

Appealing Attributes of Low Carbon Innovations

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Background

Consumers contribute significantly to global CO₂ emissions (Cherry, Scott, Barrett, & Pidgeon, 2018). Many technologies exist which offer lower carbon alternatives to high emitting consumer behaviours. Although these low carbon innovations have a presence in the market they remain at the edges of market share, with a minimal contribution to reducing global CO₂ emissions (Wilson, Pettifor et al. 2018). If adopted at scale, however, these could significantly reduce consumer based CO₂ emissions.

Why this research?

Adoption of an innovation depends on whether its characteristics or attributes appeal to consumers (Davis, 1989; Rogers, 2003). However, there is a lack of empirical research into the appealing attributes of low carbon innovations beyond a direct comparison with incumbent technologies. Such research tends to focus on private attributes including price, against which low carbon innovations perform badly. Low carbon innovations are often perceived as being just higher priced alternatives (Schuitema, Anable, Skippon, & Kinnear, 2013). It is important that sources of added value (beyond price) have more central focus in policy and marketing strategy.

Our Objectives

In this paper we provide an in-depth and comprehensive understanding of the wide ranging attributes of low carbon innovations. More specifically we address three key research questions:

- RQ1** - what are the attributes of low carbon innovations that appeal to people?
- RQ2** - how do different low carbon innovations appeal against these?
- RQ3** - which attributes (other than price) offer added value (compared to incumbent technologies)?

Conceptual framework

We draw on the work of Axsen & Kurani (2012) whose work on electric vehicles identifies a clear framework for the attributes of low carbon innovations. This clearly distinguishes between private and public attributes, identifying four distinctive domains (Figure 1).

- private functional attributes** relate to what an innovation does and how it impacts the consumer.
- private symbolic attributes** relate to what an innovation represents and how it impacts the individual.
- public functional attributes** relate to what the innovation does and how it impacts society.
- public symbolic attributes** relate to what an innovation represents and how it impacts society.

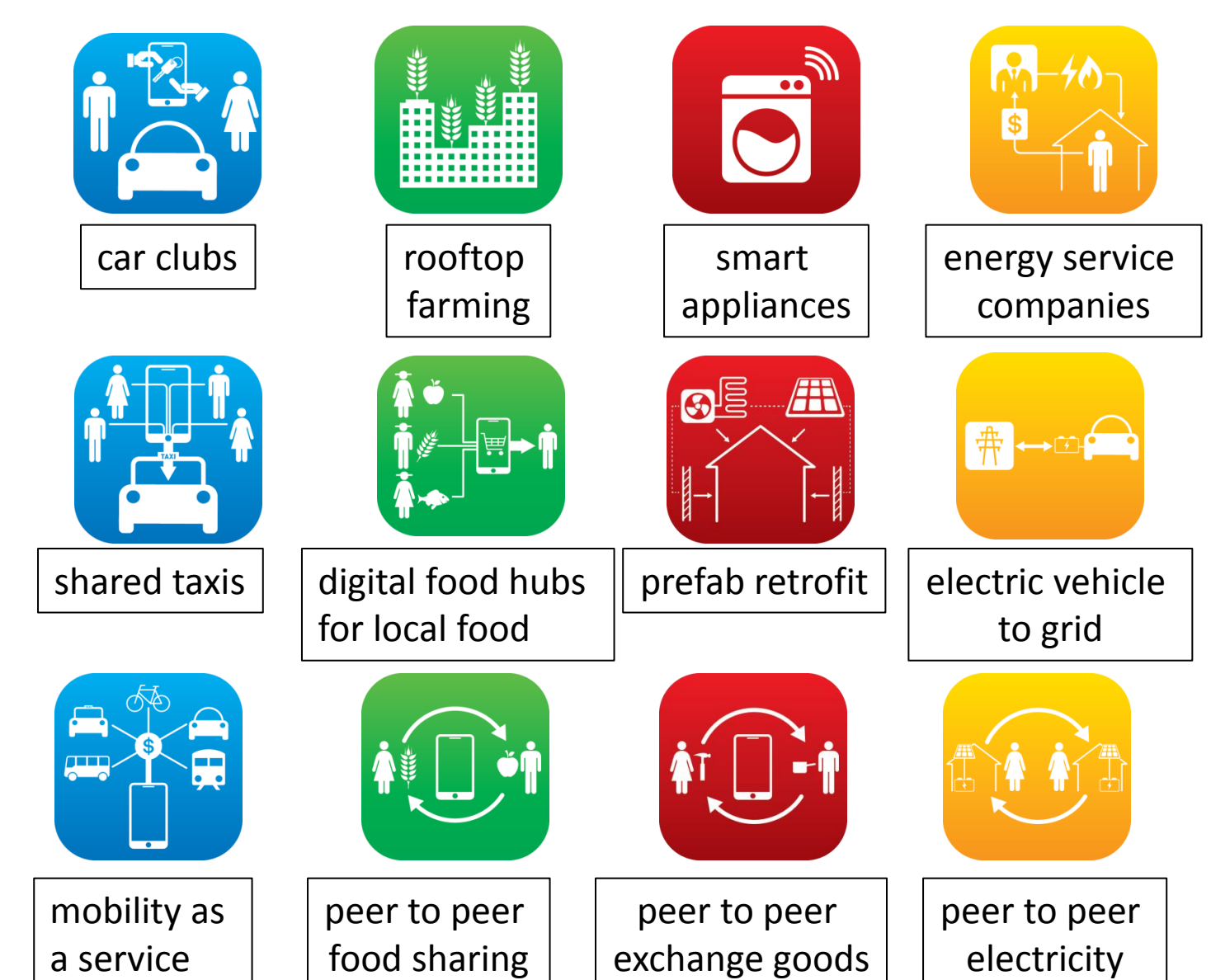
	Private (... that impacts the consumer)	Public (... that impacts society)
Functional (what it does ...)	Functional benefits to the consumer, e.g. - money saving - reliable - improved performance	Functional benefits to society, e.g. - environmental stewardship - reduce CO ₂ emissions - reduce oil use
Symbolic (what it represents ...)	Symbolic benefits to the consumer, e.g. - expression of self identity (including gender) - convey personal status (class and wealth) - attain group membership	Symbolic benefits to society, e.g. - oil independence - innovativeness

Figure 1 – The four domains of attribute

Axsen, J. and K. S. Kurani (2012). "Interpersonal influence within car buyers' social networks: applying five perspectives to plug-in hybrid vehicle drivers." *Environment and Planning A* 44(5): 1047-1065.

Methodology

We use a structured elicitation method known as repertory grid technique (RGT)(David & Dale, 2000). People living in a representative UK city were recruited by a professional agency. Participants (N=67) were all interested in new technology. We ran two elicitation exercises. In the first participants were asked to compare between elements (low carbon innovations) and identify constructs (attributes). In the second they were asked to rate all elements against what they felt were the most important constructs using a scale of 1-7 (7=high appeal, 1=low appeal).

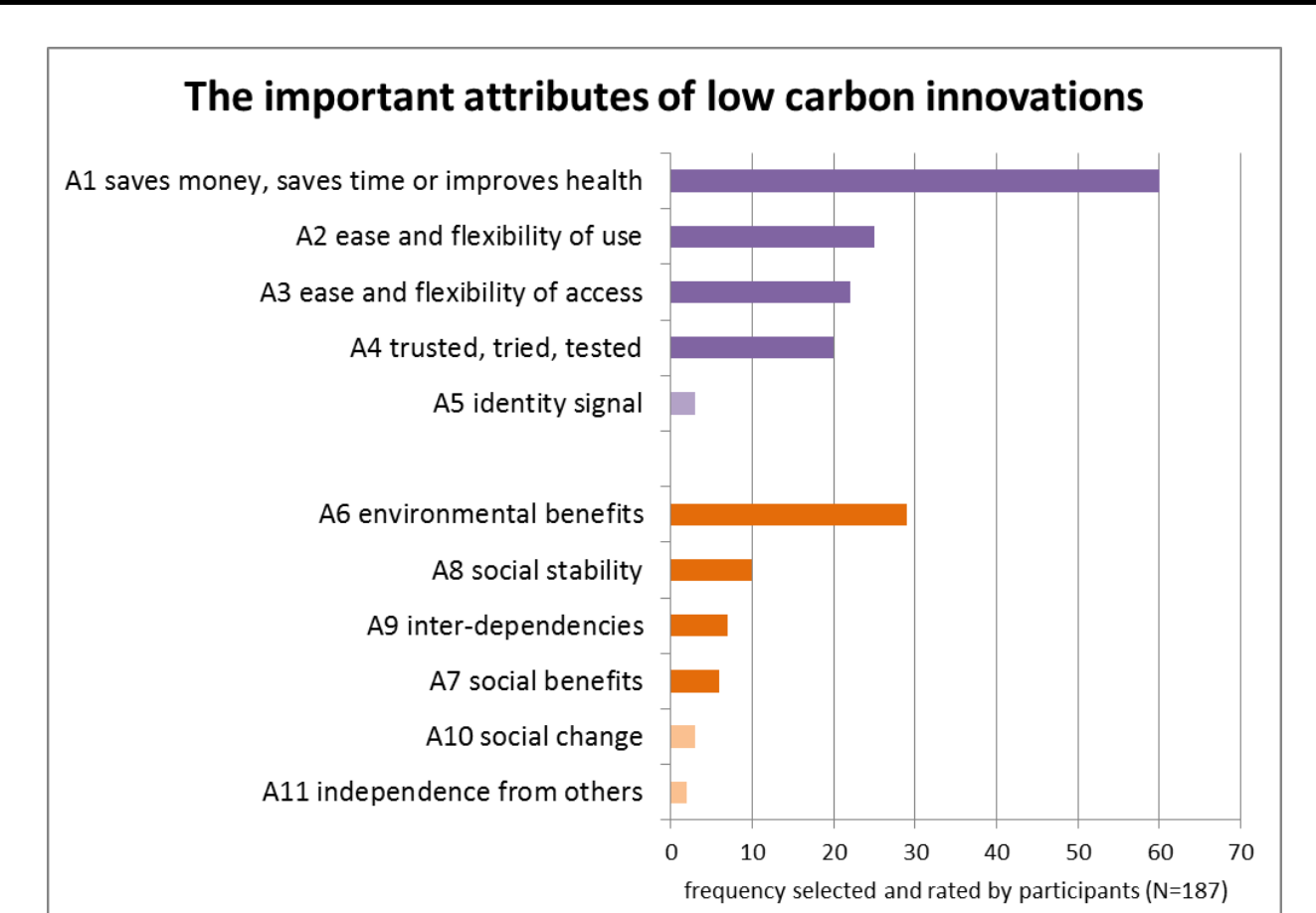


The elements are 12 low carbon innovations. They represent four key sectors (**mobility**, **food**, **homes** and **energy**).

Results

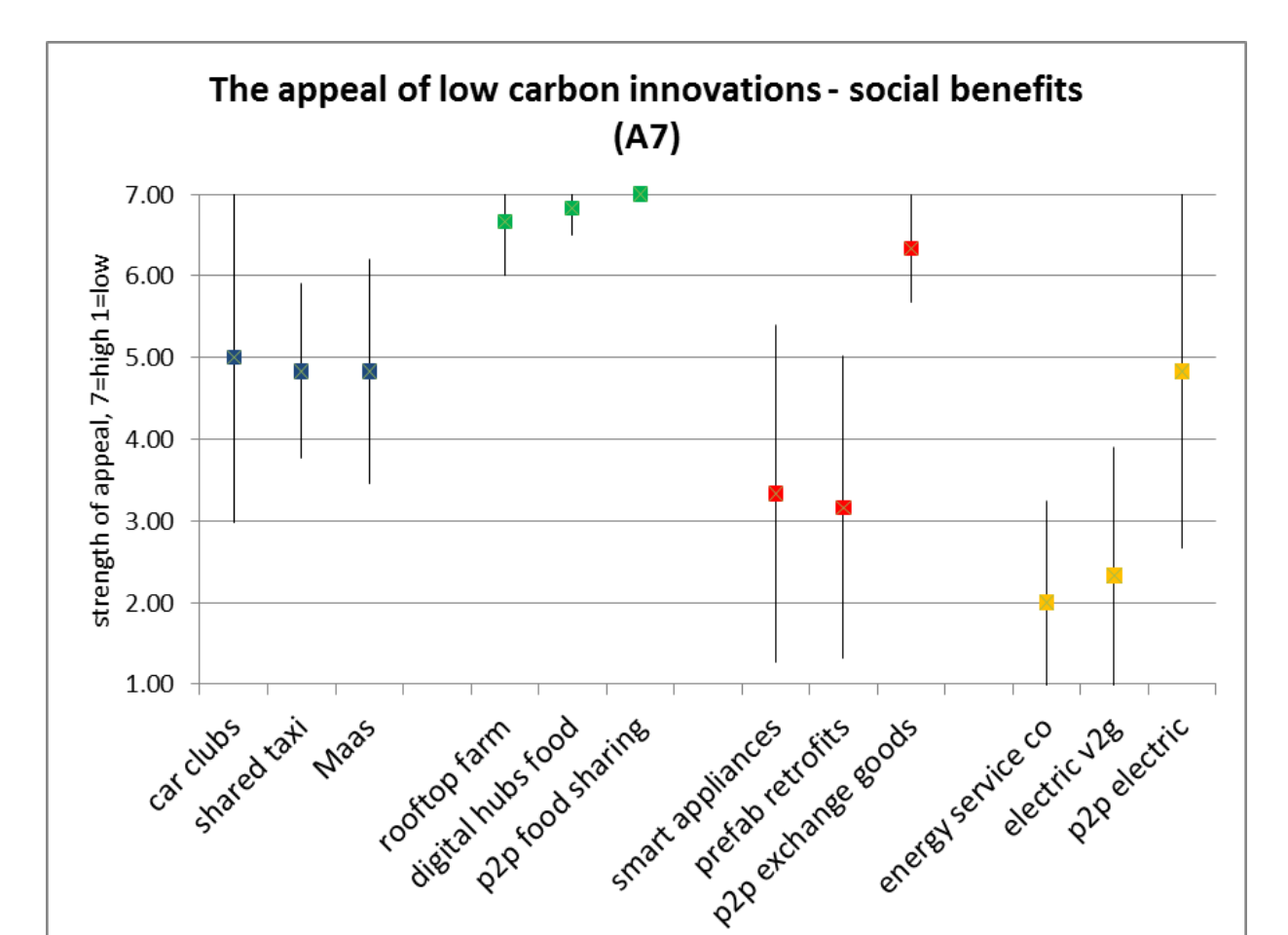
Key Finding RQ1: Participants mentioned 471 constructs which formed 12 unique attributes. **Private functional** attributes are salient but a range of **Public functional** attributes also widely appeal.

Figure 2 (right). The important attributes of low carbon innovations include concerns for lowering CO₂ emissions (A6), and providing clear benefits to society (A7).



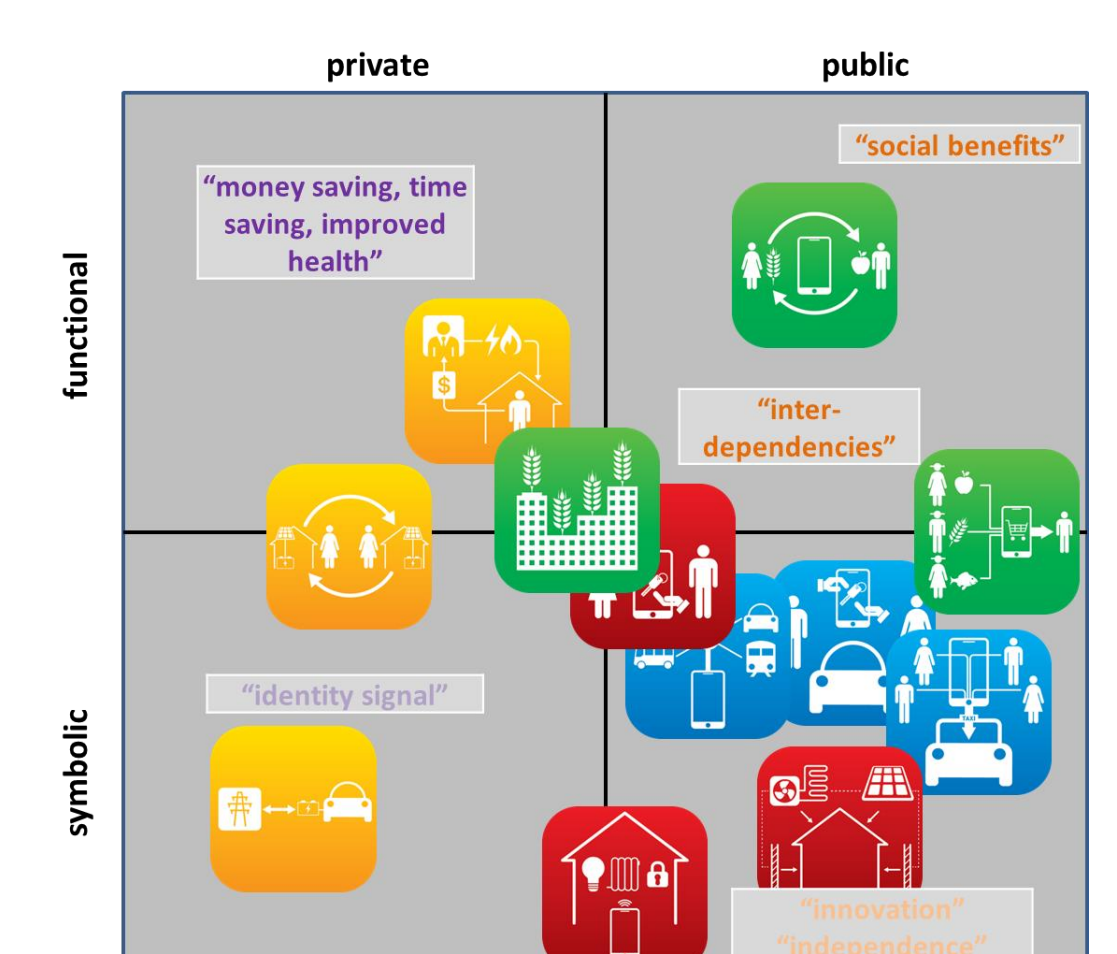
Key Finding RQ2: Low carbon innovations vary in their appeal against **public functional** attributes.

Figure 3 (right). **Food innovations** are highly appealing against social benefits (A2) compared to **energy innovations**. Food and diet aligns people with particular social and political issues such as local production and welfare (Chuck, Fernandes, & Hyers, 2016). In contrast energy generation and more efficient use enables people to embrace responsibility and autonomy (Simcock 2016).



Key Finding RQ3: Low carbon innovations cluster in terms of added value above incumbent technologies.

Figure 4 (right). The relative positioning (added value) of all low carbon innovations within our conceptual framework. Innovations based on the sharing economy have high appeal against "inter-dependencies". This relates to the creation of localised networks, friendships and the satisfaction of sharing with others. It emphasises the human need for community and connection with each other (Botsman & Rogers, 2010).



Discussion

It is important that low carbon innovations are positioned within the marketplace to emphasise unique sources of added value above incumbents. Our study shows they appeal against a range of both private and public attributes. Pro-active social marketing campaigns are required by government, local authorities, and industry which better align the unique benefits of low carbon innovations to the characteristics and social identities of consumers.