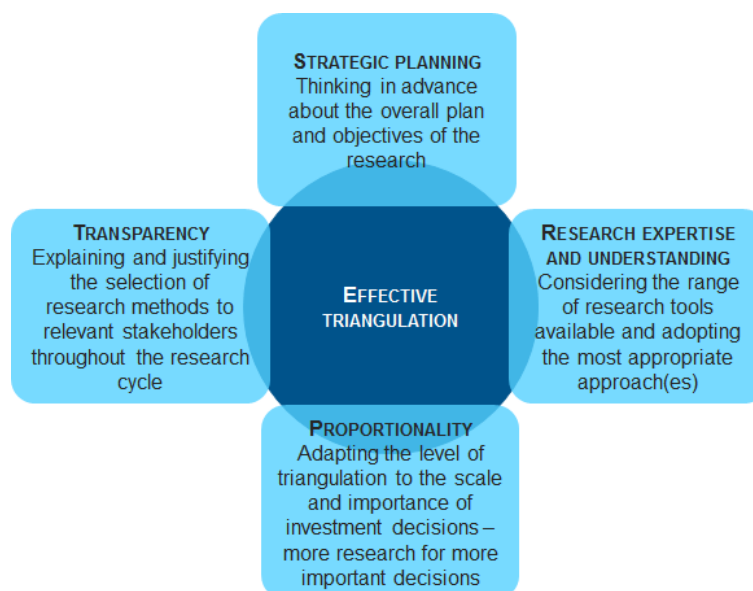
<sup>7</sup> Cohen, L., Manion, L., and Morrison, K. (2000) *Research Methods In Education*. London: Croom Helm. [https://research-srttu.wikispaces.com/file/view/Research+Methods+in+Education\\_ertu.pdf](https://research-srttu.wikispaces.com/file/view/Research+Methods+in+Education_ertu.pdf)

<sup>8</sup> Farquhar, J. and Michels, N. (2016), Ibid.

<sup>9</sup> Consumer Council for Water and Water UK. (2016). Water Industry Workshop 10<sup>th</sup> November 2016.’

Water companies discussing triangulation at a recent industry workshop generally indicated that they should be given adequate autonomy to decide how to approach triangulation in practice. Participants envisaged a principles-based approach that recognised that water companies will undertake triangulation subject to various practical constraints, in consideration of research timescales and cost implications. This is depicted below in Figure 2.1, which is adapted from a recent water industry workshop.<sup>10</sup>

Figure 2.1 Broad principles for effective triangulation



Source: ICF (adapted from evidence from the 2016 Water Industry Workshop)

These materials highlighted some important considerations for water companies. This study has considered the principles as one input into the proposed framework for triangulation in the water sector. These principles and perspectives were considered alongside the materials collected in the desk research for this study and the contributions of the stakeholders that were interviewed for the study.

This approach recognises:

- the need for recommendations to avoid restricting the ways that water companies can apply triangulation; and
- that the value and application of triangulation in the water sector is likely to evolve over time, as it is employed by more water companies, applied to an increasing array of data and as it is scrutinised in the context of assessing water companies' business plans over the course of PR19.

In light of those considerations, this report aims to describe current practice in the water (and other) sector(s) and provide a framework to help water companies identify, plan and implement an approach to triangulation to inform their business plans. In doing so, the report aims to provide material for ongoing industry discussion about the potential benefits of triangulation in PR19 and beyond.

<sup>10</sup> Consumer Council for Water and Water UK. (2016). Ibid.



### 3 Current triangulation practices

This chapter gives an overview of how triangulation has been used to date in the water sector, and its potential future use. The study sought to explore how triangulation is used in other sectors, but found little published information on the practices applied or associated outcomes. This may reflect the fact that many applications in the private sector generate company-specific and commercially-sensitive information. It goes on to describe the opportunity for greater use of triangulation in the water sector and stakeholders' appetite to do so.

#### Chapter summary

This chapter describes how water companies are already undertaking various forms of triangulation, with a focus on methodological triangulation. It also concludes that practices vary considerably across water companies and that further guidance on triangulation would be a valuable tool for water companies.

#### 3.1 Triangulation in the water sector

Many stakeholders in the water sector – water companies in particular – have been applying the principles behind triangulation for some time, without necessarily describing this practice as triangulation. For example, some water companies have been tracking estimates of customer valuations, comparing between valuation methods and using multiple studies in their evidence base for some time.<sup>11</sup> One water company stated that it had been triangulating customer evidence for some time without using that terminology. Another water company reported that it has established triangulation practices, such as senior decision-makers considering evidence from a range of different sources and applying a simple checklist for assessing the strength of sources. It then uses these checklists to inform later qualitative judgements about the relative weight to attach to different sources. This was attributed to a general recognition across the sector of the limitations of WTP evidence.

One water company reported its view that triangulation is often rather informally applied in the water sector. This highlights the potential for stakeholders across the sector to see triangulation as a more rigorous process that can generate real insights into customers' preferences and values, as well as providing better evidence for the periodic review.

For the most part, to date, triangulation in the water sector has focussed on identifying alternative sources of customer evidence, to cross-check against estimates from stated-preference research. Notably, one CCG reported that, where water companies (including its own) had used triangulation to date, it has often been focussed on checking stated-preference research at the end of the research programme underpinning its work for a price control.

Some parties in the water sector have for some time recognised triangulation as a concept in the water sector. UKWIR (2011) suggested several methods for water companies to triangulate estimates of customer values and preferences.<sup>12</sup> This guidance suggested that water companies triangulate their own research with other methods of research and other sources.

<sup>11</sup> ICS and effec (2016) *Ibid*.

<sup>12</sup> UKWIR (September 2011), *Carrying out Willingness to Pay Surveys*, <https://www.ukwir.org/eng/forefront-report-page?object=66874>

In contrast, many other stakeholders do not recognise the term triangulation but, as reported by several water companies in interviews for this study, the kind of activities which fall within a triangulation process are nevertheless being carried out. Consequently, the extent to which the term 'triangulation' is recognised in the water sector may understate the extent to which its underlying principles, approaches and methodologies are being applied in practice by water companies.

### 3.1.1 Methodological triangulation in the water sector

Most triangulation in the water sector to date appears to have focussed on methodological triangulation; using multiple research methods to estimate individual estimates of customer preference and/or values. For example, by using SP research as well as revealed-preference (RP) research, either in multiple studies or within the same study. This is relevant because most water companies were conscious that estimates based on WTP data had limitations and so they sought to validate these estimates by using more than one data source.

Water companies have used a wide range of customer data collection methods in previous price controls.<sup>13</sup> This includes a variety of methods within SP research, but also includes other methods for gathering information on customer values and preferences, such as revealed-preference methods and collection of a wider array of customer data.<sup>14</sup> Using a range of sources of customer evidence was common across all water companies, many of which carried out multiple separately-commissioned research studies. And many of these research studies themselves included multiple methodological approaches to estimating customer preferences and values.

### 3.1.2 Other types of triangulation in the water sector

This section explores the other types of triangulation that water companies are using (while not necessarily seeing these as forms of triangulation). Most water-sector stakeholders interviewed for this study reported that water companies generally carried out few other forms of triangulation (of the type described in Section 2.2 of this report) in their research for PR14. UKWIR (2011) guidance on WTP focuses on methodological triangulation (to the extent that it discusses triangulation), although this likely reflects the scope of the study to focus on WTP research.

Of the other triangulation methods that have been used to date in the sector, the most prevalent was [data / 'source' triangulation](#) (using different data / sources to address the same questions using the same methods). One CCG noted that its water company is already exploring how other sources of data can be used to triangulate its evidence base. In particular, how it can use data on customer complaints/complements to compare with data from other sources. This company also sought to compare market research that it commissioned with other publicly-available sources of evidence on similar areas, taking into account the different scope of these various sources.

Many companies notionally triangulated evidence by gathering and incorporating independent viewpoints into their analysis. One way they did so was through the scrutiny that was applied by CCGs. In some cases, water companies carried out

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<sup>13</sup> For example, see ICS and eftec (2016) *Ibid*.

<sup>14</sup> [Insert reference to ICF paper on improving WTP in the water sector, when link available]



additional research studies in response to CCGs' challenge of their evidence base.<sup>15</sup> One CCG reported that it is shown quarterly research and operational data and it challenges any apparent discrepancy between the different sources. Another water company reported gathering evidence from a range of operational data from different geographical locations, by comparing key aspects of performance against other water companies, where these are available.

Water companies also commonly use third-party input as a way to review, challenge and validate research methods and results, both internally and externally with independent parties. This form of triangulation is not described in the literature, but is described here as '[perspective triangulation](#)'. Ofwat has already recognised the importance of the role that third parties – such as CCGs, charities, business groups, and relevant sector regulators – are expected to play at PR19 in terms of the review, challenge and assurance surrounding the quality and use of customer evidence on preferences and valuations. In addition to sharing any relevant customer evidence with water companies, third parties, principally CCGs, will be expected to provide independent challenge to companies and independent assurance to Ofwat on:<sup>16</sup>

- the quality of a company's customer engagement; and
- the extent to which the results of this engagement are driving decision-making and are reflected in the company's plan.

Third parties can thus critically assess the evidence base and, if they draw similar conclusions as companies, heighten confidence in the evidence gathered.

In addition, one water company noted that it set up a customer insight technical group to serve as a forum for collecting different types of evidence from different units of the business. This practice spans [source triangulation](#) and [investigator triangulation](#), by gathering viewpoints from different parties. It covers various internal teams including those that hold operational company data.

Finally, one water company reported that the type of triangulation carried out to date within the water sector may be dependent on the type of data collected and the use for which the estimate/data is intended. This point illustrates the nature of triangulation to date as an 'ex-post' method – used to verify results once they have been collected.

Annex 1 explores the full range of potential data sources that water companies could explore when applying triangulation to their customer research or evidence-gathering strategies.

## 3.2 Triangulation in other sectors

This study searched for examples of triangulation in other sectors<sup>17</sup> and asked stakeholders for their input. Despite this, few examples of explicit triangulation were identified. One, from Ofcom, noted the ongoing use of methodological triangulation in the sector to track consumers' views on various telecoms services. In particular, it highlighted the Ofcom media-tracking survey as an example of multiple methods being applied. It also noted that Ofcom takes a long-term approach to evidence-

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<sup>15</sup> Water companies also incorporated independent expert review of their WTP methodologies. But source triangulation refers to gathering different viewpoints on sources, rather than methodological aspects of evidence gathering.

<sup>16</sup> Ofwat (2016), 'Ofwat's customer engagement policy statement and expectations for PR19.' Link: [http://www.ofwat.gov.uk/wp-content/uploads/2015/12/pap\\_pos20160525w2020cust.pdf](http://www.ofwat.gov.uk/wp-content/uploads/2015/12/pap_pos20160525w2020cust.pdf)

<sup>17</sup> Including other regulated sectors such as gas and electricity, telecoms and aviation. It also searched more widely for triangulation not specific to individual sectors.

gathering, to generate data that can be compared over time to generate further insights into factors influencing customers' preferences and values. Little evidence was found on other specific examples, perhaps due to the commercial nature of this kind of research in many sectors (when carried out by companies operating in competitive markets, for example).

### 3.3 Potential greater use of triangulation in the water sector

The potential for triangulation is at the forefront of discussions within the water industry ahead of PR19. One CCG reported at interview that in its engagement with water companies, Ofwat has been pushing for greater use of triangulation, particularly to supplement WTP estimates based on SP research alone. In particular, water companies are being encouraged to explore alternative and complementary methods in the estimation of consumers' general well-being as a window into their preferences. There is evidence to suggest that some companies are exploring several methods, including qualitative and quantitative methods (such as RP, WTP techniques, Likert scales, multi-criteria analyses, quality-adjusted life year (QALYs) estimations, and using behavioural economics to design customer engagement).<sup>18</sup>

A water company also reported this view, indicating a considerable shift towards more triangulation across the sector in recent times. It reported that in PR14 most companies presented WTP estimates in their business plans with little reference to evidence from other sources, but expects more referencing to other sources of customer evidence in water companies' business plans for PR19.

Another water company also reported a shift towards more [data / source triangulation](#). It indicated that it is increasingly examining a wider range of data taken from other areas of the business, for example by examining the subject of customer queries to identify customers' priorities. It is also examining possibilities to collect evidence through other sources, including exploring if any valuable data is commercially available to support wider triangulation.

At the time this study was carried out, many water companies were only in the early stages of planning or commissioning consumer research to inform their PR19 business plans. Few were therefore willing or able to indicate specific triangulation methods they were planning to use. Nonetheless, some companies did report plans to implement [method, source and temporal triangulation](#):

- several water companies identified the need to continue and expand method triangulation (see ICF report on Improving WTP in the water sector<sup>19</sup>). For example, in an interview for this study, one CCG reported its water company's intention to further expand WTP evidence collection to combine quantitative and deliberative methods; and
- some water companies reported exploring temporal triangulation, in particular to help identify the influence of external factors on any changes to customer preferences and valuations over time.

Another water company reported in an interview for this study that temporal triangulation has not been greatly used in the sector. Instead, it said there has been a tendency for triangulation to be 'one-off' and carried out at a single point in time.

<sup>18</sup> Consumer Council for Water and Water UK. (2016), Ibid.

<sup>19</sup> ICF (July 2017), *Improving willingness-to-pay research in the water sector*, <https://www.ccwater.org.uk/research/defining-triangulation-and-willingness-to-pay-in-the-water-sector/>

There is also considerable appetite among water companies for triangulation to play a greater role. One company reported in an interview for this study that it is fully committed to using triangulation to improve its customer research and that its CCG is equally enthusiastic. Another water company noted that it is already working on a process that will enable it to identify the robustness of certain sources of evidence. Another company indicated its intention to use a wider range of information to estimate customer preferences and values in the next price control, including how these values vary between different socio-economic groups and different regions within its area.

One company reported that it sees benefit in taking a more iterative and longitudinal approach to its research, rather than simply carrying out WTP research when a periodic review is approaching. Nonetheless, this company did only discuss this sort of longitudinal triangulation in the context of WTP estimates, rather than in relation to a wider set of customer evidence.

### 3.3.1 The need for further guidance

The evidence presented in this chapter perhaps highlights the need for water companies to more explicitly highlight where they are doing triangulation and how they have approached it. This has the potential to improve the transparency and quality of evidence that water companies include in their business plans.

This highlights the fact, as reported by one water company that there is little practical guidance on how triangulation can be carried out in the water sector. It welcomed the prospect of further work in this area, beginning with this report. A water company and a CCG reported that the sector would benefit from further formalisation of triangulation, or a steer on 'what good looks like'. Both indicated that this could help to encourage water companies to expand the breadth and depth of their data sources.

Combined with the obvious appetite that water companies have to apply it, triangulation offers a real opportunity for improving the interpretation of the evidence base for business planning and the periodic review process.

## 4 Known challenges in triangulation

This chapter describes findings related to good practice in triangulation applicable to the regulatory context of the water sector. It then describes challenges associated with triangulation in general.

### Chapter summary

This study found no good-practice guidelines for applying triangulation as a concept generally. Academic literature generally focussed on conceptual debate around triangulation. This chapter explores the challenges associated with carrying out triangulation, of which practitioners need to be aware, including when using the framework set out in chapter 5. In particular it focuses on weighing up and comparing contrasting data and the expertise required.

### 4.1 Good practice in triangulation

This study sought to identify good practice or good practice guidelines in triangulation. Although research identified several informal sources of advice for practitioners, none of these amounted to complete good-practice guidelines for triangulation. Nor were the stakeholders interviewed for this study able to identify any examples of guidance that water companies could use to apply triangulation concepts (neither sector-specific guidance, nor more general triangulation guidance). The academic papers referenced in this study generally focussed on the types of triangulation, without giving guidance on how it should be carried out in practice.

This study therefore seeks to provide recommendations as a starting point for practitioners wishing to use triangulation in the water sector to support company business plans. It aims to identify challenges in triangulation and offer guidance on how these challenges can be met.

### 4.2 Known challenges in triangulation

This section describes a range of challenges that can apply to research in general, but which are particular challenges in the context of triangulating different sources of evidence and data.

Specifically, this section describes:

- weighing-up and comparing data;
- the requirement for methodological expertise; and
- for water companies, uncertainty over how triangulation in their business plans will be evaluated.

Chapter 5 discusses how triangulation can be approached, including how these challenges can be overcome.

#### 4.2.1 Weighing-up and comparing data

Triangulation affords the possibility to incorporate a significantly wider evidence base into water companies' business planning. As highlighted above, this brings a new challenge, which is to compare and weigh up a variety of evidence.

For PR14, Ofwat's risk-based review<sup>20</sup> used three criteria to assess companies' approaches to customer engagement and willingness-to-pay (WTP) evidence. In relation to the WTP evidence, Ofwat asked: "how far has the company demonstrated a robust approach to gathering willingness to pay information and in mapping this to its outcomes, performance commitments, and outcome delivery incentives?" Consequently, although there were other criteria related to customer engagement, it viewed the assessment of customer evidence solely in relation to WTP evidence and only specifically mentioned robustness.

Several stakeholders questioned on the challenges associated with triangulation described various scenarios in which it would be challenging to decide which sources of evidence to favour over others. The main scenarios described by stakeholders are set out below:

- **Comparing quantitative and qualitative data.** One water company noted it can be difficult to decide how much weight to give to quantitative versus qualitative. Another company's CCG concurred that it can be difficult to determine how to weight and compare these different types of data.

One CCG and a water company reported in an interview for this study that it perceived a bias in the water sector towards quantitative data. Therefore applying triangulation methods could help to widen debate to include a range of sources previously not considered, and compare qualitative and quantitative data together.

The Environment Agency in an interview for this study also reported that triangulation in environmental valuation can be challenging to generate quantitative (or monetary) estimates of values. In this context, it highlighted the need to find ways to compare quantitative and qualitative information. There are strong parallels with some of the valuations that water companies must generate in their business planning, particularly as some water services overlap with environmental valuations.

- **Over-simplified comparisons of data.** Some stakeholders interviewed for this study noted that it can be challenging not to over-simplify when faced with a need to favour one source over another (e.g. when two sources produce different or contradictory evidence).

Two companies concluded from discussing this challenge that any triangulation method applied in the sector should allow water companies flexibility to accommodate different types of comparisons, depending on the nature of the evidence they are considering. This highlights the need for triangulation not to overly constrain water companies' comparisons between methods, recognising that each individual situation is different. Guidance should therefore not aim to provide a prescriptive method for weighting sources. Another water company concluded that triangulation should not be a 'black box' that implies a formulaic process of comparing different evidence. It expressed the view that an over-simplified weighting method would worsen the evidence base and lead to inferior decisions. It indicated that this would be inappropriate in light of the need to compare quantitative and qualitative sources. Its view was that an inflexible weighting method would negate the advantages of gathering evidence from a wide and diverse range of sources.

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<sup>20</sup> Ofwat (2014), *2014 periodic review risk-based review – internal methodology*, [http://webarchive.nationalarchives.gov.uk/20150624091829/http://ofwat.gov.uk/pricereview/pr14/pap\\_tec140404pr14internalmeth.pdf](http://webarchive.nationalarchives.gov.uk/20150624091829/http://ofwat.gov.uk/pricereview/pr14/pap_tec140404pr14internalmeth.pdf).

Another water company concurred, expressing its concern that a simplified universal method that sought to combine different sources into a single-figure comparison would do nothing to improve the robustness of evidence. It highlighted that it preferred a detailed debate on the merits of individual pieces of evidence in order to reach a balanced and transparent judgement on the relative credence to be given to each source.

This challenge is contrasted with the value of providing a structured and transparent framework for triangulation in the water sector, which could help to provide water companies with guidance to improve the way they gather and use customer evidence (addressed later in Section 5).

- **Comparing contradictory evidence.** A regulator from another sector noted the challenge involved when evidence is contradictory. Another water company also noted that comparing a greater number of sources would generate greater potential for discrepancy between them.

The water company that highlighted this challenge noted in particular that many stakeholders believe that triangulation implies that there is a 'right answer'. This highlights the need for water-sector guidance to emphasise the strength of triangulation in generating an evidence base that considers and balances the various and different insights that can be gained from different evidence sources. Contradictory evidence should, therefore, not be seen as a barrier to triangulation. Anomalies and contradictions are a natural outcome of using multiple sources – it would be odd for every single evidence source to 'agree' given the diversity of evidence sources with which water companies work. Therefore contradictory evidence should be seen as an opportunity to examine those different perspectives and to gain new insights from understanding the reasons behind the discrepancies.

- **Avoiding convergence.** Another related challenge is the need to avoid confirmation bias; a tendency to favour evidence sources that agree with an established hypothesis. This risk was also highlighted by Farquhar et al (2016).<sup>21</sup> Cohen et al. (2000) support this view by indicating that triangulation that is undertaken simply to confirm or validate findings from an existing or main source is being carried out on a false premise.<sup>22</sup>

## 4.2.2 Requires methodological expertise

One final challenge highlighted by one water company interviewed for this study was the need for sufficient expertise to understand different research methodologies. Water companies would need to have a good methodological understanding of different research techniques to understand the weighting that could be applied to each. Notably though, this water company did not see this as a barrier to methodological triangulation.

## 4.2.3 Uncertainty about how it will be evaluated

All water-sector stakeholders interviewed for this study welcomed the idea of triangulation, albeit some with more trepidation than others and some with more emphasis on one or more of the specific concerns outlined above.

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<sup>21</sup> Farquhar, J. and Michels, N. (2016), Ibid.

<sup>22</sup> Cohen, L., Manion, L., and Morrison, K. (2000), Ibid.



One underlying concern, not mentioned by stakeholders but reported by BritainThinks (2016)<sup>23</sup>, is stakeholders' uncertainty about how Ofwat will assess any new or different approaches to customer research, including triangulation of different evidence sources. In particular, this report notes stakeholders' concerns about the basis on which they can justify their approach to favouring or weighting different sources of evidence.

This challenge again emphasises the opportunity for further guidance to be provided on how water companies should triangulate evidence sources.

## 4.3 Conclusions

There is no current guidance that describes approaches that companies could take to mitigate these challenges. Nonetheless, it is important that any company seeking to triangulate sources is aware of these challenges. Indeed, this could lead to greater awareness of the strengths and opportunities associated with triangulation. In particular:

- triangulation can be applied in a wide variety of ways, to many sources, including qualitative and quantitative sources; and
- contradictory evidence can be an opportunity to learn about different perspectives that have not been previously revealed.

The evidence set out in this chapter also leads to the following conclusions about how triangulation should be applied:

- triangulation cannot be a 'black box'. It must be a transparent process about the approach used and the rationale for the weight applied to each evidence source in any final reasoning;
- triangulation must be flexible to different needs and different situations;
- it must also be explicit when evidence is contradictory and to explain what can be learned from those contradictions; and
- deliberate steps must be taken to avoid confirmation bias; favouring sources that agree with an already-established hypothesis.

Finally, water sector stakeholders would be more confident about implementing triangulation methods if there were further guidance about how Ofwat would assess companies' approaches to triangulation in the context of their PR19 business plans.

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<sup>23</sup> BritainThinks (2016),

## 5 Recommendations on triangulation in the water sector

This chapter sets out triangulation practices in the water sector and explores how triangulation can be applied to the water-sector context and expanded to form the basis of a strategy for evidence gathering.

### Chapter summary

This chapter identifies recommendations for the water sector which could be used to improve triangulation practices across the sector. These recommendations develop the starting definition of triangulation into a broader process that water companies can use to improve their evidence base. It also identifies principles that could be used to help water companies decide how to compare evidence, recognising that a clear framework is needed, rather than a prescriptive or mechanistic process.

### 5.1 The role of triangulation in the water sector

This study has analysed the literature available on triangulation, and the evidence presented by stakeholders in interviews for this study, to identify principles of triangulation that could be applied as guidelines for water companies in their evidence-gathering and analysis. One of the key challenges in applying triangulation, in the water sector and beyond, is how to assess and prioritise alternative sources of evidence. This section sets out a potential approach to weighing-up evidence that could be used in the water sector.

The principles for triangulation described below aim to address the challenges identified above. They draw on discussion at a recent industry workshop<sup>24</sup>, which concluded that water companies should apply the following practices to gathering, analysing and triangulation customer evidence for business-planning purposes:

- **strategic planning** – make a research plan in advance, including being clear about the objectives and purpose of evidence-gathering as a whole and for individual studies. This is intended to ensure that the relative strengths and weaknesses of evidence sources are recognised and built into evidence-gathering;
- **research expertise and understanding** – understand the range of research tools available, choose and apply the most appropriate tool for each specific purpose (and relate that to the objective);
- **proportionality** – adapt the level of triangulation to the specific circumstances of the research, i.e. conduct more research for more important investment decisions and less where the decisions are less important; and
- **transparency** – triangulation must not be a black box, and approaches must be explained and justified to relevant stakeholders (such as CCGs) throughout the research cycle and it must generate an appropriate audit trail for the evidence gathered and the way it is used.

Stakeholders think this process should not be mechanistic. Instead, it needs to be adaptable to different evidence sources, so that water companies can apply it to many different types of evidence sources and to the various ways that evidence is

<sup>24</sup> Consumer Council for Water and Water UK. (2016). Ibid.



used in business planning. At the same time, a systematic and transparent framework across water companies could help Ofwat to interpret and assess triangulation approaches at PR19. Likewise, Ofwat's contribution to this debate could provide water companies with confidence around how such approaches will be treated during assessment of their PR19 business plans.

Along these lines, ICS and Economics for the Environment Consultancy (eftec) (2016)<sup>25</sup> noted that acceptance of companies' evidence in their business plans will depend crucially on the extent to which companies engage key stakeholders to explain their approach to evidence gathering, including their comparison of alternative sources and types of evidence (which can be addressed through triangulation). It concluded that this will need to include close working with CCGs in particular, alongside other stakeholders, to explain their approaches.<sup>26</sup> One CCG reported a similar point, highlighting that CCGs can have a significant and valuable role in promoting water company triangulation. It noted, in particular, that the regular nature of its interaction with water companies offers a significant opportunity not only to provide a different viewpoint on water companies' research, but also to offer ongoing temporal triangulation in addition to the more obvious triangulation of viewpoints.

CCWater commissioned this work to contribute to the debate around triangulation, already begun at its industry workshop.<sup>27</sup> These are initial proposed guidelines, to be discussed and debated by stakeholders in the sector. They are acknowledged to be a starting point that will need further refinement. As outlined above, Ofwat's involvement could give water companies greater confidence about how their triangulation analysis will be assessed in PR19, even if Ofwat does not produce specific guidance on this. These principles are not a substitute for the triangulation methods identified above, rather they could be applied by water companies wishing to explore all types of triangulation.

**Recommendation 1** – Stakeholders from across the water sector should discuss the framework for water-sector triangulation set out in this report, to establish some common ground for triangulation across water companies. This should allow triangulation to be a systematic process that nonetheless accommodates the needs of triangulating various types of evidence. Ofwat's engagement in discussions surrounding the (further) development of such a framework/guidance would give water companies the confidence to incorporate such an approach in the earlier stages of their evidence-gathering for PR19.

## 5.2 Ongoing triangulation

Two CCGs noted concerns that water companies saw triangulation as a method to be applied to a set of initial conclusions at the end of the business planning process to test those conclusions. Interviews with some water companies seemed to confirm this may be the case. As noted above, triangulation literature reports that this approach omits some of the key benefits of triangulation and it increases the risk of confirmation bias if only used at a later stage in the process when timescales and the costs already invested in research may make it more challenging to step back and revisit (see Section 4.2). Instead, **triangulation should be used continuously and variously according to the context**, as recognised in UKWIR (2011).

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<sup>25</sup> ICS and eftec (2016) *Ibid.*

<sup>26</sup> ICS and eftec (2016) *Ibid.*

<sup>27</sup> Consumer Council for Water and Water UK. (2016). *Ibid.*

The beginning of a periodic review cycle can be seen as an opportunity to take a fresh approach, which could incorporate new sources of evidence into an ongoing customer insight / valuation framework. Cohen et al (2000) note the advantages of seeing triangulation as an ongoing process, rather than as one-shot events.<sup>28</sup> One CCG highlighted that, generally, water companies do not have coherent customer insight / valuation frameworks, but instead tend to carry out customer research for a specific purpose at a specific point in time.

Ongoing triangulation could provide much greater value to water companies if it were an all-encompassing process used on an ongoing basis, rather than a 'check' on evidence that has already been collected. ICS & eftec (2016) identified that companies should have an overarching customer insight / valuation framework. In that context, water companies could use a well thought-out triangulation process to help design and inform an overarching customer insight / valuation framework. Using triangulation only once data has been collected is a missed opportunity to generate insights that could improve the evidence base available to water companies.

There is evidence that some companies are already beginning to use triangulation across the price-review cycle, not just towards the end of the business-planning process. In an interview for this study one water company reported aiming to apply triangulation at three key stages in the business planning process for PR19. It plans to triangulate existing data sources during the initial stages of business planning, then once WTP research has been completed to inform conclusions drawn from that WTP research and finally in 'acceptability research' (generally this is qualitative research to test the findings of WTP research) to test the conclusions of that research.

Another water company reported that triangulation should be iterative, in particular to reveal the influence of context and situation on findings of customer research. It reported making attempts internally to move triangulation towards an ongoing process, though indicated its belief that this is not widespread practice across the sector. One other company noted the desire to move towards a more ongoing approach to gathering customer evidence, indicating that it has put in place a quarterly customer tracking survey to examine how customer satisfaction and preferences change over time, as well as to generate insight on what factors are driving these changes.

Ofcom provided further evidence of this view in an interview for this study. It reported that triangulation can have benefits at all stages of evidence gathering. It outlined the benefits of (methodological) triangulation at the design stage of a study as well as data triangulation at the results stage, to check new research against an already-established internal evidence base. It also highlighted the value of perspective triangulation. For Ofcom, in practical terms this meant harnessing alternative viewpoints from across the organisation at an early stage of any research it is planning to commission. Ofgem also highlighted the benefits of doing so during the early stages of planning research, to ensure that alternative perspectives are considered.

At a recent water-sector workshop, one company highlighted the time-pressure that companies face when attempting to apply triangulation. This challenge could be addressed directly by considering triangulation from the beginning of the process, rather than at the end. Some stakeholders recognise the advantages that such an approach would bring. United Utilities (2016) emphasise the need for water

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<sup>28</sup> Cohen et al. (2000), Ibid.

companies to “get to know customers better, more actively involving customers in decision-making and encouraging their participation in developing service delivery solutions. This will contribute to building customer trust and confidence in water companies.”<sup>29</sup> Another company also recognised the need to collect evidence on customer preferences “throughout the delivery period ... to give all stakeholders confidence that these [business] plans reflect a deep understanding of what our customers expect, not just a snapshot of preference at a point in time.”<sup>30</sup>

**Recommendation 2** – Water companies should maximise the benefits of triangulation by considering all types of triangulation and evidence gathering as an ongoing strategic requirement to understand their customers’ needs. The principles of triangulation should be applied from the beginning of the process of designing and planning customer evidence-gathering, not just as a tool to cross-check information that has been collected.

### 5.3 A framework for triangulation in the water sector

This section puts forward a potential framework for triangulation, intended to inform stakeholders’ ongoing development of triangulation in the sector. It aims to outline practical steps that water companies can take to build triangulation into their evidence gathering, for the periodic review and for their wider needs.<sup>31</sup> It also aims to incorporate the multiple types of triangulation explored above.

This framework should be considered within a wider necessary first stage – for water companies to define their strategic objectives for customer evidence gathering. Water companies should define strategic objectives so that applying the framework below will generate evidence that is useful and valuable to water companies. These objectives should see to describe what customer evidence is valuable to water companies, taking into account the following considerations:

- What do water companies already know, taking into account existing customer research and knowledge about their customers?
- What customer evidence is required to feed into companies business planning for the periodic review?
- What customer evidence is valuable to water companies for other reasons (e.g. to help improve service quality of make operations more efficient)?
- Which customer evidence will have the greatest influence on what companies do (either in business planning or operationally)?

Water companies can then apply the proposed framework set out below, focussing on customer evidence gathering that will have the greatest influence on what they do. This would also allow companies to prioritise strategic objectives, based on the sensitivity of outcomes to any estimates of customer WTP values or preferences. For example, WTP estimates that are used to directly set financial incentives should be subject to greater assurance than those used to inform high-level assessments of

<sup>29</sup> United Utilities (February 2016), Improving Customer Research and Engagement. <http://corporate.unitedutilities.com/documents/Water2020-Feb16-CustomerEngagement.pdf>

<sup>30</sup> Southern Water, <https://www.southernwater.co.uk/Media/Default/PDFs/Water-2020-Customer-Engagement.pdf>

<sup>31</sup> This set of steps draws in part from twelve proposed steps in the public health triangulation process, adapted for the water sector. Those steps were proposed by Rutherford et al. *Public health triangulation: approach and application to synthesizing data to understand national and local HIV epidemics*, BMC Public Health 2010 <https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-10-447>

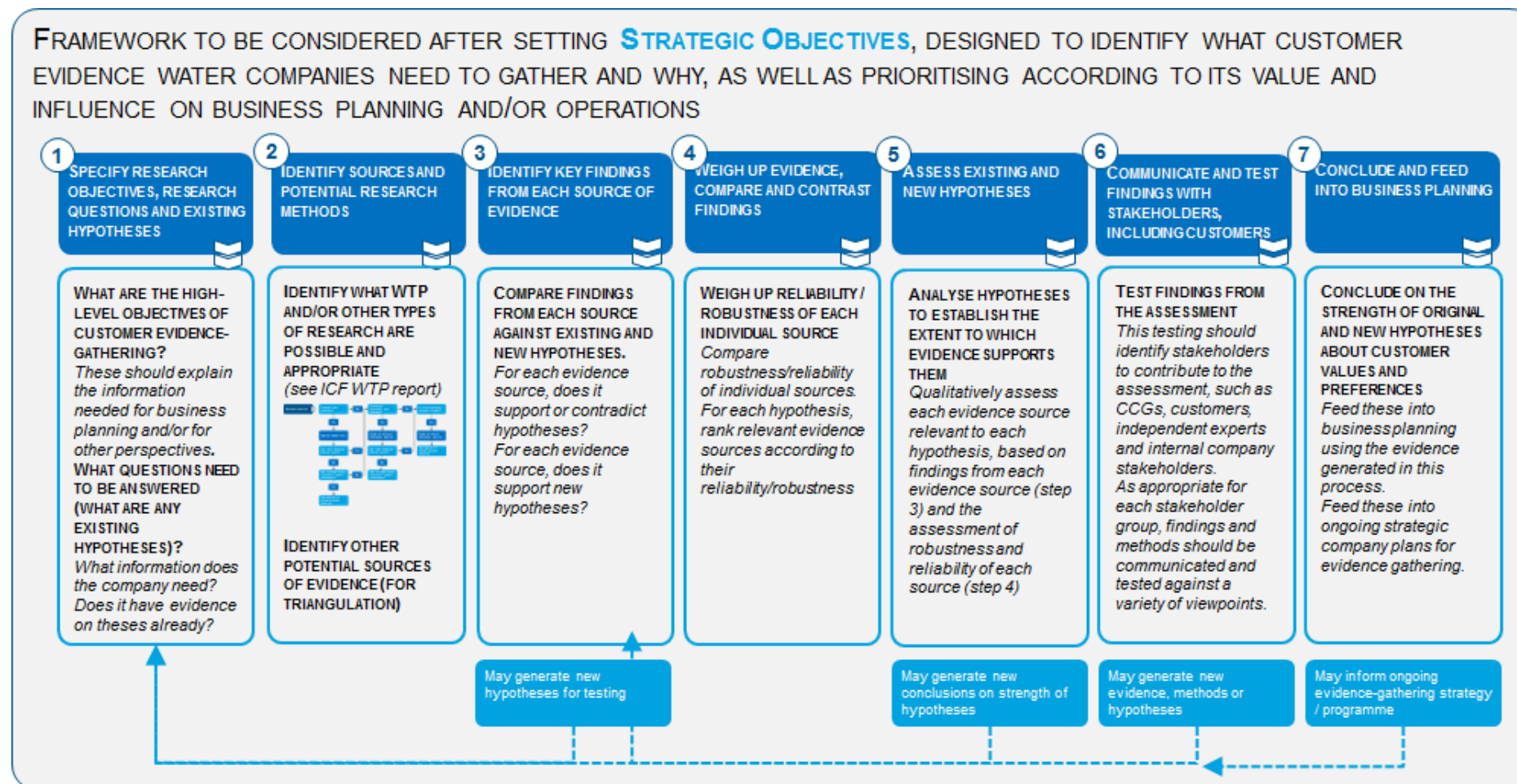
alternative investments (see ICF report on *Improving WTP in the water sector*).<sup>32</sup> Answering these strategic questions should allow companies to create strategic objectives for customer evidence gathering that describe what they want to know about their customers and why.

The steps in the proposed triangulation framework are outlined in Figure 5.1. Each stage in the process is explained in further detail below. The early stages in this framework aim to encourage companies to use valuable information collected previously, to ensure new research is triangulated with old. The latter stages of the framework seek to encourage companies not to see this as simply an exercise in verifying existing research.

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<sup>32</sup> ICF (July 2017), *Improving willingness-to-pay research in the water sector*, <https://www.ccwater.org.uk/research/defining-triangulation-and-willingness-to-pay-in-the-water-sector/>

Figure 5.1 A framework for triangulation in the water sector





## ① Specify high level research objectives and existing hypotheses/questions

This step involves identifying the key research objectives that water companies are seeking to answer via customer evidence and business intelligence, as well as hypotheses about their customers or specific questions they seek to answer. This framework aims to capture learning from all evidence sources, whether or not their findings contradict each other, as contradictory evidence should be seen as an opportunity to generate new insights. This approach reflects Erzberger and Prein (1997), who point out that all apparent empirical agreements or contradictions between evidence sources reflect methodological considerations, applications and research hypotheses.<sup>33</sup> Any research outcome, no matter how contradictory, can therefore be seen as an opportunity to refine existing views on customer values and preferences, or to gain new insight.

This stage recognises that part of the value of triangulation is the premise that weaknesses in individual evidence sources should be compensated for by counterbalancing the strengths of others.<sup>34</sup> This emphasises the need for a first step to set out research objectives against which to verify a good strategic mix of evidence sources that balances the various strengths and weaknesses of sources.

Research objectives and questions may be specific to the price-review process, but may also meet the company's wider ambitions to improve their understanding of their customers. Water companies would set out viewpoints and hypotheses based on their existing evidence base and other internal and public information. Evidence generated for previous periodic reviews may be a starting point for this stage in the process. Questions which could be used to test the appropriateness of these high level research objectives are as follows below.

- How will answering the research question influence the company's business planning?
- Is there an order in which these high level research questions should be 'answered', i.e. where does the answer to one, inform the development of others?
- How will each question deliver the company's strategic objectives for customer research (to be outlined before applying the framework, as described above)?
  - Which research questions will have the greatest influence on business planning decisions (what is essential/most important to know)?
- Can the question be answered using known research methods that produce valid and meaningful outputs, suitable for the intended use of the answer?
- Are sufficient resources available to gather data to answer these questions?
- Is sufficient time available to gather evidence within business-planning timescales for the next periodic review or for another business purpose?

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<sup>33</sup> Erzberger and Prein (1997), *Triangulation: Validity and empirically-based hypothesis construction* [https://www.researchgate.net/publication/225917398\\_Triangulation\\_VValidity\\_and\\_empirically-based\\_hypothesis\\_construction](https://www.researchgate.net/publication/225917398_Triangulation_VValidity_and_empirically-based_hypothesis_construction)

<sup>34</sup> As recognised by Jick in the context of methodological triangulation: Jick (1979), *Mixing Qualitative and Quantitative Methods: Triangulation in Action*, Administrative Science Quarterly, Vol. 24, No. 4, Qualitative Methodology (Dec., 1979), pp. 602-611, [http://www.pm.lth.se/fileadmin/\\_migrated/content\\_uploads/Jick\\_1979\\_Mixing\\_qualitative\\_and\\_quantitative\\_methods\\_-\\_Triangulation\\_in\\_action.pdf](http://www.pm.lth.se/fileadmin/_migrated/content_uploads/Jick_1979_Mixing_qualitative_and_quantitative_methods_-_Triangulation_in_action.pdf)

The purpose of this stage is to identify questions that could feasibly be answered. Answers to these questions may not be forthcoming in the early stages of practical triangulation, but could emerge at a later stage of the process once evidence has been gathered.

## ② Identify possible data sources and research methods

This step involves gathering information on possible data sources to analyse the scope, extent and quality of data. It also includes examining possible research that could be carried out to supplement that existing data.

As a starting point for this step, this study has identified the following potential sources of data, which water companies reported they were exploring when interviewed for this study (Table 5.1).

Table 5.1 Potential evidence sources for water companies

Potential data source	Possible evidence
Customer complaints and enquiries	Information on the volume / frequency of customer complaints and contacts, the reasons for customer complaints and contacts, how quickly these are resolved.
Call centre data	
Proactive customer engagement data / Campaign data	Information relating to the effectiveness of advertising and/or promotional material, the extent to which this influences customer preferences / valuations.
Publicly available cross-company information	Any published research from other water companies (potentially spanning all sources of customer evidence), or independent research published by other stakeholders.
External (research) data	
Internal operational data	Could include a wide variety of information. In addition to the customer contact data mentioned above, this could include information about the quality of service provided, which could be linked to customer research data, for example.
Market data	Data from related or substitute markets available to inform revealed-preference analysis.
Social media and online data	Information on customer preferences, values and attitudes gathered from social media interactions with customers. Could generate similar information to customer complaints data, with potential to inform views on customer values and preferences.

Having identified the fullest possible range of evidence sources, water companies could then assess the nature of the (qualitative and quantitative) data available from each. This will allow them to establish which evidence sources offer potential to inform the research objectives and research questions specified in the first stage. For example, understanding the extent of market data on possible compliments and substitutes for water and wastewater services will inform companies' views on what revealed-preference analysis can be carried out. It will also help them to establish priority areas to carry out stated-preference research or other forms of customer research. This is explored further in the ICF report, *Improving WTP in the water sector*.<sup>35</sup>

<sup>35</sup> ICF (July 2017), *Improving willingness-to-pay research in the water sector*, <https://www.ccwater.org.uk/research/defining-triangulation-and-willingness-to-pay-in-the-water-sector/>

### ③ Identify key findings from analysis of each evidence source

This stage first involves analysing the evidence from each source (and any research based on the evidence), to conclude:

- for each evidence source, how it can inform answers to the research questions that the company has set out to explore;
- whether the evidence source raises any new research questions that the company wishes to consider (in which case it should return to stage 1 for those questions); and
- whether each evidence source supports any new findings about customers' preferences and values, beyond those previously considered.

This seeks to capture the full value of any new evidence or new analytical findings that a company identifies at this stage. In particular, if evidence or analysis identifies findings that appear contrary to other findings, it aims to encourage companies to identify possible hypothetical explanations *before* reliability and robustness of information is assessed. This aims to ensure that companies can learn from both supportive and adverse findings, by challenging existing thinking and hypotheses and encouraging companies to consider possible reasons for contradictory findings.

Evidence sources can then be mapped against company hypotheses, so that the full range of evidence relevant to each hypothesis can be identified.

### ④ Weigh-up evidence, compare and contrast findings

This stage involves weighing-up the validity of sources from the perspective of each hypothesis, to inform the assessment of each hypothesis at the next stage.

The aim of this stage of triangulation is to analyse the quality of various evidence sources (in and of themselves – the next stage considers how evidence can be matched to its use). As discussed above, this study does not recommend prescriptive quality scoring, because this is unlikely to be applicable to all scenarios in which water companies may seek to apply triangulation. Instead, this study sets out principles that can be applied to this process and practical research questions that water companies could analyse and answer to inform their assessment against these principles. These principles have been adapted from Cabinet Office guidance on qualitative evaluation.<sup>36</sup>

**PRINCIPLE 1: Contributory evidence** - evidence should contribute to water companies' understanding of their customers' priorities, needs and values.

This principle aims to encourage water companies to assess both qualitative and quantitative evidence (of all types available) to understand how it can improve their understanding of their customers. This directly addresses the challenge of overcoming confirmation bias, by encouraging a wider assessment of what can be learned from each source, with the source itself at the beginning of the process, rather than an established hypothesis.

Following this principle should also ensure that relevant context is considered in assessing the weight to be attributed to each source, for both qualitative and

<sup>36</sup> Cabinet Office (2003), *Quality in qualitative evaluation: a framework for assessing research evidence*, [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/498322/a\\_quality\\_framework\\_tcm6-38740.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/498322/a_quality_framework_tcm6-38740.pdf) These guidelines were developed in a different context, specifically for qualitative evaluation, but have been adapted to the required purpose for this study.



quantitative estimates. Ofcom noted in an interview for this study that building a strong evidence base often involves building a strong narrative to explain the relevance of each piece of evidence. This narrative should include explaining *how* the evidence improves water companies' understanding of their customers.

Applying this principle to all potential sources of information could also encourage water companies to consider sources of evidence that may previously have been discarded if considered in a narrower context. For example, some evidence may not specifically contribute to more accurate WTP estimates for attributes or facets of water services, but nonetheless could help companies to understand their customers better. This would also generate a narrative to explain why other potential sources may have been discarded.

Applying this principle could significantly widen the types of information that water companies incorporate into their business planning and may also generate evidence that is useful to the company generally, even beyond the price control context. ICS and ettec (2016) concluded that water companies could strengthen their evidence base to better demonstrate that their business plans represent consumers' interests.<sup>37</sup>

**PRINCIPLE 2: Methodological soundness** – evidence should have been generated using methods that have been soundly applied, with sufficient evidence to demonstrate that is the case; and

**PRINCIPLE 3: Rigorous data gathering** – evidence should have been gathered in such a manner as to maximise the amount of information gained from the evidence, without introducing any bias into the evidence, with sufficient evidence to demonstrate that this is the case.

These two principles rely on water companies gaining sufficient understanding of the methods applied and the context in which they have been applied to weigh up alternative sources of evidence. One company highlighted this as a particular challenge associated with triangulating evidence from a wide variety of sources.

Applying these principles should ensure that the methodology used in the research is the right methodology for the specific purpose that it has been used for. This might involve detailed review of the method, depending on the extent to which methodological refinement, checks and/or independent verification has already been carried out and written up.

The evidence and/or data used in each method should have been gathered in line with best practice, both in terms of methodological considerations and data-gathering. For example, WTP evidence should have been gathered in accordance with well-established principles for good practice in WTP research.

Examining the soundness of the methodology and the rigour of the data gathering should yield information on the overall reliability of results. This is a key consideration in how much weight is applied to each evidence source.

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<sup>37</sup> ICS and ettec (2016), *Ibid*.

**PRINCIPLE 4: Credible interpretation** – conclusions drawn from the evidence must be credible, including sufficient exploration of alternative interpretations of the same evidence and comparison of the various sources of evidence explored for each alternative interpretation.

Applying this principle should help to identify any interpretation that biases findings. For example, it should identify selective or unrepresentative use of data, or unjustifiably placing more emphasis on some evidence over other evidence, or indeed, research findings that are not sufficiently supported by the evidence.

Evidence can only be credible if its context and purpose is well understood, even for quantitative estimates. Building a strong evidence base often involves building a strong narrative to explain findings. In particular, building a narrative around quantitative findings can help to allow comparison with qualitative findings, because it allows for a direct comparison against a common hypothesis, expressed in the narrative.

Sensitivity testing can also play a role in this assessment. This can involve understanding whether original evidence has been tested for sensitivity and, if so, understanding the factors to which it is sensitive.

Each of these principles could be tested through a range of more specific research questions that seek to generate the analysis required to make conclusions about them. As noted above, a weighting scale is not appropriate given the diverse range of evidence sources that will need to be assessed. Furthermore, the relative importance of each aspect of the principle may itself depend on the specific evidence sources that are being compared.

#### ***Applying the principles in practice***

Practical questions are outlined below, which seek to illustrate how water companies could apply these questions in practice. Analysing these questions will generate evidence on the overall quality of each evidence source.

The individual assessment of each source is consistent with Erzberger and Prein (1997) who found that individual evidence sources should be reviewed separately to evaluate methodologies, prior to being analysed together to answer a research question.<sup>38</sup>

Questions may differ according to whether a source includes quantitative or qualitative data, but the principles are intended for application to both types of evidence. Possible questions for assessing evidence against each principle are outlined below (Table 5.2).<sup>39</sup> These could be used by water companies within this process, but also provide guidance for CCGs and other stakeholders when challenging water companies' evidence.

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<sup>38</sup> Erzberger and Prein (1997), *Ibid.*

<sup>39</sup> United Utilities (2016), *Ibid.* and Cohen et al. (2000), *Ibid.*

Table 5.2 Criteria for weighing-up evidence<sup>40</sup>

Principle	Practical questions
<b>Principle 1: contributory evidence</b>	What kind of information does the source tell me about water customers?
	Is this information valuable for business-planning purposes?
	Does this information confirm what I already know about my customers? <ul style="list-style-type: none"> <li>– If no, what explains the discrepancy?</li> <li>– If no, does it give me an alternative perspective?</li> <li>– If yes, how should I adapt my analysis of customer's preferences?</li> </ul>
	Do I already have this kind of information about my customers?
<b>Principle 2: methodological soundness</b>	What sorts of questions does this method appropriately answer?
	Are any of the methods applied less well established, new or innovative? If so, do I need to do any further checks or investigation to establish how sound these methods are?
	How widely has the methodology been tested by the practitioners who generated the evidence?
	Has the methodology been appropriately adapted and refined for the specific purpose for which it has been used?
	Is it clear that good practice was followed?
	Was the methodology peer reviewed? If so, is the extent and depth of the review clear from the research write-up?
<b>Principle 3: rigorous data collection</b>	How was data gathered?
	Was data-gathering in line with best practice for the methods applied?
	Are there lessons that can be learned and applied in other areas of evidence-gathering, to improve my company's evidence base?
	(Building on previous questions) did the research include independent review of evidence?
<b>Principle 4: credible analysis, interpretation</b>	Is the context for the evidence described?
	What was the overall purpose of the research that generated this evidence?
	Have the limitations of the data been identified and recognised?
	Does that purpose influence my interpretation of the evidence?
	How was data gathered?
	Are there biases to be aware of, which have not been mitigated with the methodology? If so, how should I account for these?
	Has the evidence been used selectively? Have all aspects of the evidence being examined been used?
	What degree of confidence can be attributed to the evidence?
	To what degree can results be generalised from one source of evidence to conclude about other areas/customers/preferences?

Water companies interviewed for this study stressed that a prescriptive mechanistic process for weighing-up evidence would not be helpful, as it may restrict their assessments. This view reflects the variety of information that water companies may seek to draw upon to inform their hypotheses on customer valuations and preferences. The proposed framework in this study seeks to accommodate those concerns, while providing a common way for stakeholders across the sector to

<sup>40</sup> Adapted from Rutherford et al. (Ibid) and a small number of these questions are reproduced from United Utilities (February 2016) and Cohen et al. (2016), although those questions were generated specifically for the context of WTP estimates (not the wider context considered in this report).

consider triangulation. It also provides a basis for further discussion across the sector – both on the framework itself but also how to apply it.

## 5 Assess existing and new hypotheses

Once evidence sources have been assessed and weighed-up, existing and new hypotheses can then be analysed using that evidence. As a general rule, greater weight can be given to higher-quality sources of evidence, as noted by Rutherford et. al.<sup>41</sup>. However, this stage captures the notion that some sources might be more credibly applied to one hypothesis but not another – as the validity of evidence depends not only on the source itself (considered at stage 3) but also the way the evidence is used (stage 4).

This analysis can be based around the hypotheses that were developed at the beginning of the ongoing triangulation. The evidence base should allow the development of an analytical narrative to support each hypothesis, which breaks down each into steps that can be tested against the evidence base, using the prioritisation of relevant sources established in the previous stage.

The previous stage focussed on assessing the reliability and robustness of evidence gathered. At this assessment stage it may also be necessary to assess how transferable findings are to the specific hypothesis in question, taking into account any differences in the scenario to which the evidence source applies and the specific hypothesis in question. This will be specific to the hypothesis being examined, so may need to be analysed separately for each combination of evidence source and hypothesis.

Broadly, this analysis could lead to one of three outcomes for each hypothesis:

- findings converge to support a hypothesis;
- findings generate new insights that lead to development of further hypotheses; and
- findings undermine a hypothesis, leading to less weight being placed on the hypothesis.

## 6 Communicate and test findings

Stakeholder engagement will be important for water companies throughout the process described here. And, importantly, this stage should not be confined to the end of the process, but should arguably occur throughout, allowing for triangulation of different viewpoints throughout the process.

The framework described here aims to help water companies generate a narrative around their customer evidence and relate it back to hypotheses about their customers' values and preferences. This should help companies to explain and communicate their assessment of evidence and their findings with clear reference to how they went about that assessment.

If a company uses its hypotheses to frame its customer evidence and conclusions, this process may well generate new hypotheses that could explain its findings from that analysis, and to which of the steps described here could then be applied.

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<sup>41</sup> Rutherford et al. (2010), *Ibid*

## **7 Coordinating with business planning**

This process should be coordinated with business-planning requirements throughout. This is consistent with this study's finding that triangulation should be seen as an ongoing practice, rather than a 'checking' process.

In particular, the following interactions with business planning should be considered:

- the need for customer evidence-gathering to consider the specific information requirements of business planning from the outset (e.g. which water/wastewater service attributes does the company need information on?). This should inform the hypotheses formed at the beginning of the process; and
- the need for customer evidence gathering to generate some specific quantitative information to inform quantitative assumptions for cost-benefit analysis.

## **5.4 Methods and data sources**

It was noted above that the principles set out in this Section could be applied to all forms of triangulation. Indeed, as explained above, triangulation can be carried out in many different ways, by triangulating evidence sources, methodologies, temporal evidence, perspectives, geographies and theories. The principle of multi-dimensional triangulation is to explore all possible methods of triangulation to their full extent.

Annex 1 explores how the various data sources that have been identified in this study could be used as the basis for triangulation, including mapping each source onto the six types of triangulation set out earlier.

## 6 Conclusions and recommendations

This chapter summarises the findings of this report. It also concludes with recommendations for how triangulation can be applied in the water sector in future and also explores possible next steps for stakeholders across the sector to develop triangulation practices further.

### 6.1 Summary

In its various forms and applications, triangulation is generally considered to involve using multiple and independent measures to improve an evidence base. This study offers a more practical look at triangulation, specifically in the context of the water sector, as a tool that can help water companies to understand their customers, but also develop better evidence for the price-review process.

To do so, water companies should consider triangulating evidence in all the ways described above. This includes triangulating methods, timing of evidence gathering, data sources, geographic coverage, investigators/viewpoints and theories.

There are also some common challenges associated with triangulation, but although existing literature offers some guidance on triangulation, this study did not find step-by-step holistic guidance that water companies could follow for the water sector context. Interviews carried out for this study suggested that stakeholders from across the water sector have the appetite for such guidance and, indeed, to contribute to its development. A framework for such an approach was therefore developed, which seeks to describe the stages in a high-level approach to triangulation and to describe specific practical steps that water companies can take to apply it. This framework describes seven key stages at which triangulation should be applied as part of a company's evidence-gathering strategy, both to inform their business plans for the price-review and to improve their strategic understanding of their customers.

In addition to setting out this framework, this study included a number of recommendations for water companies that should be applied generally to their evidence-gathering as a whole.

**Recommendation 1** – Stakeholders from across the water sector should discuss the framework for water-sector triangulation set out in this report, to establish some common grounds for triangulation across water companies. This should allow triangulation to be a systematic process that nonetheless accommodates the needs of triangulating various types of evidence. Ofwat's engagement in discussions surrounding the (further) development of such a framework/guidance would give water companies the confidence to incorporate such an approach in the earlier stages of their evidence-gathering for PR19.

Taking a holistic approach as set out in this framework should ensure that triangulation can deliver strategic benefits to improve the variety and depth of water companies' evidence base, rather than simply a check on existing viewpoints or research conclusions. The full benefits of triangulation can only be realised if it is considered on an ongoing basis. This means applying triangulation at a strategic level from the outset of the price-review process. This study therefore recommends that:

**Recommendation 2** – Water companies should maximise the benefits of triangulation by considering all types of triangulation and evidence gathering as an ongoing strategic requirement to understand their customers' needs. The principles of triangulation should be applied from the beginning of the process of designing



and planning customer evidence-gathering, not just as a tool to cross-check information that has been collected, or applied across all the evidence at the end of the evidence gathering process.

Triangulation involves combining multiple evidence sources and potentially making use of evidence from a wide range of methods/sources. It can therefore demand that practitioners applying triangulation are familiar with a broad range of evidence and methods. Cross-sector cooperation could contribute to the former, while the latter is likely to depend more on individual water companies, which could be a particular challenge for smaller companies. Designing triangulation into evidence-gathering from the outset (before carrying out or commissioning research) could help water companies produce outputs that are specifically geared towards use in triangulation.

The range of evidence that triangulation can leverage can also make it challenging to compare different sources and to decide how much weight to give different evidence sources, particularly where the nature of evidence is very different. For example, when comparing quantitative and qualitative data. This study therefore proposes four principles to help water companies formulate their plans for triangulation.

**PRINCIPLE 1: Contributory evidence** - evidence should contribute to water companies' understanding of their customers' priorities, needs and values.

**Principle 2: Methodological soundness** - evidence should have been generated using methods that have been soundly applied, with sufficient evidence to demonstrate that is the case.

**PRINCIPLE 3: Rigorous data gathering** - evidence should have been gathered in such a manner as to maximise the amount of information gained from the evidence, without introducing any bias into the evidence, with sufficient evidence to demonstrate that this is the case.

**PRINCIPLE 4: Credible interpretation** - conclusions drawn from the evidence must be credible, including sufficient exploration of alternative interpretations of the same evidence and comparison of the various sources of evidence explored for each alternative interpretation.

These principles are integral to the framework for triangulation outlined above, but recognise the specific challenges associated with weighing-up and balancing evidence sources of various types. This study also sets out specific questions that water companies can use in practice to test evidence sources against each of these principles.

## 6.2 Conclusions

Triangulation is not just another method to check results at the end of a process. Indeed, the real and genuine value of triangulation is to inform data-gathering from the outset and on an ongoing, iterative basis.

Furthermore, the nature of triangulation is that it seeks to bring together evidence from the widest possible range of sources. This suggests that greater cooperation across the sector in developing triangulation and evidence-sources would benefit all parties, leading to better outcomes for water customers. Opportunities for cooperation could include:

- shared development of triangulation good practice in the sector, building on the foundations set out in this study, developing this further into practical guidance for water-sector professionals;
- Ofwat involvement to examine the value of triangulation in its price-review process, to give water companies the confidence that triangulation methods will be recognised in the periodic review (as well as helping water companies to understand their customers in any case); and
- exploring opportunities to share customer data across the sector, to allow individual companies to understand and benefit from the work that others are doing, as well as potentially to generate a sector-wide evidence base against which individual companies could triangulate their own evidence on their own customers.

For the water sector in particular, the value of triangulation within the price control process is likely to be greatest if Ofwat can be involved in sector-wide development of triangulation as a tool. This could include, for example, Ofwat's development of its criteria for its risk-based review of company business plans, which could be used to offer a clear method for assessing water companies' triangulation efforts. The conclusions and principles set out in this study could be a starting point for developing such an assessment. This would provide companies with greater confidence that any work to develop triangulation methods and to develop a wider evidence base will be recognised by Ofwat in its assessments for PR19. In turn, this would give companies greater incentive to pursue the advantages of more strategic and ongoing application of triangulation.



# Part A: ANNEXES

## Annex 1 Potential data sources in the water sector

Water companies rely on a wide range of sources and methods to assess customer preferences on service improvements, measure satisfaction and collect various kinds of feedback from customers. In the absence of market data, companies can rely on economic valuation methods (typically grouped into stated preference (SP) and revealed preference (RP) techniques) to assess benefits of investments in water services. However, these approaches are often not giving a full picture of all the areas of a service and of customers' views and preferences. As a consequence, an increasing number of companies are combining these with other innovative approaches to consumer engagement and evidence gathering. These can be qualitative vs. quantitative, primary vs. secondary data sources, involve online vs. physical interactions, etc.

This section explores sources identified during this study, explains what stakeholders have indicated about how these could be used or what could be gained from each. A mapping of these data sources across the types of triangulation identified is also proposed, which can be used as a starting point for companies for how source triangulation could be explored.

### A1.1 Sources explored

This section identifies and describes different sources that are being used by water companies to gain insights into their customers' expectations and preferences. These consist of behavioural studies, cross-company comparisons, direct customer interaction, external data, gamification techniques, internal and operational data, market data, willingness-to-pay stated or revealed preference surveys, and well-being approaches.

- **Behavioural studies:** Behavioural studies consist of experimental research, including online experiments and randomised control trials (RCTs) that generate insights into the preferences and biases of customers when it comes to making choices between alternative products and services. Behavioural water economics applies the findings of behavioural economics, as well as insights from other related general fields (e.g. psychology, sociology, ecology, marketing, etc.) or more specific fields (e.g. behavioural environmental economics, experimental economics, environmental psychology, and behavioural finance).<sup>42</sup> Drawing on these scientific insights, experiments aim to understand and promote the underlying mind-sets (e.g. ownership, growth, grit, belongingness, and the "belief in service to the community") that make behavioural change more likely.<sup>43</sup> Behavioural research is a growing area of interest in the water sector, with a number of companies investing in consumer behavioural research ahead of PR19. It is, for example, already being applied by providers to help consumers be more mindful about their water consumption and save water. Consumers are then able to see how they are using water and how their usage compares with others in their community, which some claim acts as a spur to behaviour change and can reduce consumption.
- **Cross-company comparison:** Comparing key aspects of performance against other water companies. This method is only possible if data is available (e.g. data published by the water companies) and if changes have been material.
- **Direct customer interaction:** Direct customer interaction is also commonly used in the water industry. These include formal complaints and enquiries handling, social media, direct feedback to staff, satisfaction surveys, online panels and focus groups.

<sup>42</sup> Correia, R., Roseta-Palma, C., 2014. Behavioural economics in water management. Available at: [https://www.researchgate.net/publication/281816586\\_Behavioural\\_Economics\\_in\\_Water\\_Management](https://www.researchgate.net/publication/281816586_Behavioural_Economics_in_Water_Management)

<sup>43</sup> May et al., 2016. Solving public problems through behavioural science. Available at: <http://www.mckinsey.com/industries/public-sector/our-insights/solving-public-problems-through-behavioral-science>

- **Campaign data:** Data collected from communication and survey campaigns addressed to customers.
- **Call centre data:** Direct feedback from customers received to call centres.
- **Customer complaints and enquiries:** A complaint allows customers to express dissatisfaction related to an organisation's product or service, or the complaints-handling process itself, with a view to obtain a response or resolution. An enquiry is a customer interaction with a water company to request information through the nominated enquiry channels.<sup>44</sup> Companies ought to handle customer complaints and enquiries with care as there is a risk of only hearing from customers who are dissatisfied (self-selection).
- **Customer focus groups:** Focus groups also provide useful qualitative information. They provide an opportunity for water companies to speak to a sample of customers about specific issues (e.g. young customers, low-income groups, etc.). They can be used to ask participants to make uninformed decisions, and then see if they change those decisions after becoming more informed and reflecting on a particular topic.
- **Online panel results:** Online panels offer water companies the possibility to engage with customers who agree to participate in online surveys on a regular basis.
- **Proactive customer engagement data:** These include ad-hoc forms of physical interactions such as exhibitions, roadshows and public meetings.
- **Social media and online data:** Social media data is increasingly being used in the water sector. By carefully monitoring customers' comments and posts on social platforms, water organisations can gain actionable intelligence that gives them a better understanding of consumers' product and service preferences.
- **Other forms of customer surveys:** Satisfaction tracker survey, annual surveys, net promoter scores.
- **External (research) data:** Using primary/secondary public research to complement a company's own research (e.g. reports into consumer debt published by Stepchange and Payplan<sup>45</sup>, data on economic and social statistics and inflation projections produced by external consultancies, industry data on the purchasing behaviour of customers, etc.), evidence of the view of customer groups supplied by third parties, such as charities, CCWater or business groups.
- **Gamification techniques:** The use of game mechanics to digitally engage people. Technological tools such as gamification are rapidly gaining prominence and are expected to become an important part of understanding and meeting customer demand. The potential for gamification has sparked interest among key actors of UK's water industry. It is however recognised that such an approach ought not "stray too far into the world of games" or it "may fail to deliver the meaningful insight required."<sup>46</sup>
- **Internal data:** Using internal data to complement consumer research conducted by the company (e.g. brand research).
- **Market data:** Where a market exists, market prices should be used to derive value. Market data are often considered as the most robust approach to assess customer preferences and assess service changes.

<sup>44</sup> SAWater, 2015. Customer enquiry, complaint and dispute resolution process. available at: [https://www.sawater.com.au/\\_data/assets/pdf\\_file/0011/19856/EnquiriesProcess.pdf](https://www.sawater.com.au/_data/assets/pdf_file/0011/19856/EnquiriesProcess.pdf).

<sup>45</sup> <https://www.stepchange.org/debt-info/free-and-face-to-face-debt-advice/payplan.aspx>

<sup>46</sup> Consumer Council for Water and Water UK. (2016). 'Water Industry Workshop 10<sup>th</sup> November 2016.'

- **Operational data:** Operational data consists of internal data providing clearly defined information on financial performance, expenditure and assets of water companies.
- **Revealed preference based research:** Techniques which derive values by observing actual behaviour in associated markets. These are often considered as the second-best approach to assess customer preferences.
- **Well-being approaches:** Looking at the impact of changes of services on well-being. Wellbeing approaches provide useful insights based on individuals' ratings of their happiness or life satisfaction rather than on their preferences. This can therefore provide a useful means of comparison with other WTP research, particularly for non-market goods and services like water.
- **Willingness-to-pay stated preference surveys:** Techniques which ask customers or consumers what values they place on the relevant aspect of service. Stated preferences surveys use different techniques allowing customers to express their preferences.

## A1.2 Mapping sources onto triangulation methods

Table A1.1 provides an overview of the types of data that can be used to conduct different forms of triangulation identified in this report (see Section 2). To develop this mapping each data source was linked to the triangulation method(s) that it is most likely to serve or support. This mapping exercise represents a practical guide to help water companies investigate how they can use potential data sources to triangulate.

### A1.2.1 Data sources

Table A1.1 Summary of possibilities for triangulation

Data source	Triangulation method					
	Methodologic	Temporal	Data / source	Geographical	Investigator	Theoretical
Behavioural studies	✓	✓	✓	✓		✓
Call centre data		✓	✓	✓	✓	
Campaign data			✓	✓		
Cross-company comparison		✓		✓		
Customer complaints and enquiries		✓	✓	✓		
Customer focus groups	✓	✓	✓	✓	✓	
External (research) data		✓	✓	✓	✓	
Gamification techniques	✓		✓	✓	✓	
Internal data		✓			✓	
Market data		✓		✓	✓	✓
Online panel results	✓	✓	✓	✓	✓	
Other forms of customer surveys: satisfaction tracker survey, annual surveys, net promoter scores	✓	✓	✓	✓	✓	
Proactive customer engagement data		✓	✓	✓	✓	
Social media and online data		✓	✓	✓	✓	

Well-being approaches	✓	✓	✓	✓		✓
Revealed preference based research	✓	✓	✓	✓		✓
Willingness-to-pay stated preference (SP) surveys	✓	✓	✓	✓		✓
WTP SP - Conjoint questioning	✓	✓	✓	✓		
WTP SP - 'Chip' allocation	✓	✓	✓	✓		
WTP SP - 'Gabor Granger'	✓	✓	✓	✓		
WTP SP - Attitudinal statements	✓	✓	✓	✓		
WTP SP - Diagnostic questions	✓	✓	✓	✓		

## A1.1 Conclusions

Water companies can rely on multiple and independent sources of data to measure customer satisfaction and preference and gain insights into service improvements. Triangulating different data sources can often serve the purpose of corroborating findings across time, space, methods, theories and points of view. While temporal, data and geographical triangulation can be obtained from a broad variety of sources, this mapping analysis suggests that only few data sources can be applied to methodological, investigator and theoretical triangulation.

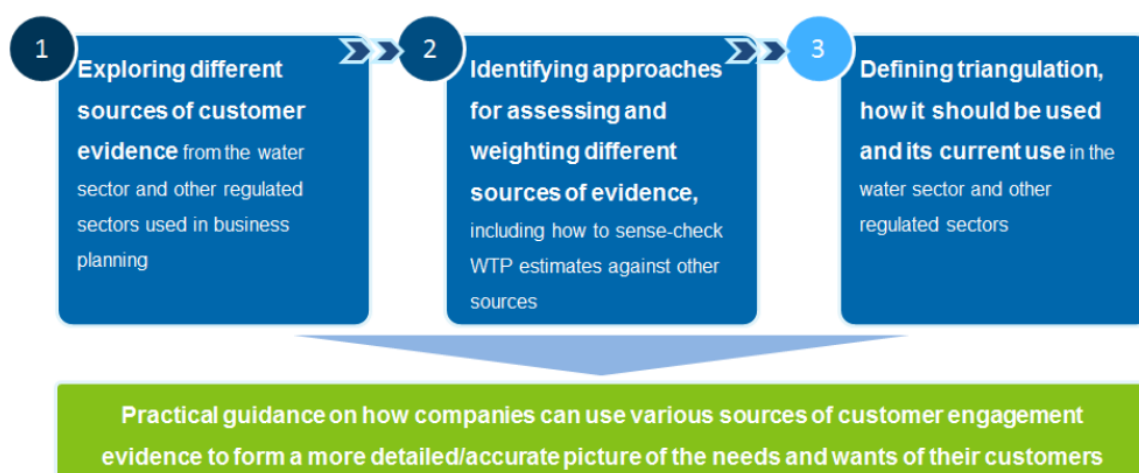
## Annex 2 Method and evidence sources for this study

This annex briefly describes the method that was applied in this study.

### A2.1 Approach to the study

The study was based on three key stages, outlined in A2.1 below.

Figure A1.1 Three key stages in the study framework



Each stage is described below.

#### 1 Exploring different sources of customer evidence

The first stage of the study identified potential sources of customer evidence that can go into the 'pool' of evidence for companies to use in business planning in the water sector (in England, Wales and Scotland) and in other regulated sectors. Sources were identified through:

- desk research; and
- interviews with key stakeholders in the water sector and other sectors.

This search initially focussed on highlighted in the ITT:

- willingness-to-pay stated preference surveys;
- revealed preference based research;
- behavioural studies;
- 'bespoke' customer consultations;
- evidence of the view of customer groups supplied by third parties, such as charities, CCWater or business groups;
- evidence from companies' customer complaints and enquiries;
- alternative approaches to gathering customers' views such as from 'wellbeing' surveys, gamification techniques; or
- other methods adopted from other sectors, such as valuation transfer (which could reference studies outside the water sector, such as Defra valuations of time for traffic disruption (for infrastructure work), other studies in the water sector, for example from Defra, or temporal transfer, whereby values are taken from previous studies in water).

This research generated a long-list of sources that were then reviewed in brief, to identify where they were sufficiently relevant for the study to be reviewed in detail. Sources were prioritised according to:

- aims of the evidence gathering / triangulation, i.e.
  - information-gathering methods applied (e.g. SP survey, revealed preference approach, customer focus group, etc.);
  - what does this source tell us about triangulation;
- sector characteristics, i.e.
  - relevant water-sector characteristics include the following:
  - monopoly provision; regulated companies must incorporate consumer preferences into their regulatory submissions – in particular, the regulator (Ofwat) has a role in price setting;
  - low consumer engagement with suppliers unless there is a problem;
  - the nature of investment in providing the service; shorter-term and longer-term trade-offs are necessary, including dealing with long-term challenges such as resilience of water supply (and to flooding) – none of which are reflected in customers' choices (which could limit the applicability of RP methods, as there are few choices that customers' make to which RP methods could be applied (such as filtering water or buying bottled water)).
- robustness, i.e.
  - sample size to conduct the research/survey;
  - distribution of customer types across the evidence source (e.g. household vs. business customers, income characteristics etc.); and
  - type of evidence collected for the study.

Each source was assessed for relevance in each of these categories – with any source that was rated as 'moderate' or 'high' relevance to the study taken forward to the next stage; a detailed review of relevance sources.

## **2 Collecting evidence on triangulation**

This stage involved detailed analysis of each source that was prioritised. Specifically, this involved collecting and recording information in the following areas, to inform later analysis.



Table A2.1 Characteristics of techniques and materials

<b>Characteristic</b>	<b>Info</b>
Briefly describe the source	Yes
Does the source define triangulation – and if so how? If not, what does the source tell you about its definition / use?	Yes
Briefly describe the method used. Is it quantitative or qualitative or a combination of both?	Yes
How was the evidence used and for what purpose? Describe its relevance to the water sector (in the business planning context of a price control).	Yes
What information-gathering methods have been used? What was the source of information?	Yes
What was the target product or service about which information was being gathered?	Yes
What shortcomings of the method have been identified in the evidence?	Yes
Are there other shortcomings that you yourself have identified?	Yes
Did the research take into account different customer types? E.g. business vs. household? Income / socio-economic characteristics?	Yes
Describe how evidence from this source could contribute towards a principles-based approach	Yes
Does it support any of the principles set out below?	Yes
Does it suggest that other principles should be used?	Yes
Does the source explain how triangulation is used as an approach to progressively build an evidence based over time? I.e. is it a long-term approach? Is a longer-term aim described?	Yes
Does the source tell you anything about the risks of triangulation or indicate how these can be addressed?	Yes

This stage also involved carrying out interviews with a range of stakeholders, summarised below (Table A2.2).

Table A2.2 Stakeholders interviewed for this study

<i>Type of organisation</i>	<i>Organisation</i>
Regulator	Ofwat
	Ofgem
	Ofcom
	Environment Agency
Water company	Anglian Water
	Thames Water
	United Utilities
	Severn Trent
	Southern Water
	Dwr Cymru
	Northumbrian Water
	Wessex Water
	Bristol Water
CCG	South Staffs CCG
	Thames Water CCG
	Severn Trent Water CCG
	YourVoice (United Utilities CCG)

Having analysed each prioritised example to produce the information set out above, we will assess the lessons that can be learned for the water sector across each issue. For each example from another sector, our analysis will identify any relevant learning points for the water sector. The team's experience of the regulatory process in water and in other example sectors will be crucial here. It is this experience that will allow us to identify which learning points will be most valuable when applied to the PR19 process.

### 3 Analysing evidence

The final step was to analyse the evidence to support CCWater in its objective to explore how to define and apply the concept of 'triangulation' as an improved approach to assessing evidence of water customers' views taken from various customer engagement activities. It aimed to develop a detailed definition of 'triangulation', what it means in the water sector and whether/how it differs from simply complementing SP data with qualitative data and other evidence/information.

It also included the development of practical guidance on how companies can use various sources of customer engagement evidence. This guidance does not seek to constrain water companies in their approaches to gathering, collating and triangulating different sources of customer evidence. Rather, it should be viewed as providing guidance to companies on the practical approaches to triangulation they might consider, drawing on examples from within and external to the water sector.

Key research questions used at this stage of the analysis are set out below.

- What methodologies are being used to triangulate evidence? For what purpose?
- What are the strengths and weaknesses of these methods?
- What challenges are faced with respect to triangulating evidence? How are these challenges overcome?

- What specific types of information have been used in triangulation?
- What existing good and/or innovative practice are you aware of in triangulating evidence?

The analysis categorised conclusions and insights according to their relevance to the methods, materials, process and role of triangulation, with a particular focus on how triangulation is used in the water sector to assess water companies' evidence of water customers' views taken from various customer engagement activities.

## Annex 3 References

Table 6.1 References

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