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Rainwater harvesting in the UK: Socio-technical theory and practice

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ABSTRACT

There is currently a window of opportunity in the UK, with respect to promoting sustainable water management (SWM). Periods of alternating drought and flooding have brought water management issues to the fore of UK media coverage and policy development. Unchallenged reliance on the historic legacy of piped infrastructure is declining, as its resilience and adaptability in the face of climate change become increasingly questioned. Despite its prevalence in other countries and a recent surge in sales, rainwater harvesting (RWH) has yet to transition from niche to mainstream in the UK. This paper provides an overview of the development of a strategic framework for enabling RWH to transition from novel to mainstream, informed by a number of evidence bases and devised using insight gained through the application of a number of theories. Identified strategic areas for action include (i) Technical Relevance (product development); (ii) Social Receptivity (capacity building) and (ii) Institutional Commitment (support services).

1. Introduction

1.1. RWH in the UK — context and background

Globally, increasing attention is being focused on water supply techniques, as climate change, population growth and other factors place increasing demands on an unevenly distributed resource. Increasing the resilience and adaptability of water supply systems is also becoming a desirable feature. Consequently, alternatives to the centralised water distribution system (mains-piped potable water) are receiving renewed interest in both new and existing building developments. These alternatives can be centralised, such as large-scale wastewater reclamation (practised widely in some parts of Australia [1]) or decentralised, such as greywater reuse (GWR) or RWH systems in individual buildings or communally between buildings. RWH is practised widely in Australia, Germany and Japan [1–3] and is becoming increasingly common in the UK.

Rainwater harvesting systems can provide a supply of non-potable ('non-drinking') water for end uses that do not necessarily require potable water. These can include toilet (WC) and urinal flushing, laundry (washing machines), hot water systems, vehicle washing and irrigation (gardens or other) [4]. Supplementing rainwater in this way reduces a building's mains water consumption, saving money (if the building is on a meter) and saving highly treated potable water. Additionally, some studies suggest RWH may provide a local stormwater attenuation feature, as rainwater is stored in tanks and released over a period of time, rather than entering the storm sewer (or combined sewer) system as a peak load [5].

In the UK over the last 3–5 years, a range of policies and strategies have been aimed at making water use more sustainable, such as 'Future Water', the Government's water strategy [6] and the Flood and Water Management Act [7], as well as the European Union Water Framework Directive (2000/60/EC). These have encouraged consideration of alternative water sources, such as RWH and consequently a number of codes, regulations, standards and best practice guidance manuals of relevance to

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RWH have been developed or reviewed. These range from the Code for Sustainable Homes [8] to the British Standard Institute's Code of Practice (BS 8515:2009).

Despite the provision of these codes and guides a number of barriers to the implementation of RWH exist, such as unfamiliarity of the general public and trades people with unconventional systems, capital outlay required, uncertainty regarding system design approaches and health and safety fears. An area in which the UK in particular lacks is engagement and consultation of stakeholders involved throughout the RWH system implementation process, such as suppliers, implementers and end users. For example limited research has been conducted on the receptivity of stakeholders to RWH, the relevance of RWH to stakeholders, their ability to implement RWH or on their opinions regarding existing incentives and support devices [4].

The aim of the present research was to devise a strategic framework to transition RWH from a novel to mainstream concept by overcoming the outlined barriers and implementation deficits. In order to determine recommendations to overcome such barriers it was crucial to adopt a socio-technical perspective, as although a RWH system is a technical entity, receptivity to it and successful installation, operation and maintenance of it, depend on a range of human factors. Consequently, a number of theories were identified, considered and used to inform both the collection *and* analysis of socio-technical data on RWH systems. The theories considered in the framework are summarised in Fig. 1. This paper provides an overview of the theories considered, their application to RWH and briefly describes how they informed the development the strategic framework.

2. Socio-technical theory — the relevance of social theory to RWH part I

The scale at which the social theories are considered to operate varies considerably, from the top-down transition/multi-level perspective to bottom-up approaches, such as self-efficacy and receptivity, which focus on individual stakeholders involved in the actual technology implementation and transition process. The consideration of theories across these scales ensures that the strengths and weaknesses of each are complemented and a comprehensive view of the technology transition process is gained.

2.1. Framework for pro-environmental behaviours

The UK government has recognised that information alone does not lead to behaviour change and has produced the 'Framework for Pro-environmental Behaviours' (FPEB) [9]. The FPEB divides consumers into segments representing different views and attitudes towards the environment, in order to develop more targeted social marketing strategies to facilitate behaviour change to more sustainable practices, including water use. However, there remains a certain level of assumption that environmental actions can be compartmentalised into behavioural 'segments', depending on an individual's '*attitudes*, *barriers*, *motivations* and *current behaviours*' [9]. Macnaghten and Urry [10] and Sefton [11] argue that such approaches do not account for an individual's alternative perceptions of trust and responsibility, the differing perspectives of promoters and receivers of information, or the influence of social context.

2.2. Receptivity

The model of receptivity, developed by Jeffrey and Seaton [12], consists of the four attributes of awareness, association, acquisition and application. The framework's basic premise is that policy change instruments designed from the recipient or 'user' (individual, organisation) perspective will be more successful, as the failure of interventions often relates to the ability of users to implement change into their situation. Therefore identifying the recipient's level of receptivity or ability is a crucial starting point to pursuing successful policy or technology adoption and its subsequent implementation. Jeffrey and Seaton [12] utilised the framework to design a survey on in-house water recycling, as well as to analyse the results. Findings were potentially useful for improving the water recycling system design in terms of functionality and aesthetics, as well as the financial, regulatory and social concerns. Brown and Keath [13], in discussing the relevance of the framework to SWM, note that previous research on stormwater quality focused on distinct phases of receptivity in isolation, such as awareness (education programmes), application (prescriptive requirements in planning codes) *or* acquisition (capacity building). They assert that the value of the framework is in representing *all* of the attributes, which the present research aims to represent, as indicated in Table 1.

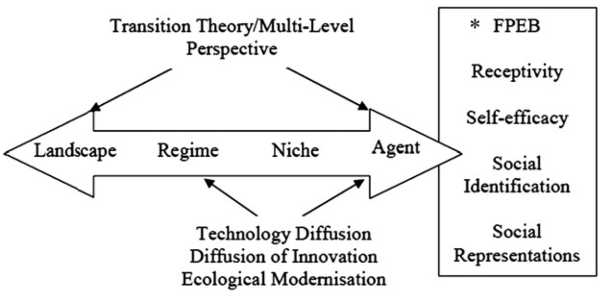

Fig. 1. The social theories considered within the research [4].