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Research article

The role of public communication in decision making for waste management infrastructure

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ABSTRACT

Modern waste management provision seeks to meet challenging objectives and strategies while reflecting community aspirations and ensuring cost-effective compliance with statutory obligations. Its social acceptability, which affects both what systems (infrastructure) can be put in place and to what extent their implementation will be successful, is a multi-dimensional phenomenon, often not well understood. In light of the growing evidence that decisions to build new infrastructure are often contested by the public, there is a clear need to understand the role of scientific evidence in public perception, particularly as environmental infrastructure delivery is often objected to by the public on environmental grounds. In this paper the need for waste management infrastructure is reviewed, and the way its delivery in the UK has evolved is used as an example of the role of public perception in the planning and delivery of waste facilities. Findings demonstrate the vital role of public communication in waste management infrastructure delivery. Public perception must be taken into account early in the decision making process, with the public informed and engaged from the start. There is a pressing need for people not simply to accept but to understand and appreciate the need for infrastructure, the nature of infrastructure investments and development, the costs and the benefits involved, and the technological aspects. Scientific evidence and literacy have a critical role to play, facilitating public engagement in a process that empowers people, allowing them to define and handle challenges and influence decisions that will impact their lives. Problem ownership, and an increased probability of any solutions proposed being selected and implemented successfully are potential benefits of such approach.

1. Introduction

Solid waste, "*the stuff we throw away*", is a striking by-product of civilization, with archeological studies showing that as early as 6500 BCE, North Americans in Colorado were producing 2.4 kilos of waste each day (Young, 2010). Waste generation is the result of resource use and historically has increased with population. However, in the past century as the world's population has grown, it has also become more urban and affluent, with resource use and the resulting waste generation linked to economic activity. As a result waste production has risen tenfold, with solid waste being generated faster than other environmental pollutants, including greenhouse gases (Hoornweg et al., 2013). The waste problem is particularly acute in emerging cities, with landfills such as Laogang in Shanghai (China); Sudokwon in Seoul (South Korea); Jardim Gramacho in Rio de Janeiro (Brazil); and Bordo Poniente in Mexico City (Mexico) competing for the title of the world's largest (Decker et al., 2002). According to the UN, by 2025, the world population will have reached 8 billion inhabitants (UN, 2011; Scherbov et al., 2011), with 70% of them living in cities (World Health Organization, 2013). Most of this growth is projected for Asia and Africa (UN, 2011). A remarkable increase in GDP per capita is also predicted, with the global economy in 2025 reaching $90 trillion, from $62 trillion in 2015 (UN, 2011). This increase in global population and GDP will present real challenges to resource security, limiting the supply of raw material and energy necessary to fuel the economic activity behind the equivalent predicted increase in GDP (Scherbov et al., 2011).

Waste management has a key role to play in both delivering public health and environmental protection, and contributing inputs to address the estimated lack of future resources— whether through material or energy recovery. A modern waste management

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provision needs to address the escalating nature of waste production, offering solutions that require a long term vision (Modak et al., 2011). In the UK, since 1999 when the European Union introduced the Landfill Directive – requiring all member states to reduce the amount of biodegradable municipal waste sent to landfill – there has been a pressing need to divert waste away from landfill by coupling efforts on waste reduction to increases in the amount of waste we reuse, recycle or use for energy recovery, to enable the UK to meet its target under this Directive of sending less than 10.2 million tonnes of waste to landfill annually by 2020 (Iacovidou et al., 2012). However, while government and industry have been working to meet this demand, the rate of planning approval for new facilities is well below what is required (Price, 2001). At the heart of this problem lies public opposition to the development of new waste infrastructure in their communities (Wolsink and Devilee, 2009).

The building of waste infrastructure, in line with environmental policy, faces a large variety of social acceptance issues (Higgs, 2006). Appraisal of the impact of siting the facilities is faced with assessing the desirability of the policies, or in many cases in the UK the lack of clear policies or indeed established strategies/vision for the future (Wolsink and Devilee, 2009). The reasoning is that such infrastructure is considered to serve the (proclaimed) public interests, whereas the potential impacts or risks are concentrated at a smaller scale, for example in local communities (Wolsink, 2010). Such risks threaten environmental quality; and a frequent type of environmental conflict arises when the proclaimed public good lies within the domain of environmental policy and sustainability (Higgs, 2006).

Public perception plays a critical role in waste management decision making, affecting both what systems (infrastructure) can be put in place, and at the same time if, and how, successful implementation is possible. This paper investigates the link between public communication and waste management infrastructure delivery. The need for waste management infrastructure is reviewed and how its delivery in the UK has evolved is used as an example of the role of public perception in the planning and delivering of waste facilities. Since it is often on the basis of environmental concerns that the public raises objections to the very infrastructure that is needed to improve environmental quality (Petts, 2004), the role of scientific evidence and the communication of science as a potential source of these concerns is also addressed.

2. The need for waste management infrastructure

The management of wastes has evolved significantly over time (Defra, 2013a). Since the industrial revolution, and more recently the post war consumerism of the 1950s, population density, industrial intensity and complexity, as well as growth in home packaging waste, has led to the need for what is termed today as '*modern waste management*' provision (Atkinson and New, 1993). In the absence of such provision, discarded wastes can generate impacts on human health in terms of clinical hygiene or exposure to toxic elements (Giusti, 2009). There is also the practical, logistical challenge of physically removing the material. The issue of waste management has become much wider in the past few decades simply due to the increasing quantities of materials used and consumed, and the estimated lack of future resources (Modak et al., 2011). In light of the ever-growing consumption and demand for raw materials, the need to manage environmental resources more sustainably is becoming increasingly important (Voulvoulis et al., 2013).

Waste management was highlighted as a priority in the first European Union (EU) Environmental Action Plan, adopted in 1972, and was recognised in law in the 1970s when the first Directives were ratified, requiring reduction in landfilling of wastes and proper management thereof (EU Commission, 1999). Waste management principles defined by EU waste legislation require waste to be managed without endangering human health, harming the environment, causing nuisance through noise or odours, or adversely affecting the countryside or places of special interest (EU, 2008). Waste management must also be an integral part of resource management by turning wastes into resources (Fig. 1). For example, Member States of the EU are bound by a number of Directives to not only reduce the amount of waste going to landfill but also to increase the recoverability of this waste through recycling (Iacovidou et al., 2012): the European Commission (EC) Landfill Directive (99/31/EC) requires Member States to reduce the amount of Biodegradable Municipal Waste (BMW) sent to landfill to 35% of 1995 levels (European Commission, 1999), while the revised Waste Framework Directive (2008/98/EC) requires a 50% recycling rate for household waste, and waste of similar nature to household, by 2020 (European Commission, 2008).

Another issue that drives the need for waste management infrastructure is the complexity of waste generation and management. When 'throwing away' waste, system complexities and the integrated nature of materials and pollution quickly emerge. Solving one problem, if not well executed, often introduces a new one, often of greater cost and complexity (World Bank, 2009).

For example, a household typically will generate waste comprising food and garden waste; packaging (including paper, card, metals, plastic and glass); electronic equipment; some hazardous streams such as oils and batteries; and bulky waste such as construction materials, furniture and textiles (Slack et al., 2004). In addition, a mixed residual waste containing all of the above will exist, as well as composites of them (Gray, 1997; Williams, 2005; Modak et al., 2011). Fig. 2 demonstrates the transition of materials found in household waste over a ~110 year period, highlighting a shift from largely dust and ash to a complex mixture of materials including wood, plastic, textiles, glass, paper and metals (Atkinson and New, 1993).

In order to recover the economic value embodied in the waste streams, a relatively complex network of collection, containerisation and logistical options, plus suitable treatment and transformation processes are necessary (Atkinson and New, 1993). Typically, the different streams grouped together and collected according to their frequency of arising (Williams, 2005; Modak et al., 2011), require technologies such as composting; recyclables sorting; energy recovery, either by anaerobic digestion or thermal methods; specialist treatments for electronic and hazardous wastes; and landfill for residual non-usable materials (Williams, 2005; Slack et al., 2009). This constitutes a significant infrastructure investment and is therefore potentially controversial due to the investment cost (of public monies), the physical presence and aesthetics of the 'factories', the alternatives that must be considered, and the complexity of the delivery mechanisms that are in the public spotlight (Burnley, 2007; Gray, 1997; Williams, 2005).

In order to ensure full implementation of European waste legislation, new (or less advanced) EU Member States have been provided with considerable funds for infrastructure projects, with 4.6 and 6.2 billion euros set aside from EU funds for urban and industrial waste infrastructures for the periods 2000–2006 and 2007–13 respectively (ECA, 2012). However, aged or outdated infrastructure also exists in the rest of Europe and most of the developed world, partly due to insufficient maintenance but critically also due to the inherent limitations of the technologies applied (Modak et al., 2011), and presents significant new infrastructure needs.

The situation is similar in the UK, as crumbling transport, energy, telecoms and water infrastructures need addressing (Armitt,