User attitudes and preferences - a study for Water Efficiency in UK Homes

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Abstract

The efficient consumption and use of water in domestic buildings is vital for protecting water resources for the future. About half of the water put into supply by water companies in England is to meet domestic demand alone and the demand from this sector continuous to rise year on year. A critical analysis of the literature showed that a common factor or barrier to acting sustainably water-wise is the level of awareness of users as well as their willingness and ability to make the necessary change. A nationwide survey was therefore commissioned to further examine this premise and to further understand the propensity of households to change behaviour and adopt technology to save water.

The study found that majority of households and water users already have a positive attitude to using water efficiently. However, the knowledge and the resources to translate this to action e.g. through behaviour change or use of water saving technologies is lacking. This confirms that developing knowledge competency and adaptive capacity in water users is needed. This can be achieved by working with households to develop technological and behavioural strategies for water efficiency that fits with their preferences and lifestyles. The paper therefore concludes by recommending a 'diy' type tool to support households to implement water efficiency solutions in line with their social, physical, economic and environmental context and constraints.

Keywords: Attitudes and preferences, Behaviour change, Households and homes, Water efficiency.

1. Introduction

Water is a strategic and critical resource which some commentators have ascribed more importance to than some energy sources such as crude oil (Koehler, 2008; The Pacific Institute, 2009). The impact of climate change on energy supply is well documented. Similarly, some 20% of the increase in water scarcity in the coming decades will be caused by climate change (UN, 2006) and a 5^{o}C increase in temperature compared to 1999 levels is likely to expose hundreds of millions of people will to increased water stress (Stern, 2007). About 1.1 billion people around the globe already lack sufficient

access to safe drinking water (UN, 2006). Water availability is also a challenge for developed countries such as the UK, where evidence shows considerable water stress in certain areas (EA, 2011). Although the Lake District is the wettest with average annual totals exceeding 2000 mm, all of East Anglia, much of the midlands, eastern and north-eastern England, and parts of the south-east, receive less than 700 mm a year (UK Met Office, 2010). According to the UN Environmental Program, buildings consume 20% of the world's available water and this continues to increase. At present in the UK, about half the water put into supply is to meet household demand and the quantity of water used by households increased by up to 55% in the last 25 years (DEFRA, 2008) while household per capita consumption remains high at around 170litres per person per day in unmetered domestic properties (EA 2008). It is worth noting that this level of resource consumption in buildings can also be attributed to technological development, economic growth, demographic factors, institutional factors and cultural developments (Abrahamse et al. 2005).

Water efficiency, compared to water conservation, is the optimised use of water commensurate to need which is not based on objective indicators but subjective need. It is also about the essential and appropriate supply and use of the right amount and type of water for necessary functions/activities for which it is intended. Water efficiency is marginally different from water conservation in that it acknowledges essential water use. Therefore, water efficiency does not advocate the reduction of water consumption to the extent detrimental to consumer health or welfare. Instead, the strategy is to understand customer behaviour, activities and how this relates to water needs, by which it will be possible to reduce wasteful behaviour by increasing the knowledge and adaptive capacity of water users. The IPCC (2001) define adaptive capacity as 'the ability of an individual, processes or system to adjust to climate change in order to moderate potential damages, to take advantage of opportunities, or to cope with the consequences'. Knowledge competency is described a process where knowledge about specific customers is generated (Campbell, 2003) and applied for their use. Gibbbert *et al.* stated that this is when customers are emancipated from being passive recipients of products and services, to empowerment as knowledge partners (Gibbert et al, 2002). Herein is the challenge with promoting water efficiency in homes.

The changes to the UK building regulations - Part G (2010) and the voluntary Code for Sustainable Homes go some distance in setting an 'objective' target which influences building design, specification and delivery. However, water efficient behaviour cannot be guaranteed after the building is commissioned. If the expected levels of reduction in water consumption are to be achieved, water users will be required to adopt positive behaviour, modify habitual activities. To achieve this, the government, water companies and NGOs have embarked on a series of initiatives to increase awareness and to motivate and incentivise users. Current strategies include leaflet messages attached to water bills, in some cases, free or subsidised fittings and gadgets. This paper focuses on water users, not water customers or building clients, as the key custodians of water efficiency in buildings. It starts with a brief review of attitudes, perceptions and behaviour. It then discusses the research aim and the methodology utilised to achieve the research objectives. The data from the questionnaire survey is then presented, followed with a discussion of the findings and conclusion.

1.1 Perceptions, Attitudes and Preferences of water users

Behaviour is influenced by people's lifestyle, values and preferences. Although design and specification to water efficiency standards is a good start to reducing water consumption in buildings, behaviour change in water users and customers is essential to achieve sustained savings. Behaviour change is a *response* to attitude change where the individual has incorporated a personal view which directs behaviour through a sense of mastery and control that the individual attributes to the self rather than to an outside influence (McCalley, 2006). Gatersleben *et al.* (2010) proposed that a degree of 'intermeshing needs to take place between people's values and lifestyle and the environmental cause for acceptance to make change to occur. This intermeshing effect is directly linked to how the environment influences everyday life and the extent at which the general public would be more willing to participate in schemes and to lower consumption. It is also more likely to take place if the individual or group is directly affected and the cause is clearly identified. For this to occur, a good understanding of factors of importance to people, and a better understanding of what it is they want to achieve by adapting, is needed (Larson, 2010).

In addition to lifestyle preferences, population growth and household demographics have also been found to impact on water consumption patterns. In England, the South East in particular, the increase in population and the creation of urban conurbations and agglomerations due to the expansion of cities and commuter belts places a substantial amount of stress on water resources. The increasing trend of low occupancy households (Mitchell, 2001) has also been highlighted has an important factor for the management of water resources. Single occupancy households are particularly on the increase. This places additional stress on housing supply and has consequences for energy and water consumption as well. Single occupancy households appear to consume more water per person than larger households with two or more occupants (Ofwat, 2009).

In a previous study, Martin (2006) found that people's lowest priorities for improvement among the public were ensuring a reliable water supply for homes, and industry, all year round. Dessai & Sims (2010) also found that people's awareness of water shortages or their understanding of the impacts of climate change seems to have little bearing on their willingness to accept incentives to use less water. No statistically significant relationship was found between people noticing more water shortages and their willingness to pay more for water or to accept water restrictions to mitigate the effects of climate change. The recurring issue appears to be that public perception of water issues vary from the perception of policy makers, regulator and key industry players. According to Larson (2010) this dissociation may be corrected through the improved "translation" of policy goals and actions into issues relevant to people on the ground. This may play an important role in increasing understanding and consequent acceptance of the principles of sustainability and adaption.

The literature review also found that technological interventions e.g. improved plumbing, water products, fixtures and fittings, are a useful baseline for water efficiency in buildings. However, technological fixes alone is often enough (Uzzell, 2008), consumer attitudes and behaviour often affect the levels of savings achieved (DEFRA & CLG, 2007). However as Gilg & Barr (2006) observed, behaviour is difficult to influence. Better results are achieved if through engagement and participation, the individual's adaptive capacity is improved, enabling them to make the choice to

change. Another approach is to remove the barriers that limit the ability to act in a sustainable manner. If people seem to be acting in environmentally damaging ways it may be a product of their attitudes and behaviours, but it may also be a function of the conditions in which those attitudes and behaviours are formed (Uzzell, 2008).

2. Research methodology

The research question was whether the preferences and attitudes of water users in the UK affect water efficiency in the home. In addition to investigating perceptions, attitudes and priorities, the study also investigated dependant factors identified in literature, such as: user characteristics, building type and ownership, geographical location, level of awareness of water and environmental issues etc. Due to the nature and range of variables under study, a quantitative methodology using questionnaires was utilised. The survey respondents were randomly sampled from the database held by a market survey company. The survey was then disseminated online and email invitations sent. The survey was 'live' for one month only. Due the random nature of sampling, the questionnaire began with general questions about gender, age, type of accommodation, location of respondents etc. Responses to these questions helped to provide context for the data and aided interpretation and analysis. As discussed in the literature review, the second part of the questions attempted to group respondents based on their attitudes, perceptions, building type, and household composition linking these with behaviour and technological preferences. Data from the survey were inputted into a statistical analysis package for statistical and descriptive analysis.

This study is limited in the amount and spread of responses received. Although the findings are valid for achieving the objectives, a comprehensive longitudinal study is highly recommended to gain further and more in-depth understanding of the influences on water consumption behaviour.

2.1 Summary of findings

About 1000 respondents which were sampled randomly from the market survey company's database were contacted. 546 respondents started the survey, of which 393 fully completed it. User comments are presented in quotes.

The age profile of respondents was represented in 6 age bands: Ages 16-24 (10%), 25-34 (30%), 35-44 (23%), 45-54 (16%), and 55-64 (13%), 65+ (8%). The gender representations were almost equal with 49.1% female and 50.9% male. The UK was divided into 7 regions to identify the geographical location of respondents. Disproportionately, more than half (51%) live in the South East region, 29% in North England, 16% in the Midlands, 2% lived in Scotland, 2.5% in the South West and Wales, with 0% represented from Northern Ireland. Majority (34%) also lived in semi-detached houses, 27% in terraced houses, 23% in apartments/flats, 15% in detached houses, 1% in bungalows (mostly respondents aged 65+) and the remaining 1% in maisonettes. The occupancy profile was such that 56% lived in households of 1-2 people only, confirming findings in Ofwat (2009). 70% were home owners, 22% tenants and the rest occupied social housing, live with parents or in student

accommodation. Only 9% live in single bedroom properties; of this percentage, more than 90% live in apartments. Majority (44%) live in 3 bedroom properties, predominantly semi-detached and terraced houses, 30% in 2 bedroom apartments or terraced houses and 17% in 4 bedroom detached or semi-detached houses. 66% of respondents only had one bathroom and 29% had two. Majority (77%) of detached houses had 3 sanitary rooms in one form or the other; bathroom, shower rooms, cloakrooms, wet rooms etc. As expected, all the dwellings have a kitchen.

> "Living in a flat means we can't have a water meter. So there's little incentive that way to save water".

> "I desperately want a water meter but the council says it's not possible due to the way my ex council house is built. This infuriates me as I had one at my previous property and it saved me a lot of money."

Lastly and importantly, 98% of respondents are directly responsible for paying water bills but 64% of the respondents do not have a water meter and therefore do not pay for water based on their consumption. Even though there was a general willingness to do so. This is because metering is not compulsory in most parts of the UK. A larger percentage of respondents in the South East had water meters; this is due to the large scale metering programme that is currently underway in this region.

2.1.1 Lifestyle and values

Respondents were asked to rate some lifestyle and value criteria on a scale of 1 to 10; 1 being highest and 10 the least priority. The 10 criteria were sourced from literature and are, in no particular order of importance: education, income and finance, health and wellbeing, family and friends, house and property value, technology and gadgets, national prosperity and welfare, neighbourhood and community, the natural environment and water – availability and quality. Figure 1 graphically shows the lifestyle and values priorities defined by the respondents.

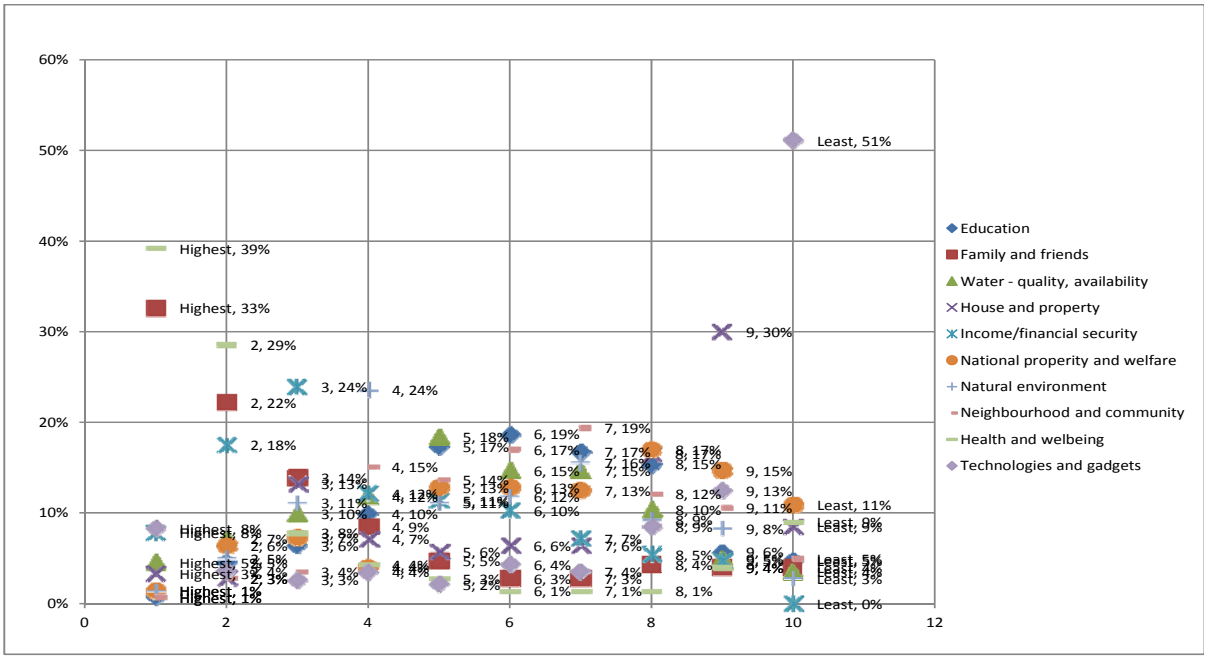

Figure 1: Respondents lifestyle and values

Figure 1 shows the highest ranking factor was Health and wellbeing at 39% - the highest scale of 1, followed by Family and friends at 33%. The least ranked factor by 51% on the lowest scale of 10 was technology and gadgets. Income and financial security was 3rd, Natural environment 4th, Water – availability and quality 5th, Education 6th, Neighbourhood and community was ranked 7th, national prosperity and welfare 8th and house and property value ranked 9th, by the majority of respondents. This finding suggests that public engagement and strategies that predominantly proposes technological solutions alone are likely to be ineffective. Water is mid-line on the list of priorities suggesting that water efficiency messages should reinforce the value of water in the context of health and wellbeing, reinforcing values of family and friendship, consolidating messages on climate change and the environment whilst emphasising opportunities to save money or protect income.

2.1.2 Awareness of water issues

There was no statistical significance or relationship between respondent's age or location and their level of awareness of water issues ($p = 0.476$ and 0.945). There was statistical significance between awareness of water issues and awareness of climate change/ environmental issues ($p < 0.001$). There was some variance in respondents' views when asked about their awareness of water issues in comparison to overall environmental issues. 23% said they had a low awareness of water issues compared with environmental issues (12%). However, those with average awareness were very close at 60% and 61% respectively. Also, 17% for water and 26% for the environment said they had a high awareness of the respective issues.

> "We're bombarded by suggestions of ways to save electricity but suggestions about saving water usage seem to have either been lost or slow to permeate".

The indication is that efforts at improving awareness of green matters have been moderately successfully (around 1 in 4 having a high awareness), but at the same time, there appears to still be low awareness of water issues by some respondents. This was also the case with respondents residing in areas that have recently experienced risk events such as floods and droughts and in spite of recent weather events internationally.

2.1.3 Attitude to saving water

There was some correlation between level of awareness and attitude of respondents on the need to save water. The question on attitude was structured on Uzzell's (2008) classification of those: "who would, could, can't, don't and won't". The important finding from this section of the study, irrespective of the level of awareness, was that 44% of respondents stated that they already conserve water but realise that they need to do more. They also needed to know more about how to go about doing this. This confirms the need for knowledge competence in water users which will ensure that information and awareness is translated into positive action.

> "I don't know a lot about water saving issues or the need to save water. I need to know more and need educating on the issues and the need to save water. I also don't understand all the technologies/equipment that are available for saving water and would need to know more so that I can make an informed

> decision. I'm not likely to undertake the research myself due to personal time constraints and higher priorities and so this information needs to be drawn to my attention. I'm generally keen on the idea of living a 'greener' life and so would adopt greener ways of living if they were presented. For example, our council introduced recycling and food waste recycling and I participate in it with enthusiasm".

Similar comments were received from many respondents. This suggests that awareness messages should be carefully designed and targeted in order to avoid a negative response as was evident in some respondents, even those with high level awareness. For this group, the next favourable responses were "I could but choose not to because there are more important things to focus on" or "I would but I don't. I recognise the need to conserve water but I still don't do anything". In addition, 24% said they couldn't do anything more due to financial constraints.

> "I can't afford to upgrade dishwasher etc to water saving one until they break, too expensive to buy new ones".

About 22% said they can't because they are tenants and do not have the right or support of the landlord to make changes. Only 2% said their lifestyle would not permit them to make changes. This trend was repeated when attitudes were correlated with awareness of climate change issues.

2.1.4 Making changes to save water

Survey participants were asked what changes they will make in order to save water. On a scale of 1-3 (1 = high preference, 3 = low preference), respondents rated the three options; adapt behaviour, revise activity or adopt water efficient technology, based on personal preference and in the context of their household and lifestyle. Findings show a general preference by respondents towards to change of behaviour, ranked high by majority (55%) first, then to save water through revising or choosing alternate water saving activity (ranked medium by 47%), and last option (ranked low by a 53% majority) was to adopt new technologies or implement technological interventions.

> "I believe that saving water is not so much about using new advanced gadgets/devices - although some devices can help to some extent. The need is for a change in behaviour through transforming attitudes, perceptions and values".

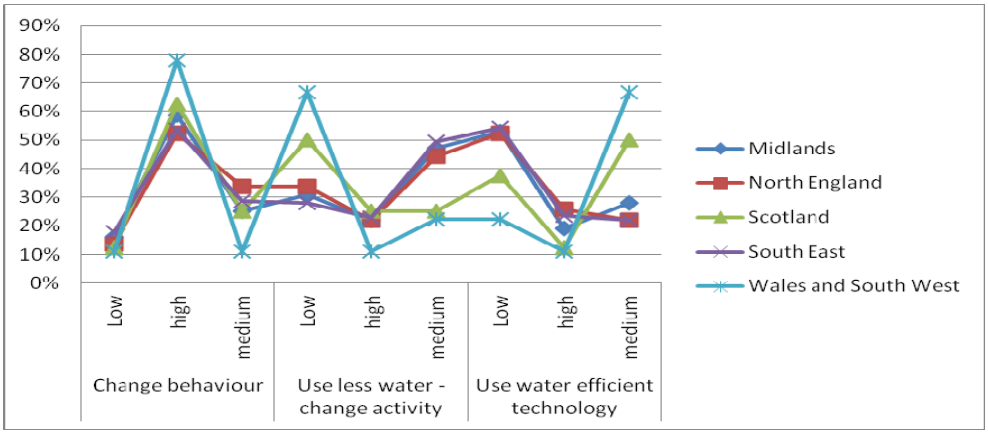

Figure 2: Preference for saving water based on location

This trend was similar irrespective of the level of awareness of the respondents to water issues or the respondent's attitude to saving water. The trend was also similar when correlated with the respondents' geographical location with the exception of the respondents from the South West and Wales, and Scotland, who ranked the use of technological intervention second and changing activity to save water third (Figure 2). Respondents living in bungalows also ranked technology second and were undecided about saving water through revising water consuming activities within the home.

2.1.5 Water efficiency technologies

With regards to the adoption of water saving technologies, it was important to first assess what water efficiency provisions already exist in the respondent's homes and what is being planned for the immediate 12 month period. A list of water current water saving technologies was provided and in a response matrix, respondents identified whether they; already have it, they plan to implement in the next 12 months, no plans to get, no plans to get but open to the idea or they need to know more.

Majority already had water efficient washing machines but there was a lot more spread with dishwashers; majority do not have plans to purchase or replace existing machines. The current strategy to give out free gadgets such as water hippos seem to have some support with 42% saying that they are open to the idea. Majority of those that have gardens said that they have a garden water butt. Also, 44% majority already have dual/low flush WCs. Majority of respondents do not have water efficient taps with 42% open to the idea but a further 29% do not plan to change their taps. Only 25% have water efficient showers, although, 38% said they were open to the idea. Interestingly, 15% said they have integrated some form of Sustainable Urban Drainage system (SUDS) in their hard paved areas. In general, 1 in 5 are 'open to the idea' of water saving technologies. Over a third of respondents already had a wide range of water saving technologies or products e.g. WC with low flush (44.06%), water butt (also 44.06%), water efficient washing machine (41.26%), in particular, the technologies that are simple, common, have been in the market some time and are easy to use.

However, a finding of note was the poor propensity of respondents to make the change to adopt water saving technologies in the short term. When asked if they plan to change to more efficient products/fittings in the next 12 months. The highest response at 9% was to change to water efficient WCs. Followed by water butts at 8% and dishwashers and waster saving showers at 7%. Recycling systems such as rainwater and grey water systems received a poor response in general and only 3% and 1% respectively said they will adopt these technologies in the short term. Even though 55-56% said they are open to the idea of water recycling. A longitudinal study is needed to further investigate medium to long term adoption.

2.1.6 Constraints to technological adoption

The majority of participants indicated that they considered water saving technologies of all varieties to be both good for the environment and a good way to save water. The constraint is therefore not the perception of the technologies or the lifestyle of respondents but the willingness and capacity to adopt them for use in their homes. It was therefore important to explore factors that affect the uptake of

water saving technologies. From the data, 67% said cost was the most prohibitive factor for adopting water saving technologies.

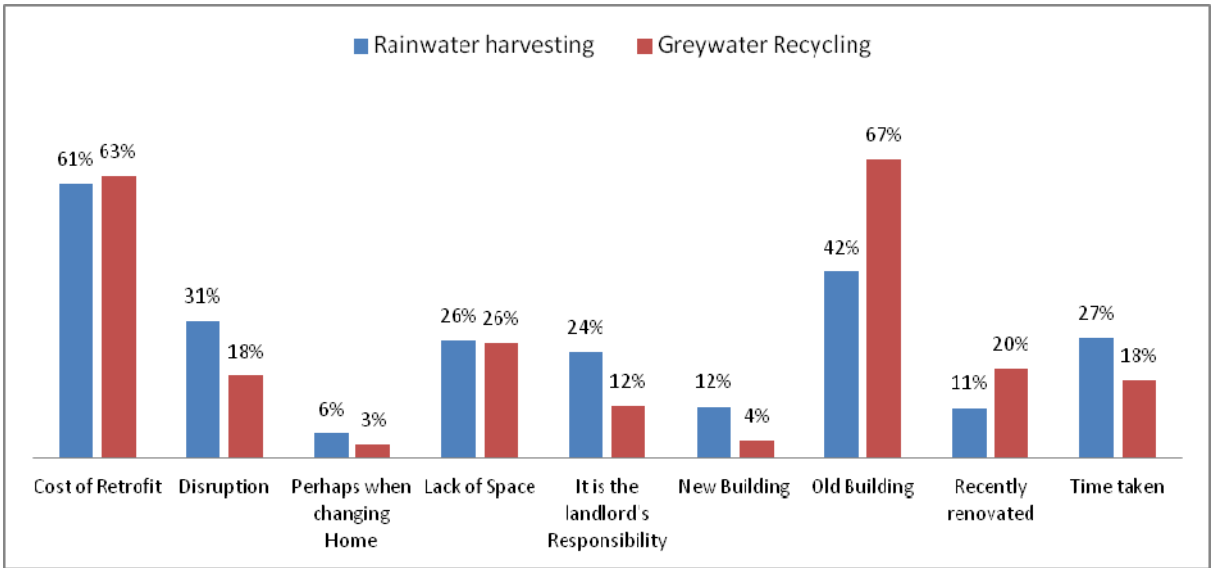

Figure 3: Constraints to water recycling in buildings

> "Further water saving equipment has prohibitive costs (i.e. rainwater harvesting) yet is very suitable to our lifestyle and household. Readily available grants or subsidies would help".

The age of the building was also important (Figure 3); especially if the building is too old or even too new. 42% said that old buildings are difficult to retrofit while 7% said that they live in new buildings and do not have the intention to start making changes in the nearest future. This tie in with the next three main constraints (at 31% each), which were space limitations, the amount of disruption and the time taken to retrofit water efficient features into an existing building. Even though 13% had recently renovated their building; some did not consider water efficient replacements. Nonetheless, this group of people would not make further changes to their property in the short term. 5% said that they will consider water efficiency when looking to change or move home and 20% said that water efficiency was the landlord's responsibility.

3. Discussion

The findings from the survey support the hypotheses that the attitude and perception of water users vary depending on their priorities, the opportunities and constraints of the property and their attitude towards water and water issues. This is in turn is influenced by the willingness to change, the capacity to change and the limitations of 'what is known'. Respondents' knowledge of water efficient technologies; information on the function, performance, effectiveness, cost, health risks etc were considered important for making decisions about whether to adopt a technology or not. But, majority of respondents will consider changing domestic activities to use less water and changing behaviour, before they consider water saving technologies. This suggests that techno-centric measures or initiatives will be less effective to domestic users who will rather engage with non-technological

approaches. Also, diminished capacity to adopt was found for respondents that live in rented properties.

> "I would love to install a variety of water saving measures as I recognise the importance of conserving water. However since I live in a rented property I am unable to make decisions on plumbing and appliances".

> "I would but I am a tenant and have next to no say in water saving measure implementation other than my own behavioural response".

Majority of comments provided at the end of the survey implied a willingness to change or adopt new technologies but the lack of empowerment to do so. This suggests another area where targeted policy (e.g. during change of occupancy, currently done with metering) might be of benefit. Findings also suggest that some measures and initiatives that apply to existing buildings are required. There is a general perception that implementing water saving technologies in existing homes will be costly, disruptive, have impact on space etc. The lack of incentive to adopt new technologies to existing homes was also highlighted. Homeowners and building users will generally like to see efforts made to change behaviour, use less water and adopt technologies, reflected in water tariffs and bills. Lastly, from this limited study it was found that user perception is important but it not the most defining factor in changing water consumption behaviour, or whether households adopt water saving technologies. More important factors include the building type and constraints, building ownership – tenants in rented properties felt powerless to make the necessary changes, awareness of water issues, and cost of implementation.

4. Conclusion

A critical analysis of the literature showed that a common factor or barrier to acting sustainably water-wise is the level of awareness of user and their willingness and ability to make the necessary change. This study confirms the last two and further identifies that water efficiency messages should be presented in a manner that confirms or conforms to individual and household priorities and preferences. It was also found that a positive perception already exists in most people towards saving water and awareness was relatively high. The barrier is translating awareness and positive perception to a positive attitude which in turn will drive positive change. A start is to tailor the message such that domestic consumption relates with the bigger picture of water resource management, the environment and climate change. 'Intermeshing' needs to take place for pro-environmental behaviour to become less detached from everyday values. The best way to achieve this is through creating knowledge competence in water users, and co-creating value through better engagement and a flexible, customisable strategy. Technology needs to be robust and perform in line with user expectations and it should be deployed in such a manner that allows users to interact with them based on their lifestyle and needs.

Water efficiency strategies should provide support for both technology and behavioural change. The Building Regulations and the Code for Sustainable Homes predominantly focus on water efficient fixtures and fittings. Interlinking technological interventions and behavioural/activity change to

propose a holistic solution in buildings is likely to be more beneficial for users. Therefore, the recommendation from this study is a 'diy' water efficiency tool for households. The tool should provide a simple and user friendly knowledge framework to help households implement water efficiency strategies based on their social preferences, physical, economic and financial context.

5. Acknowledgements

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