Theme: 5. New business models and understandings of human behaviour

Subthemes:

- 5.3. Product-service systems and transition to a circular economy
- 5.4. Changing practices and patterns of human behaviour

Households' motivation and barriers for utility service-performance contracts

Summary

End-user centred infrastructure operation through service-performance contracting has been seen as a valuable business opportunity while at the same time reducing resource consumption of infrastructure services. Research on energy service contracting has identified that domestic end-users' acceptance of service contracting arrangements may be a barrier to the mainstream adoption of a change in infrastructure services. In this research we examine end-user behaviours in the current UK context of utility provision and compare responses with those of future scenarios of service and service-performance infrastructure provision. This contrast allows for an analysis of the extent to which domestic end-users may be willing to accept intervention from service providers. We present the theoretical background, survey design and procedure, and introduce a set of testable behavioural hypothesis. In the conference contribution we will present the full results of the survey and highlight implications for future research and practice.

Extended abstract

Introduction

Reliable provision of vital infrastructure products, such as water, energy and transportation, is necessary for the most basic human and economic development to occur [1]. Such development is not enabled by the infrastructure products per se nor by the physical infrastructure assets but rather through the infrastructure services provided. The present form of infrastructure operation consists mostly of separate supply systems that have provisioned unconstrained demand. An alternative perspective of sustainable consumption would prioritize coordinated infrastructure operation and focus on essential service delivery at the lowest possible level of resource consumption [2, 3].

The total resource consumption of an infrastructure service is defined by demand levels, the efficiency of the active and passive conversion technologies [4], their operation and maintenance, and the efficiency of supply and distribution networks. Thus, for resource-efficient infrastructure operation, integrating the end-users is of particular importance [5]. In the current mainstream setting, end-users' behaviours consist of four key aspects: (i) they

select the utility company to deliver the infrastructure product; (ii) they choose technologies to convert the product into a service; (iii) they define how these technologies are used and in what operation mode; and (iv) they determine the quality and volume of the infrastructure service demand [6].

If utility companies start towards extending their value proposition to include technologies, operation modes and service demand, these four key behavioural aspects need to be considered together. Such alternative arrangements will be more complex than billing based on metered quantities; however they could simplify the fragmented and poorly informed decision-making of end-users, and incentivise efficient solutions rather than throughput [6]. However, research on energy service contracting has highlighted end-users' barriers to mainstreaming service contracting in the domestic sector [7-9]. The success of such service or service-performance delivery is dependent on detailed understanding of motivation and barriers for end-user behaviours at these different levels.

Efficiency and curtailment behaviours: Theoretical background

Previous studies looking at energy and water saving behaviours in households can be broadly categorised as intervention studies, theory driven research, or combined approaches [10]. As this research is concerned with a transition from the current mainstream to potential service-performance delivery, which does not yet exist for domestic costumers, a theory driven approach was considered most appropriate. Previous research has divided energy and water saving behaviours into two different groups of behaviours: efficiency behaviours and curtailment behaviours [10-13]. Curtailment behaviours typically imply repetitive action or an established habit, and corresponding little alertness or cognitive effort in the conduct of the behaviour (e.g. switching off lights when leaving the room). Changing such behaviour is often associated with increased effort and/or reduced comfort. Efficiency behaviours on the other hand are referred to as efficiency increases or technology choice behaviours, and typically involve a one-off decision (e.g. installation of loft insulation) calling for initial investments but with potential future savings [13, 14].

In this research, we examined *efficiency behaviours* using the Theory of Planned Behaviour (TPB) [15] as the theoretical underpinning. The TPB is one of the most widely applied theories of social behaviour and it goes beyond basic cost-benefit analysis. Intention is the key determinant of behaviour in the TPB, which is itself influenced by attitude towards the behaviour (i.e. beliefs about and evaluation of outcomes), the subjective norm (i.e. the perception of what most people important to the person think he or she should or should not do), but also by the perceived behavioural control [15]. However, the TPB is limited when habits, emotions or moral factors gain importance [14], which is, by definition the case for curtailment behaviours.

Therefore, *curtailment behaviours* were investigated using Triandi's Theory of Interpersonal Behaviour (TIB) [16] as the theoretical framework. Similar to TPB, in TIB intention is an

important predictor of behaviour. So too is habit, which is facilitated by contextual factors. Intentions themselves are seen as being determined by attitudes, social and affective factors. Social factors include roles, norms, and self-concept. Triandis is one of few theorists who also include affective factors as determinants of behaviour.

Survey procedure and design

Infrastructure services

Services to be considered in the survey were selected according to their relative importance regarding resource consumption, their potential for combined utility provision, and their suitability for a combined utility/technology provision in a potential service and service-performance contract. Table 1 shows the behaviours that were selected.

Table 1: Purchase, efficiency and curtailment behaviours analysed in the survey (light grey: not considered / bold: main behaviours analysed)

behaviour	**efficiency behaviour**	**habitual or curtailment behaviours**	
service	technology selection / installation of	technology operation	service demand
thermal comfort	**- Loft insulation** **- Cavity or solid wall insulation** **- Double or triple glazing** **- Condensing boiler**		**- Lowering the room temperature** **- Closing the curtains before dark to keep the heat in** **- Use blankets or warm clothes instead of putting the heating on** **- Turn the heating off when out of the house**
human waste disposal	**- Dual flush toilet**	**- Using single flushes when appropriate**	not considered, as usually not actively influenced by occupants
personal hygiene	**- Aerated shower heads** **- Low-flow taps** **- Rainwater catchment** **- Greywater re-use**	**- Turning off the tap when brushing teeth** **- Using reduced flow taps appropriately**	**- Taking showers instead of baths** **- Taking shorter showers (4 min. or less)**

Survey procedure

The survey was divided into three parts that were administered over two time periods. The first survey (approximately 1600 respondents) aimed to establish baseline measures of current energy and water saving behaviours, and to collect relevant socio-demographic data. The second and third surveys were administered three weeks later and asked the same set of respondents (i.e. about 400 for each) to respond to a hypothetical situation where a service or service-performance contract would be available to them.

Behavioural hypothesis

In the current UK mainstream setting efficiency behaviours were expected to show higher intention for energy related behaviours than water because of high awareness, and programs that facilitate efficiency measures related to energy. The opposite was expected for curtailment behaviours because of the high visibility and immediate feedback water behaviours have compared to energy saving behaviours. In a hypothetical situation where service contracts (SC) and service-performance contracts (SPC) are available, higher intentional values for efficiency behaviours were expected compared to the baseline because investment costs and risk evaluation of future savings are shifted from the end-user to the service provider. Curtailment behaviours on the other hand were expected to show lower values in a SPC scenario because this type of contract will require end-users to engage in conservation behaviours that they may have already been doing based on intrinsic motivations.

Conclusion

In this research efficiency behaviours (i.e. adoption of energy and water saving technologies) and curtailment behaviours (i.e. everyday energy and water saving behaviours) were analysed in the current mainstream setting and contrasted with potential alternative service delivery arrangement scenarios. This contrast allows for analysing the extent to which domestic end-users may be willing to accept interference from service providers. The testing of the hypotheses allows for specific recommendations for utility providers for service and service-performance contract scenarios. In addition, the theoretical models allow for the derivation of specific motivational factors and barriers to enable a broader acceptance of service and service-performances contract schemes.

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