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Water Supply Services and the Practices, Perceptions, and Representations of Non-Residential Water Users: An Exploratory Study in France

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ABSTRACT: In France, the performance indicators applied to drinking water supply systems tend to be service-oriented, making no distinction between residential and non-residential users. In this paper, we seek to test our working hypothesis that these different groups of consumers each have their own sets of expectations, constraints, and vulnerabilities and would thus constitute distinct actors in case of a service failure. Three water utilities located in southwestern France serve as a case study. Results show that non-residential users' perceptions of service performance can differ significantly from those of residential consumers. Our findings indicate that non-residential users tend to focus more intensely on certain subjects, i.e. the balance of remaining comfortable while not wasting time, trade-offs between restrictions and profitability, etc. Furthermore, non-residential users do not form a homogeneous category. Within non-residential users, three rationales can be distinguished: 'productive', which relates to users who are highly dependant on the current model of drinking water supply; 'routine', in which use of water from the tap seems to continue out of habit, convenience, and/or safety reasons; and 'economic optimization' or 'moderation'. This additional performance-related knowledge could prove invaluable in designing effective strategies for water infrastructure asset management as it allows utilities to prioritise sectors for improvement and be more efficient. It helps utilities better serve their customers by addressing their specific needs. It also helps target communication on less familiar or understood topics. Finally, our work contributes to the debate on management through indicators as it questions their meaning and scope.

KEYWORDS: Water supply, global change, performance, interviews, perceptions, asset management, France

INTRODUCTION

The term 'performance' is protean when applied to a water supply service (Alegre et al., 2014). In France, a core set of indicators is used to assess the various dimensions of performance. These indicators are designed to be used at water supply service scale, with the aim of reflecting the wide range of tasks carried out by utilities, which range from customer satisfaction and network maintenance to efficient operation of equipment (Canneva and Guérin-Schneider, 2011a). The goal behind these indicators is essentially to assess the results of the operator's work. This ensures the quality of the service provided and helps to identify and control possible deviations. At the same time, it also identifies areas where progress can be made (Guérin-Schneider, 2003).

However, no distinction is made between residential and non-residential users when constructing these indicators. While 'domestic', 'industrial', and 'agricultural' users are identified, several types of

users are thrown together into the 'domestic' category, including bakeries, hair salons, dental offices, clothing shops, and even garden centres.[1] This category is the most diverse collection of water users in the urban environment, and they account for a high percentage of the total urban water use. For instance, according to the US Environmental Protection Agency, approximately 2.5 percent of withdrawals from public water supplies in the United States take place in hospitality and food service establishments, 2.5 percent in hotels and other lodging businesses, 1.5 percent in office buildings, and 1.2 percent in hospitals and other health care facilities. In the Netherlands, shops, hotels, restaurants, schools, offices, health care institutions, and campsites use 12 percent of the total distributed water (Pieterse-Quirijns et al., 2013).

In addition, performance indicators used by utilities currently provide insufficient information on the specific issues and needs of non-residential users regarding drinking water supply; typically, these indicators only report non-residential users' hypothetic satisfaction and the ratio of their uncollected bills. Moreover, a growing number of research studies shows that the limits and biases of performance monitoring originate from some form of socio-technical resistance, which is inherent in the technical nature of the water sector (Bolognesi et al., 2021). Thus, these insufficiencies in indicators for non-residential users give rise to a certain opportunism on the part of the 'technical citadel'[2] (Tsanga-Tabi, 2003) in order to break free from regulatory constraints on its activity and to focus on key strategic issues, namely the organisational level and the mobilisation of necessary resources to carry out the economic and operational goals of utilities (Tsanga-Tabi and Verdon, 2014; Bolognesi and Pflieger, 2021). Consequently, before one can even think about developing and proposing appropriate and useful indicators for improving the monitoring of operators' management, further detail is required. These details relate on the one hand to non-residential water uses, and on the other hand to non-residential users' perceptions and expectations regarding the drinking water service performance.

In this paper, we propose to test our working hypothesis that these different consumers each have their own sets of expectations, constraints, and vulnerabilities and would thus constitute their own category of stakeholders in the case of a service failure. On that basis, we assume that their vision of current service performance and its development (particularly in relation to climate and global change) does not entirely blend into that of households. We also expect this vision to be shaped and most probably conditioned by the nature of their businesses and their 'captivity' in relation to their water services and water utilities, i.e. their capacities to 'get out of' them. Three water utilities located in southwestern France serve as a case study. France is particularly interesting in its principle of equality of treatment for users with regard to public services. This, along with the principles of continuity of operations and of mutability (i.e. adaptation to changing needs), was enshrined in the Rolland Laws in the 1930s. The evolution of case law now opens the consideration that equality should be applied within the same category of users and not between categories. In other words, a utility has the possibility of introducing different tariffs for schools, hospitals, farmers, shopkeepers, or industries for instance, but it has an obligation to expand each tariff equally to all users who are in the same situation. A difference in treatment between residential and non-residential users would then be legally possible and technically doable, as long as non-residential users are identified by occupation in the customer database.

[1] As observed in the literature, no explicit mention is made of 'non-residential users' and authors often refer to a neutral and vague category called 'users' (e.g. Alegre et al. (2014)). Readers interested in learning more about performance indicators are invited to consult Alegre et al. (2014) for an overview of the indicators with reflection on their practical application and Canneva and Guérin-Schneider (2011) for their implementation in the French context, Cunha Marques and De Witte (2010), Tsanga-Tabi and Verdon (2014a), Gerrish (2016), Pinto et al. (2017) or Bolognesi and Pflieger (2021) for a discussion on their effectiveness, Bolognesi et al. (2021) for the issue of their use by local actors or Renou (2015) for an analysis of the impact of their deployment.

[2] This concept, introduced by Tsanga-Tabi (2003), seeks to emphasise the inherent technical nature of the internal organisation of public water utilities and of the work performed. This makes both work and organisation difficult for outside parties and the lay community to conceive and understand.

In other words, the present article aims to understand and analyse the water supply practices and preferences of non-residential water users. It also focuses on their expectations[3] in terms of water supply service performance and their views of how this performance has developed and will likely continue to develop against a backdrop of global change.[4] Taking these specific users into account is crucial for operators, since they exhibit demand patterns different from residential users (Blokker et al., 2010; Pieterse-Quirijns et al., 2013). They may also have stronger requirements because supply delivery failures result in (sometimes significant) economic losses (Sjöstrand et al., 2020). Finally, the observed inversion of the consumption curve since the 1990s is first and foremost due to non-domestic users (factory closures, relocation of factories abroad, amelioration of processes, improvement of equipment, etc) (Barraqué et al., 2011; Florentin, 2020). This performance-related knowledge is especially important when designing water infrastructure asset management strategies (Han et al., 2015), as it allows utilities to prioritise sectors for improvement and be more efficient (Lewis and Pattinasarany, 2009). It helps utilities better meet the needs of their customers while also considering their own specificities. It also helps target communication on less familiar or understood topics (González Villarreal and Lartigue, 2017).

To do so, we are embedding our analysis in a cognitive and comprehensive sociological perspective. In addition to its praxeological contribution (Lemieux, 2011), this approach has the advantage of revealing the challenges that distinguish the consumption practices of non-residential users. These may affect the activity of the services through a variety of factors: social representations linked to the uses of water and to individual capacities of action; perceptions of the quality of the service provided; and moral judgements surrounding these public services, common goods, and solidarity. In this sense, we want to acknowledge the variety of perceptions and positions among the non-residential users interviewed. This helps us move away from an overly normative or generalist approach, which would be inadequate to address the complexity of social matters (Friedman, 2011; Grossetti, 2020). By "situating" (Barbier et al., 2020) the stances of users, our analysis makes a contribution to criticising management through performance indicators (Bezes et al., 2016).

The remainder of this article is structured as follows: Section 2 presents the methods. Section 3 discusses non-residential users' expectations in terms of performance of the existing drinking water service. Section 4 addresses their perception of the drinking water supply service currently provided and its development. The last section presents a discussion and conclusions.

METHODS

Study sites

Located in southwest France, the Nouvelle-Aquitaine region, with 5.8 million inhabitants, is experiencing one of the highest levels of demographic growth recorded anywhere in the country (+160,000 between 2011 and 2016 – data from Insee, the French National Institute of Statistics and Economic Studies[5]). The Gironde department, home to around a quarter of the region's population, has seen the highest level of growth (+1.4 percent per year). This trend is expected to continue. This rapid growth is mainly due to a net migratory inflow resulting from the attractiveness of cities and coastal areas. This mobility relates to both young professionals and elderly people, and it affects domestic demand for drinking water.

[3] Municipal or public uses are not considered in this study because there are most of the time specific local regulations governing such activities.

[4] Global change is understood here as the combined effects of trade globalisation, demographic trends and migratory flows, food needs, potential environmental crises, and impacts of development on ecosystems and sustainable access to natural resources, including water (Salles, 2013).

[5] https://www.insee.fr/fr/statistiques/3678900

When considering trends and patterns in non-domestic drinking water consumption, other structural factors also deserve attention. While agriculture accounts for 25 percent of the Gironde's land use, the industrial sector also plays a key role in the local economy, particularly in sectors like aerospace, agri-food, and wood-related processing. Significantly, this last sector includes paper production, which calls for large volumes of water. The Gironde is also the fourth largest French department in terms of tourism, boasting some 7.9 million overnight stays in 2019 (data from Insee[6]). In the summer months, the population of some seaside towns can increase tenfold. In other words, tourism severely affects peak water consumption, both in terms of infrastructure and service quality.

Generally speaking, the tertiary sector is expanding rapidly: human health and social work activities, business and personal services, design/research and development, culture, leisure activities, etc. are becoming increasingly important. The way people work has changed significantly in the past 30 years, and these changes have inevitably impacted the need for, and consumption of, drinking water.

This study relies on the use of three contrasting case studies in terms of local issues:

1) Carbon-Blanc – an inter-municipal water supply association located around 10 km northeast of Bordeaux, the capital of the Nouvelle-Aquitaine region. Carbon-Blanc services ten municipalities, some of them within the Bordeaux metropolitan area. It has around 28,000 subscribers, including large industrial customers. Groundwater is collected from seven boreholes, and the network has more than 580 km of pipelines. At the time of the interviews, the service was delegated to Suez (now merged with Veolia).
2) Cestas – a city located 13 km southwest of Bordeaux. Cestas's service provision is delegated to Veolia, which supplies drinking water to 8,000 subscribers. The infrastructure includes five boreholes and 190 km of pipes. The network is over-pressurized most of the time, and pumps operate upon request. Some industries, in particular a food industry, are found in the territory.
3) Bassanne-Dropt-Garonne – an inter-municipal water supply association located around 53 km southeast of Bordeaux on the left bank of the Garonne river. It is made up of 32 municipalities surrounding La Réole. The service was previously operated by Suez and is delegated to Veolia under a leasing arrangement (the French 'affermage' system) since September 2017. As there is only one borehole and the 531 km network is poorly meshed, it is not unusual for the utility to have trouble supplying all 5,900 subscribers. The annual subscriber consumption ranges from 100 to 400 m^3 and is therefore relatively low. Unlike the rest of Gironde, the population is declining in this area.

Finally, it should be noted that the three case studies belong to the same water development and management plan (Schéma d'Aménagement et de Gestion des Eaux – SAGE).

Selection of the participants

We selected the participants in our interviews based on two criteria. The first is related to water consumption – it used the assumption that high-volume consumers have specific expectations and constraints and that small consumers share similar water uses and practices with households. On this basis, sub-categories of economic activities were created in a way that highlights those non-residential users with the highest level of demand for water. This distinction builds on the study of Gérard (2016), who estimated the water consumption of non-residential users by category.

The second criterion relates to dependence on the drinking water supply system. Non-residential users may use both the public drinking water system and some form of alternative supply. Some of these users do not require any water in the course of their ordinary business, while others use water only for domestic-like purposes (e.g. cleaning, drinking, and sanitary purposes). This means that, except for

[6] https://www.gironde-tourisme.fr/espace-pro/wp-content/uploads/sites/2/2021/03/La-client%C3%A8le-touristique-en-Gironde-2019-2020.pdf

drinking, using water of lower quality is legally possible. This led us to assume that users requiring 'safe drinking water' to carry out their business can be considered more of a 'captive' of the drinking water supply system. They may in consequence exhibit different views and expectations regarding service performance. Five sub-categories of economic activities were created according to the type of water required: (i) those who do not need any water, (ii) those who need drinking water and have domestic-like water uses (e.g. material warehouses; financial, insurance, and banking entities), (iii) those who need drinking water and have specific water uses (e.g. agri-food industries, restaurants, food retail stores, grape and wine producers, human health services), (iv) those who need 'pure' water (e.g. chemical and pharmaceutical facilities and laboratories), and (v) those who could use non-potable water (e.g. construction companies, non-food retail stores, transport companies, manufacturing facilities, forestry companies).

Data collection

The list of interviewees was designed to contain at least one representative per economic sector within each pre-established group and to reflect the variety of economic activities extant in the study sites as well as possible. In that sense, our sampling is based on the search for "atypicals" (Merton, 1968), i.e. original situations that reveal the issues and logics of action in the field under study by accentuating their features. This makes it possible to confront the 'conventional' character of the social practices studied with more specific ways of using drinking water resources and the public service and to draw "lessons from the unexpected and the unusual" (Becker, 2014). This sampling method based on the diversity of interviewees' profiles allowed us to carry out one interview per position held.

Fifteen interviews were carried out in June and July 2018, covering a wide range of economic categories and individual workers (Table 1). Interviews faced a number of challenges. One example is the way in which tasks are allocated within bigger companies: there is no one person responsible for water issues. For example, the QHSE (Quality, Health, Safety, and Environment) manager is in charge of fire defence and water quality, but decisions regarding water supply are made by the head of a factory or of the business group to which it belongs. This is the reason why, whenever feasible, interviews were conducted with both the QHSE manager and the plant manager. In addition, a number of self-employed workers were simply unable to respond to our interviews due to a lack of time.

Topics covered during the interviews included:

- Water use (including criteria for quality, quantity, continuity, pressure, etc)
- Water consumption (quantity, seasonal or annual variations, water-saving measures, etc)
- Performance of the existing water supply service (perception of performance, constraints, expectations, dependence on the drinking water supply system, etc)
- Long-term vision (future changes in practices, water consumption, service performance, etc)
- Information about the company (position of the interviewee, economic sector, size in terms of employees, and location)

The remainder of this article is based on analysis of the interviewees' responses.

NON-RESIDENTIAL USERS' EXPECTATIONS FOR THE PERFORMANCE OF THE EXISTING DRINKING WATER SERVICE

The first category of interview results has to do with non-residential users' water uses and their expectations for their existing drinking water service. Thus, this section describes a variety of views and expectations that illustrate the singular diversity water utilities have to manage.

Table 1. Respondents by economic sector.[7]

Sub-categories of economic activities	Position held
Do not need any water	- Owner of a fruit and vegetable wholesaler
Need drinking water and have domestic-like water uses	- Hotel manager - Restaurant manager - Baker (owner of a bakery) - Dentist (head of a dental office)
Need drinking water and have specific water uses	- Estate owner and winemaker - Brewer (owner of a brewery) - QHSE* manager and site manager of a food processing plant
Need 'pure' water	- Biologist (manager of a medical analysis laboratory)
Could use non-potable water	- QHSE* manager and site manager of a production plant - Hairdresser (manager of a hair salon) - Senior biologist in a manufacturing plant - Florist (owner of a flower shop) - QHSE manager and site manager of a warehouse - Site manager for a transport company

Note: * Quality, Health, Safety, and Environment

A varied range of uses and expectations

The first lesson drawn is that interviewees consider an uninterrupted supply of an adequate quantity of clean drinking water at the correct pressure as the minimum 'normal' level of service. Turning on the tap and having water come out is an automatic and usual phenomenon (Euzen and Levi, 2013). Non-residential users are aware of water constraints and of the fact that the delivery of safe drinking water relies on a network that can be subject to failure when faced with technical or bacteriological problems. For example, the dentist we interviewed in Cestas sees performance as the provision of a continuous flow of water of sufficient quality. He was aware that without water he would not be unable to work. However, in his experience, the water supply had never failed, and he had every reason to trust the service.

Depending on the category to which they belong, non-residential users have differing expectations in terms of the quality of water supplied. For example, winemaking, agri-food production, and catering must, by regulation, use water that meets drinking water standards, as their products are destined for human consumption. Their primary expectation is therefore to obtain water of a legal level of quality (i.e. in accordance with the European Drinking Water Directive and a number of national standards set out in regulations). As they use water seven days a week and at all hours of the day (except for closures), either in small or large quantities, continuity of service is also essential to avoid unforeseen breakdowns in the manufacturing process and the associated economic losses. High pressure is required to clean equipment quickly and thoroughly, which in turn achieves savings in terms of time and money. Chemical, pharmaceutical, and electronics industries have perhaps the most stringent requirements of all the non-agri-food industries and re-treat tap water to be sure that it is 'pure'. Medical and health care centres may also use treated ('pure', softened, demineralised, etc) as well as non-treated water (Bordet and Husson, 2012). When tap water is used, it must be of the highest quality. Continuity of service is also

[7] The construction sector was not taken into account in the interviews because water is in most cases consumed at the client's home.

essential for medical purposes, as an interruption in supply can have serious health implications (e.g. for treatments such as dialysis).

The expectations of consumers with domestic-like water uses are fairly close to the expectations of those who do not depend on drinking water to stay in business. This category includes both small and large companies (more than 250 employees), with the difference in size leading to differing practices and consumption behaviour. For small shops (bookstores or clothing stores for instance), finance and insurance firms, estate agencies, and technical and scientific facilities (tertiary sector), water is said to be used comparatively little. In the medical analysis laboratory (Cestas), tap water is used only for flushing the toilet and cleaning the floor. For drinking, they use a water fountain filled with bottled water provided by a supplier. Some service-related users (hairdresser, dog groomer, etc) use water only when customers are in the store: "I only use water when I have customers, it varies from day to day" (Hairdresser, Cestas). The interviews revealed few significant concerns relating to the resource among this category of non-residential users. They mainly use the drinking water network, although good quality water from other sources would be equally satisfactory.

Conversely, warehouse and storage companies, as well as medium-sized businesses, voiced concerns in terms of water consumption. They are seeking to cut water consumption by adopting specific initiatives in the same way as they adopt environmental initiatives (installation of solar panels, waste recycling, etc). These initiatives stem from financial motives, environmental motives, or both (Corporate Social Responsibility). For instance, the hotel manager (Cestas) acknowledged that he uses water-saving devices in rooms for financial reasons. While a large proportion of water consumption can be attributed to staff (Gössling et al., 2012), tourism is a special case because managers (i.e. the people we interviewed) have difficulty identifying water consumption behaviour among their customers:

> We can't always be breathing down our customers' necks, watching their every move, but we have developed techniques to consume less water (…) We place one towel in rooms instead of two (Hotel manager, Cestas).

Studies show that tourists use more water at their holiday destination than they do at home (Hof and Schmitt, 2011; Page et al., 2014). For these non-residential users, drinking water is not essential for their core business, but is a necessary resource to provide client satisfaction. Should the water supply fail, they would still be able to rent rooms, but they would need to adjust. These users typically used water in two ways (for sanitary purposes, via sinks and showers[8] and for domestic-style uses when cleaning rooms, washing laundry, and potentially cooking/catering), and the water they use has to meet potability criteria.

Similar to the domestic sphere (Euzen et al., 2015), this wide range of non-residential uses and expectations highlights an individualised relationship with water supplied through the public system. Specifically, three rationales can be distinguished.[9] The first rationale, referred to as 'productive', relates to users who are captives of the current model of drinking water supply. Because water is a key element in their production processes, their activity directly depends on quality of service and the water distributed. These users are subject to the water safety (or even purity) requirements of safe or even pure water offered by the drinking water system. We labelled the second rationale 'routine'. In their everyday lives, these non-residential users exhibit water uses and expectations similar to those of households, and tap water is not essential to their production. Using the public drinking water system is a convenience. This habit could equally be replaced by recovered rainwater or even other commercial

[8] This accounts for 75% of consumption, according to a study carried out for the Rennes basin drinking water utility.

[9] Other forms of rationale may certainly be found in other contexts and sectors. Similarly, we do not consider these forms of rationale as immutable. Users are likely to modify their relationship with water and the service, following the evolution of their expectations, their needs, and the technical and technological possibilities both in their activities and within water services in general. However, the forms of rationale identified here are mutually exclusive, since they correspond to specific relationships with water.

products, such as rinse-off household products, bottled drinks, products intended for use without thinning, etc. The use of water from the tap, which varies depending on the company size and season, seems to continue out of habit, for convenience. The third rationale refers to 'economic optimization' or 'moderation'. The companies using this rationale seek to reduce their water consumption by addressing a lack of proper equipment or practices (often among their customers). Their uses are fairly close to the ones described in the previous category, but they are distinguished by their economic relationship with the utility and the resource supplied as well as the lack of any real motivation to disconnect themselves from the public network.

Performance of utilities measured from industrial and commercial viewpoints

Non-residential users expect their utilities to keep their systems functional (i.e. network maintenance, inspection and rehabilitation, even if not mentioned explicitly) and manage water resources: "We pay for a full integrated service" (QHSE manager of a food processing plant, Cestas). Non-residential users are aware that they are delegating some tasks to the utility. Producing safe water requires infrastructures and specialist knowledge, and utilities essentially market their know-how. However, this requires utilities to develop good relationships with users and ensure that they always provide a good quality of service. Although performance indicators were originally established to deal with the poor image of French utilities (including Veolia and Suez..) in the 1990s and rebuild customer trust (Canneva and Guérin-Schneider, 2011), our interviews show that these companies now enjoy a good reputation among their users. Their expertise in drinking water production and supply is internationally recognised (Lorrain, 2005).[10] For a food processing plant located in Cestas that exports its products abroad, bacteriological quality is paramount. Exporting to countries with stricter regulations and ever-more stringent bacteriological controls requires clear identification of where the water comes from. Their water system provides managers or supervisors an iron-clad guarantee of the quality of drinking water (especially in the case of multinational firms).

> We export to the United States, where health controls are more demanding (…) Veolia is the world leader in its field, they are mastering water issues (QHSE manager of a food processing plant, Cestas).

Finally, non-residential users also want to be provided with an after-sales service. They want to be notified of any technical or bacteriological problem as soon as possible in order to suspend their activities and adjust accordingly. If anything goes wrong, they expect a rapid response, something that was particularly emphasised during interviews. For non-residential users, a 'high-performance' utility will not only monitor the quality of water, but also be quick to respond when disruptions occur. They expect a 'premium' service without (to the greatest degree possible) having to bear the costs, since the latter are the same for all users, whether domestic or not.

In some cases, water uses include not only domestic-like uses (e.g. cleaning, drinking, and sanitary purposes, and sometimes showers) but also, for example, fire defence and catering services. This is particularly true for non-residential users such as storage companies or intermediate- to large-sized companies. During the interviews with managers of larger companies, QHSE managers were also present. A QHSE manager is typically in charge of water-related facilities, including fire-fighting equipment. Flow rates and pressures are imposed by the departmental fire safety service. A mandatory standard is based on the level of risk and the size and function of a given building. Fire detection and suppression equipment (such as sprinkler, fire hose cabinets) are generally connected to the water network. Where this is not possible, companies are required to be properly equipped and ensure they have suitable access to water. Our interviews show concerns about drinking water supply (notably about reliability, regulation, and economic impact). The network must be able to provide sufficient volume, flow rate, and pressure to

[10] Although our interviewees focused on private operators, this statement holds generally true for all operators, i.e. also for public utilities (Renzetti and Dupont, 2003).

extinguish a fire. According to fire defence regulations, any company whose premises have a surface area of 250 m^2 to 1,000 m^2 must be able to sustain a minimum flow rate of 60 m^3/h for two hours. For surface areas of 1000 m^2 to 2000 m^2 and of 2000 m^2 to 3000 m^2, the minimum required flow rates are 120 m^3/h and 180 m^3/h, respectively. For spaces of over 3000 m^2, requirements are defined on a case-by-case basis. Some of those interviewed in Cestas believe that the water supply network is not sufficient to entirely fulfil these regulatory requirements.

Non-residential users have a wide range of water uses depending on their business activities and individual needs. However, their expectations and assessments of the performance of the drinking water supply networks do converge in many areas. This performance is assessed from both industrial and commercial standpoints. While certain requirements are laid down in regulations, a large proportion of them tend to fall more within customer relations between operators and their (domestic or non-domestic) users. These non-regulatory requirements include consideration of users' issues and needs, responsiveness and continuous user information and support, provision of an efficient and reliable service, and risk prevention. In other words, social representations and expectations with respect to service performance depend on the relationships between public service providers and recipients. This also makes efforts towards staging and monitoring ('make people believe') as important as an action actually undertaken by the utility.

PERCEPTIONS OF THE DRINKING WATER SUPPLY SERVICE CURRENTLY PROVIDED AND ITS DEVELOPMENT

This section presents the results of the interviews regarding the non-residential perceptions of the drinking water supply service currently provided and its development. Specifically, these perceptions are built on and framed by blending values and representations. This collection of values and representations enables the non-residential users to continue their operations while maintaining some comfort.

Using the drinking water supply system: a safe solution

The first finding that emerged from the interviews regarding perceptions of non-residential users is that they see their drinking water supply system as a safe solution to their water needs. Like their domestic counterparts, non-residential users may use alternative water production and/or supply techniques. We define alternative techniques as any process aimed at transporting drinking water to one's home without using the central system (borehole, rainwater collection system, etc) (Montginoul and Rinaudo, 2013). Using these alternative water production and/or supply techniques is not without its constraints, both for consumers and operators/utilities (Coutard and Rutherford, 2009; Rutherford and Coutard, 2015). The water delivered by water utilities is controlled and thus potable on a day-to-day basis (except in the case of contamination) and is continuously available. This guarantees users some form of security in the sense that the utility is responsible for the water it provides. This means that users do not have to take action that is outside their area of expertise. It avoids the necessity of having a water treatment unit on-site. There are also clear advantages in terms of safety: the risk of human-induced damages is greatly reduced. Indeed, water systems are protected against malicious acts under article L.732-1 of the French Internal Security Code.[11] As a consequence, non-residential users are reassured, as shown from the following interview extract:

> As an American group, we are more likely to be targeted by attacks, these are regularly-asked questions: how do your suppliers guarantee the security of the facilities? (QHSE manager at a food processing plant, Cestas).

[11] "Operators of a public-intended wastewater, water supply and distribution for human consumption, electricity or gas, as well as publicly available electronic communications operators must lay down the necessary measures needed to satisfy the population's priority needs in crisis situations".

Ensuring safety can therefore be regarded by non-residential users as forming part of overall service performance.

Being connected to the drinking water network also guarantees long-term water supply. Operators should apply an appropriate, effective, and fair approach to management, delivering a continuous service and adapting to the needs of the diverse users. As for all French public services, they must observe the principles of 'continuity', 'adaptability', and 'equal access'. Water supply problems were rarely mentioned during interviews: those discussed tended to come more under the heading of 'service disruption' rather than issues of quality.

> This has already happened once or twice, but that's rare (…) and when water cuts occur, we're notified beforehand, it leaves time to adapt (Baker, Ambarès et Lagrave).

According to the regional manager of Veolia – interviewed during the exploratory phase of the interview template design – forewarning non-residential users is a priority in the case of an event of scheduled service interruption. This relates to the performance indicator, "Occurrence ratio of unplanned service disruptions". Communication and collaboration between the two sides is important. It allows non-residential users to take appropriate measures (such as closing down of the shop/factory, buying bottled water) and minimize economic losses and/or health problems.

The perception of water-related risk and safety reminds us of the importance and weight of the institutional framework for drinking water systems. This framework relates to the utilities' internal rules of operation as well as the professionalism of the operators (i.e. their expert knowledge and know-how, recognized among users). Risk and safety also draw attention to the way in which responsibilities are shared between the various parties.

Water, a resource to be preserved… while maintaining some comfort

The second dimension of non-residential perception of the drinking water supply service currently provided refers to water as a resource to be preserved. Consumption of drinking water declined sharply in the 1990s. In addition to the expansion of the service sector, this evolution is based on two main factors (Barraqué et al., 2011; Poquet and Maresca, 2006). The first has to do with the changes in behaviour and attitudes of users and operators towards the resource and the price of the service, while the second has to do with the development of the water-saving technologies in our lifestyles and production methods. Generally speaking, environmental-consumption practices (water, energy, waste management) are largely driven by social standards (Shove, 2003; Maresca and Dujin, 2014; Brisepierre, 2013; Caillaud, 2018). Residential and non-residential users tend to develop 'moderation standards'. This occurs especially when they benefit from feedback information (Strengers, 2011; Schultz et al., 2016), i.e. they seek to maintain a certain level of comfort while trying to preserve the resource. Water must not be 'wasted', but its use should not be restricted. They attempt to reach a compromise between the negative (too much control, too much pressure) and the positive (well-being). Both extremes would not be well perceived and would be considered unduly burdensome in the ordinary course of business. The hairdresser (Cestas) for instance said that in comparison with her behaviour at home, she cannot really "be careful about water consumption" at the hair salon, as she does not really have any other option apart from consuming water.

However, the interviews validate the fact that water should not be 'wasted', nor should its use be restricted for non-residential users to maintain a certain level of comfort while not wasting time or being less effective in their work. "The concept of waste is inextricably linked to the concept of need: waste would therefore correspond to the production of a good or service which does not meet an essential need" (Grandchamp Florentino, 2012, p. 249, translated by the authors). The word 'waste' came up in all of our interviews:

> When I was a kid, I got water from the well, we had to take care not to waste it too much (…) These are consumption habits (…) Waste should no longer be estimated by rule-of-thumb if all people are to be guaranteed access (Restaurant manager, Cestas).

High value is placed on what is regarded as good practice (like turning off taps, installing water-efficient equipment). A study of social perceptions and environmental practices reveals that French people are more likely to turn off taps than to undertake major work (e.g. setting up a rainwater recovery system or closed-loop system), in order to save water (Calvet et al., 2011). Their cost-saving practices can be regarded as micro-gestures toward protecting water resources: they 'tinker', as de Certeau (2011) writes.

Non-residential users adopt these practices for two main reasons: the first is economic (reducing costs) and the second is environmental (preserving water resources).

> Saving water is not a constraint, it's a way of working, but in the end you act faster than the person who pays no attention (Brewer, Loupiac la Réole).

The literature shows that water-saving behaviours are influenced by personal values and environmental concerns (e.g. Pinto et al. (2011), Willis et al. (2011), Wolters (2014)). Optimising water consumption can also be attributed to increasing regulatory, environmental, and economic constraints leading to a willingness to reduce energy and water consumption (the latter not always being regarded as the most urgent priority in relation to gas or electricity consumption). Such environmental awareness, viewed positively by society, is also a manifestation of 'green marketing' which is defined by Laville and Deveaux (2008) as "using ethical argument to sell products with a social or environmental value-added and then promoting them". "Our consumers expect us to pay attention" (QHSE manager a food processing plant, Cestas). This is especially true for environment-related activities:

> It's a question of branding: flowers and nature… attention should be paid to the environment (Florist, Carbon-Blanc).

Behind this aseptic reasoning, one recognizes the influence of politics and awareness campaigns. However, water uses are driven by individual values and socialisation to ecological issues (Bozonnet, 2012). Thus, water-saving behaviours are to be conceived in a broader reflection and are part of individual broader measures to control and reduce the environmental impacts of humans' daily behaviours (Gilg and Barr, 2006). It is for this reason that some non-residential users will adopt environmentally efficient practices while others from the same sector will not (Gilg and Barr, 2006).

Finally, non-residential users stated their wish that operators apply environmental best practices and are exemplary in terms of resource management. Some interviewees mentioned the importance of proper capture and use of groundwater. Some also stressed the need to fight against, and reduce, water losses so as to maintain the operators' exemplarity in limiting losses. This is in line with the performance indicator relating to the efficiency ratio of the water distribution network. "They cannot ask us to be exemplary if they are not" (Florist, Carbon-Blanc). In other words, saving water is a matter of trade-offs and compromises for non-domestic users. They match a level of need deemed essential for their business to economic issues, social comfort, and eco-citizen aspirations. Public information campaigns relating to water resource preservation provide an additional corpus of justification, partly used in arbitrations and practices and imposed on (or strongly suggested to) utilities.

Using an alternative resource: between constraints and financial gains

By addressing their dependence on the drinking water supply system, the interviews led non-residential users to consider the advantages and disadvantages of alternative water resources. This constitutes the third dimension of their perception of the drinking water supply service currently provided. As explained above, using alternative water production and/or supply techniques is not without drawbacks. The installation of the equipment depends on the structure of the property (building, plant, shop, etc), the

geographical location (rural/urban), the weather, and a number of other parameters. The quality of raw water is also important since treatment may be required. Beyond installation, infrastructure maintenance can also be substantial and time consuming. Using an alternative resource means that the user becomes responsible for his/her own water supply system. On the other hand, this means that any problem could impact the overall level of business activity. Users in this situation must therefore provide an adequate 'after-sales service' on their own.

Furthermore, all the necessary equipment should be able to be installed. Yet, it is imperative that non-residential users should be able to achieve a return on their investments: "It has to lead to a return on investment within three years" (Site manager of a production plant, Saint-Loubès). Those considered 'small' non-residential users will most likely not be interested in alternative techniques for financial reasons. Larger companies may rely partially on alternative forms of water supply, the two systems being complementary. The interviews show that non-residential users adjust their water supply depending on types of uses and volumes consumed. They look for maximum comfort and durability, regardless of the resource used as input. For instance, the estate owner and winemaker (Camiran) uses water from the public system to clean his agricultural machinery. He justifies the choice by saying that the pressure is greater than that of his borehole, allowing him to save time and do other work.

Some economic activities are more suited for using an alternative water system than others, i.e. those who have no regulatory regimes to comply with and the largest users of water. In Gironde, an estimated 20 percent of farms use their own water resources (Gérard, 2016). Despite the associated limitations and costs, alternative water production and/or supply techniques are an option increasingly considered by non-residential users, particularly during a crisis (such as tension surrounding water resources and water restrictions). The manager of a warehouse (Cestas) stated that constructing a new building must now include the possibility of installing its own water management system. Some initiatives have also earned high praise in the press, like Carlsberg and Mor Bratz producing beer brewed from recycled wastewater and sea water.

Non-residential users are differently placed in terms of their relationship with 'alternative' water production and supply systems. The most decisive factors appear to be linked to the nature of their economic activity, company size, and geographic location. They relate to the capacities entrepreneurs have (or consider themselves to have), including access to other resources (such as raw water sources to draw from or rainfall sufficient to meet needs) and a sufficient amount of economic, human, and technical capital to take this path. This (real or perceived) capacity to invest in alternative systems plays an even more important role in non-domestic users' strategies and projections. These actors are actually well aware that these systems would remove a significant level of responsibility from utilities, both legally and operationally. Behind these aspirations and choices lies a trade-off based on multiple values (Heinich, 2017), particularly pertaining to the economic, legal, functional, technical (efficiency), ethical, civic, and reputational spheres.

Adaptation of activity in the event of a water crisis

A fourth dimension of their perception of the drinking water supply service currently provided deals with the changing environment. More intense and diverse uses of water over the past few centuries (e.g. new requirements related to recreational use in swimming pools and aqua leisure parks), as well as others phenomena like expanding populations and rapid urbanisation, changing lifestyles, and the rapid growth of industrial and agricultural activities have led to increasing conflicts over water resources over time (Scheffran and Battaglini, 2011; Bouba-Olga et al., 2006; Le Treut, 2013). Bishop (2013) showed a link between local drought conditions and users' level of concern about water supply. Following this finding, our hypothesis is that the way service performance is perceived by non-residential users may also be impacted by these global changes.

The users interviewed had never experienced water supply malfunctions at the time of the interviews. This is important information to help interpret the results. Graymore and Wallis (2010), Gilbertson et al. (2011) and Gholson et al. (2019), among others, show that behaviour and attitudes to water conservation are highly influenced by previous experiences of drought or water shortages and by their magnitude, frequency, and timing (Tang et al., 2013; Switzer and Vedlitz, 2017). Dolnicar et al. (2011) draw the same conclusion with respect to public acceptance of recycled and desalinated water. Above all, Switzer and Vedlitz (2017) have shown that drought awareness is crucial in determining risk perceptions and policy preferences. It would have been logical to expect that the same would apply to non-residential users' attitudes in the event of a water crisis. Specifically, we expected that those who need drinking water and have specific water uses would be more aware of potential global change impacts, as has been proved for farmers in the study by Tang et al. (2013). Our interviewees also expressed difficulty in being able to project into the future. In particular, they believe that the water distribution network and drinking water service are not likely to change significantly in the next few years. They do not expect to experience water shortages or deterioration in the quality of the water supplied.

> I think that if we experience problems, others will also have problems and, well, it will become serious (Brewer, Loupiac-La-Réole).

To place this in context, a study of environmental concerns conducted in 2019 by the French Research Centre for the Study and Observation of Conditions of Life (Credoc) reveals that French people are less concerned by water pollution than by other environmental issues such as climate change, air pollution or natural disasters.[12] The interviewees stated that other environmental concerns should be given priority over water shortages: they have no sense of urgency and think problems may arise several decades in the future. In their view, it is less a problem of lack of water resources and more an issue of resource management. They refer to national and local laws and current restrictions on water consumption. Be it water use restrictions during a heat wave episode or consumption allowances, they have no choice but to comply and adapt their work accordingly. The word 'adaptation' was often used during interviews:

> If provision was interrupted for a long period of time, I would wait and adapt, but caring for the plants would be tricky, I would have to take them home or have lots of water bottles (Florist, Carbon-Blanc).

When an economic activity depends heavily on drinking water supply, the one and only option is to shut down production. Adjusting to a loss of water in the long run could become extremely difficult, if not impossible:

> Maybe a well? I don't know, I'd adapt, but it would be an additional constraint (Wholesaler in fruit and vegetables, Cestas).

Using an alternative water source or having water delivered are possible short-term measures, but they are deemed too burdensome in the long term, especially when water is essential to the economic activity in question. Non-residential users using water for domestic-like uses are more willing to consider alternatives (such as dry toilets, water re-use for or other purposes like cleaning). In both cases, non-residential users would start looking at the least stringent and most cost-efficient way to be supplied with drinking water. Restrictive solutions, such as greater water savings or not using water at all, are not considered.

This means that non-domestic users are unable to imagine a future different from what they know, be it in terms of available raw water resources or water supply systems (in this case the public service in its current hydro-technical operation). The combination of uncertainty and short-term thinking keeps them in a kind of routine, a "stability mind-set" (Grossetti, 2020). They thus prevent themselves from

[12] Results (in French) can be found here: https://ree.developpement-durable.gouv.fr/themes/enjeux-de-societe/les-francais-et-l-environnement/preoccupations-environnementales/article/opinions-des-francais-sur-l-environnement

exploring alternative visions and other possible solutions. It will require some radical (but not necessarily sudden) change, experienced rather fatalistically, to trigger a change in the way they get drinking water and use it for their business activities. Their present stance suggests that they will adapt "in response to pressing needs" (perhaps by continuing operations while redoubling efforts or by changing their business activities and/or water supply systems to cope with the strains they experience and the feeling of not being able to wait any longer) or simply adopt a "survival strategy" (preserve, by any means necessary, the activity and operation through tinkering and improvisation, notwithstanding the precariousness of such an outlook), or even "resign" (accept the situation and abandon businesses for lack of control over the situation) (Grossetti, 2020).

DISCUSSION AND CONCLUSIONS

In France, performance indicators related to drinking water supply systems tend to be service-oriented, with no distinction made between residential and non-residential users. However, the water uses, expectations, and challenges of non-residential users are not identical to those of domestic households. As the present study shows, they also differ from one category of non-residential users to another (and sometimes between two non-residential users within the same group). With these results, our interviews provide some insights into non-residential users' outlook on drinking water and public drinking water supply (consumer patterns, perceptions, and preferences). Although this study can be regarded as exploratory because of the small sample size, it fills a significant gap in the academic literature. The interviews show that non-residential users would at least partially adjust their behaviours and practices during a water crisis. For instance, they think that they could move towards alternative sources of water supply (such as rainwater collection systems or private drilling that supplies water of poorer quality). Some have already begun to use such systems, mainly for environmental and/or economic reasons. While this could occur more frequently in the future – with encouragement from public authorities, non-residential users themselves, or professional associations – there is some uncertainty surrounding the actual capacity of some non-residential users to adapt their operations (their ways of working as well as drinking water supply systems).

Regarding global change, our interviews show a growing awareness that water is a limited resource, and they demonstrate that non-residential users are developing a number of water-saving measures. However, the risk of water shortage is not a subject of major concern. Non-residential users are accustomed to being continuously supplied with drinking water of sufficient quantity, quality, and pressure. There is no room to perceive major changes. Potential adaptation seems to be part of a distant future. In addition to the reasons mentioned above, this difficulty in planning ahead may be due to the difference between short- to medium-term timing for economic activities and the long-term timing frequently associated by interviewees with global changes. Finally, we sometimes faced an apparent lack of interest in discussing water issues because some non-residential users are currently unable to imagine what the actual consequences of water scarcity or a water shortage would be. They also think that their water consumption is not particularly high when compared to that of others, who they perceive as 'big consumers', such as farmers or industries: "Electricity would have been talked about, but I hardly use water" (Wholesaler in fruit and vegetables, Cestas).

The concept of performance could be enriched by taking these multiple preferences into account. Specific indicators could, for instance, be used to reflect the key expectations of different types of users. Existing indicators focus mainly on technical issues and do not consider the very active phenomenon of global change. The ability to maintain and/or adapt service quality and water infrastructures over time could be considered as a new performance objective, along with the ability to secure infrastructure against the risk of natural disasters. In addition, the current indicators do not consider the users' preferences, the logic behind their actions and production activities, or the multiple corpuses of values associated with the drinking water supply and distribution system. Interviews like the ones conducted in

this study help ensure all voices are heard (Vásquez et al., 2011). However, there are still shortcomings in some areas, and they expressly call for replication of this type of survey on larger panels of non-residential users.

The observed gap between performance indicators and the variety of positions held by (non-) residential users raises at least two questions around management through indicators (Bezes et al., 2016). The first one relates to the factors and logics of this discrepancy. Some studies have hinted several elements of response: a "socio-technical resistance" (Bolognesi et al., 2021), the persistence of a bureaucratic and consumerist logic (Tsanga-Tabi and Verdon, 2014), and/or a managerial "expediency" aimed at reducing the burden of service activities (Bolognesi and Pflieger, 2021). The second question has to do with its impacts on both the visibility of the issues affecting the drinking water sector and their consequent politicisation. We are thus entitled to ask, to what extent the institutionalisation of performance indicators in their current form constitutes an additional obstacle to the involvement of users in the management of drinking water as a common good because they do not, or they only partially, recognize themselves within this form of quantified objectification of the activity of their public service? This allows us to partly explain why non-residential users experience difficulties in projecting themselves into potential future problems in terms of their drinking water supply. By targeting issues that are part of the public service activity, these indicators would help make the service operators and public authorities bear the responsibility for issues such as those arising from water management and service performance first, and then they would make users face their own actions and their joint contributions to the sector. In other words, this would once again illustrate the framing effects of the construction process of public problems and of instruments of action. This has already been highlighted in other sectors (e.g. Caillaud and Nougarol (2021) for the waste sector; Florentin and Faugier (2020) for urban innovation) or in other dimensions of water supply services (e.g. Florentin and Denis (2019) for the asset management). The development of performance indicators and their use by public authorities (and, more generally speaking, public bodies) and operators hinder the emergence of a shared water governance. It keeps (non-residential) users away from issues related to water management, water utilities operation, and water infrastructures asset management and locks them into a 'passive' stance. On the one hand, users cannot grasp these issues because performance indicators are not part of their everyday life. On the other hand, they are in a situation where they can only comply with the rules and requests of public authorities and operators. A tacit pact of confidence is established under the idea that public authorities and operators would be enlightened and skilled professionals.

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