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FLOOD ALLEVIATION DESIGN: ADOPTING A SOCIAL PERSPECTIVE

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ABSTRACT: The argument presented in this paper calls for an approach to flood alleviation design that considers not only the need for a technical perspective, but a social perspective as well. As a result of climate change and changing weather patterns, it is predicted that more intense rainfall will be experienced with rising sea levels due to increased precipitation. Consequently, a greater number of people across the world are vulnerable to flood events. Flooding is a social problem, affecting not only people's lives, but also the economic prosperity of local business and the local area. However, flood alleviation design within the UK is focused upon technical and cost-effective solutions, neglecting the consideration of the people it is designed to protect. This paper examines the preliminary findings from research that seeks to understand how the social value of a UK flood alleviation scheme is interpreted and discussed by the local community and those responsible for the design of the scheme. The preliminary findings are taken from the examination of an example scheme conducted between October and December 2013 in Ripon, Yorkshire, UK. A series of semi-structured interviews were conducted with the local community and those responsible for the design and delivery of the flood alleviation scheme. The findings presented will demonstrate how social value is articulated and the difference in interpretation between the local community it is designed for compared to those responsible for the design and delivery of it. The conclusions drawn from the preliminary research supports the argument that adopting a social perspective in flood alleviation design produces not only a technically successful scheme, but a considered and socially acceptable one. This is an approach for future adoption in flood alleviation design, as more communities around the world are exposed to the very real risk of flood events.

Key Words: Flooding, Flood alleviation, Social value, Design, Infrastructure

1. INTRODUCTION

Current patterns of increased intensity in rainfall and rising sea levels are predicted to continue as a result of climate change (IPCC, 2013; Johannessen and Hahn, 2013; Tripathi et al., 2014). The result is an increase in the number of people vulnnerable to flood events across the world. In the UK alone, the Government predict that in 2013, approximately 5 million properties were at risk of varying degrees of flooding (HM Treasury, 2013). This is predicted to increase by 210,00 properties, from 560,00 to 770,000 and even reach 1.3 million by 2050 (HM Treasury, 2013). Flooding is a very real and social problem. It affects not only people's lives, but also the economic prosperity of an area. This is reflected in the UK Government's increased financial investment in flood protection measures for the most vulnerable (HM Treasury, 2013). However, flood alleviation design in the UK is strongly driven by economic, environmental and technical considerations (Germond - Duret, 2012; Penning-Roswell and Pardow, 2012; Simm, 2012). This approach omits to take into consideration the social aspect, arguably one of the main purposes for which flood alleviation schemes are designed and constructed.

The current approach to flood alleviation design raises concern. The increasing number of people vulnerable to the effects of flood events means flood alleviation design is set to become more important and vital for communities. If current approaches continue to be followed with little consideration of the social aspects, it may be difficult to ensure that future schemes are not only technically successful, but also socially successful, meeting the social needs of the communities they protect.

The purpose of this paper is to present the preliminary findings from on-going research which seeks to understand how different stakeholders interpret and discuss the social value of an example UK flood alleviation scheme. One approach to this is through understanding how social value is interpreted and discussed by the local community the scheme is designed for. Understanding how the local community experiences the service provided and the physical infrastructure, in addition to the perceived value gained, will help inform a more socially considerate future approach to flood alleviation design.

The paper is structured as follows: Section 2 provides further discussion on the topic area. Section 3 explains the research design including a description of the example scheme, the process of data collection and analysis. Section 4 presents the preliminary results concerning how social value is interpreted and discussed by the stakeholders interviewed, and a discussion of these results, while Section 5 presents the concluding remarks.

2. BACKGROUND

Infrastructure, of which flood alleviation is included, is critical for the physical and economic growth of communities and society (Frantzeskaki and Loorbach, 2010; Marshall, 2012). Markard (2011) explains that many academic studies have been conducted to develop the understanding of infrastructure. However, this work has concentrated upon perspectives such as the technical details of the structure, governance, marketing and financial mechanisms, and the operation and maintenance of both the structure and the services created (Markard, 2011). Nevertheless, the development of the Large Technical Systems (LTS) approach in the 1980's sought to examine infrastructure through a socio-technical lens, introducing the concept that a relationship exists between society and the infrastructure system itself (Geels, 2007; Hughes, 1983; Van der Vleuten, 2004). This approach has since been built upon (Jonsson, 2000; 2005). Jonsson (2005) uses Maslow's Hierarchy of Needs (Maslow, 1954) to demonstrate the very complex relationship between society and infrastructure systems and services. For flood alleviation specifically, there are economic, environmental and social drivers for the design and construction (Penning-Roswell and Pardow, 2012), but as section 2.1 explains, satisfying the needs and desires of communities and society is a difficult task.

2.1 Community Experience

Contributing to the lack of research concerning the social perspective is the way communities, and consequently society, experience and interacts with infrastructure systems and the services created. The LTS approach (Geels, 2007; Hughes, 1983; Van der Vleuten, 2004) and subsequent work (Jonsson, 2000; 2005; Markard, 2011) has sought to tackle this area. However, society experiences infrastructure, including flood alleviation, in different ways (Marshall, 2012; Star, 1999). Becker and Vanclay (2003) have identified three terms in order to explain the different ways society interacts and experiences infrastructure. They include:

Group 1: The host community – This group of people are situated within close proximity to the physical infrastructure system. However, they do not receive significant value from the service created. For example, a community situated in close proximity to a railway line, but not within reasonable distance of a train station for which to conduct journeys.

Group 2: The source community – This group of people, in contrast, gain value from the service created, but is not situated within close proximity of the physical infrastructure system. An example of this is the community whose waste is transported through a sewer system to a waste treatment plant many miles away. The community benefits from the removal of waste, but is not affected by the impacts of living close to a waste treatment plant.

Group 3: The host and source community – This group of people can be termed both the host and source. This applies to communities that are impacted by both the physical structure, but also gains value and utilises the service created. An example of this is the communities protected by a flood alleviation scheme. They are situated in close proximity to the infrastructure, be it floodwalls, river

culverts or floodgates to name but a few. However, they also utilise the service created through the level of protection afforded by the scheme.

Boztepe (2007) and Sandstrom et al. (2008) argue that society determines the value of something through the service created. In terms of flood alleviation, the value for society is not born out of the physical structure, but the service created by the overall system. This reinforces the argument that society does not uniformly experience flood alleviation in the same way. Therefore considering the social perspective in design is a very complex task, not least of all because determining and understanding community values, and subsequently the value they attribute to the flood alleviation service created, is highly subjective.

2.2 Community Value

Similar to the ways in which they experience flood alleviation schemes, the values that communities place on the schemes, and consequently the extent to which the schemes fulfill their needs are not consistent. The work of Rokeach (1979) examines how human values are developed and identifies that values are used to help guide decision making as to what is right and wrong, and what is liked and disliked. These sets of judgments inform certain behaviours (Shillito and De Marle, 1992). However, values change over time. They are influenced by living and working environments and thus as these change, so do people's value sets (Rokeach 1979). The influence of living and working environments do produce a level of similarity between people's value sets (Shillito and De Marle, 1992). For example, people working in the same workplace will have similar values regarding certain aspects such as working practices, client relations or treatment of colleagues. Similarly, communities possess certain values which are influenced by the environment they live in. However, these values are underpinned by personal value sets, which differ (Shillito and De Marle, 1992). Considering the social perspective of flood alleviation in design is complex because the way in which communities experience and value the scheme differs greatly. Downton et al. (2005) explain that approaching the design of flood alleviation with a generic, uniform template will result in an unsuccessful scheme, omitting to provide the community with what they require.

3. RESEARCH AND CASE STUDY DESIGN

3.1 Research Approach

The approach to this research is qualitative and inductive in nature and the process of constructivist grounded theory is followed. Constructivist grounded theory has developed from the epistemology of grounded theory (Glaser and Strauss, 1967). Constructivist grounded theory is concerned with the development of theory from data using the process of checking the proposed theories against further data collection and the interpretation the researcher places on the data gathered and the emerging theories (Charmaz, 2006; Urquhart, 2013).

Data was collected through semi-structured interviews employing a mixture of theoretical and snowball sampling in order to gather participants (Bryman, 2012). Using an example UK flood alleviation scheme, the Ripon Rivers Flood Alleviation Scheme, 20 semi-structured interviews were conducted with a range of stakeholders. This scheme was chosen using rigorously developed criteria including industry recognition. The scheme was awarded a Centenary Award and Certificate of Excellence from the UK Yorkshire and Humber branch of the professional institution, the Institution of Civil Engineers (ICE) in 2012 (Institution of Civil Engineers, 2012).

3.2 Scheme Description: Ripon Rivers Flood Alleviation Scheme

Ripon is a city located in North Yorkshire, UK. It lies under the authority of Harrogate Borough Council (HBC). Ripon has been subject to flooding due to the convergence of three rivers within its vicinity, the River Laver, the River Skell and the River Ure (Figure 1).

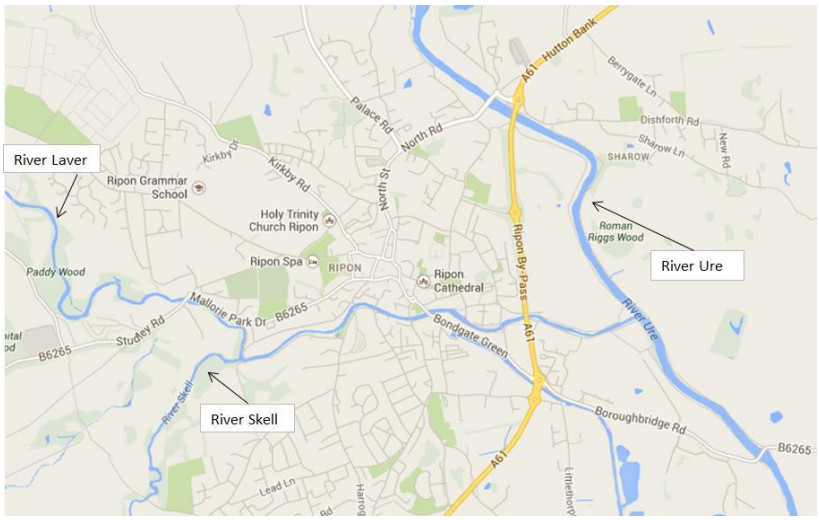

Figure 1: The town of Ripon situated close to three rivers. Source: Google maps

The last significant flood within the city was in the summer of 2007. However in 2006, the body responsible for flood alleviation management, the Environment Agency (EA) submitted a planning application to HBC for a flood alleviation scheme for Ripon (Halcrow, 2006b). Construction started on the scheme in 2009 and was completed in 2012. The scheme protects in excess of 500 properties, a mixture of residential and commercial, and has been designed to afford protection from a 1 in 100 year flood event (Williams, 2012). The scheme consisted of a number of phases of works. The first phase consisted of constructing an 8.6m high flood storage embankment on Birkby Nab farm, north of Ripon (Figure 2).

Figure 2: Birkby Nab dam.

The purpose of the embankment is to allow the River Laver to pass through a culvert in normal conditions. However, when the River Laver is in flood, water will be stored by the embankment. The presence of the culvert will allow the water to run at normal flow down through Ripon, alleviating the risk of high flows and subsequent flooding (Halcrow, 2006a).

In addition to the construction of the embankment at Birkby Nab farm, additional flood alleviation works were carried out within the town of Ripon itself. The residential properties along one side of Borrage Lane

are bounded by the River Skell. For this reason, new bespoke floodwalls were constructed in the gardens of the properties to afford protection from high flows. Similarly, the Fishergreen area of the city also sits on the banks of the River Skell and for this reason floodwalls and embankments were constructed. Just along from Fishergreen on the River Skell, works were carried out on a large weir. The riverbed was lowered by 100m upstream of Alma Weir and the actual weir itself removed and replaced with a smaller one, which includes a fish pass (Halcrow, 2006a).

3.3 Data Collection

Possible participants were identified using the consultation information contained in the planning application submitted to HBC in 2006 (Halcrow, 2006c). This information identified the residents and businesses who were likely to be impacted by the works and therefore consulted as part of the planning process. It was necessary for local participants to be classed as both the *host* and *source* community and for this reason, participant gathering was focused upon the three main areas of work in Ripon; Fishergreen, Borrage Lane and Skellfield Terrace (adjacent to Alma Weir). A leaflet was created explaining the research, the need for participants, and what would be involved. In total 74 leaflets along with a cover letter explaining who the researcher was and why the leaflet was being received, was sent to residents and local businesses in the areas mentioned. The leaflet explained that if the recipient was willing to participate, to contact the researcher on the details included. Two leaflets were also sent to recipients that were classed as *host* community. They were not at risk of flooding, but they were impacted by the construction of the works. Local community participants were gathered in this manner, but at the end of each interview, the participant or participants were asked if they could recommend anyone who would be relevant for the research and willing to be contacted by the researcher.

To gather participants responsible for the design and delivery of the scheme, the planning application was also used. Members of the design team were identified from the documents submitted as part of the planning application and were contacted to ask if they were willing to participate. Similar to the discussions with the local community, at the end of the discussion, participants were asked if they could recommend anyone who had a role in the project and could be contacted.

In total, 20 semi-structured interviews were conducted with 26 participants between October and December 2013. Six interviews were conducted with two participants, at the request of those participants, while the remaining 14 interviews were carried out with single participants. The composition of participants is as follows:

- Three participants were interviewed in their professional capacity as employees of the Environment Agency.
- Four participants were interviewed in their professional capacity as members of the design team responsible for the scheme.
- 19 participants were interviewed because they were members of the local community.

Prior to each interview, participants received information concerning a brief synopsis of the research, protocol for the interview, information regarding the use and storage of the data and a signature form to confirm their agreement for the recording of the discussion (Ryen, 2011). In addition to this information, a discussion guide was also sent. The purpose of the discussion guide was to provide an element of direction during the interview to ensure that key topics were covered. These topics included:

- The participant's understanding of the rationale for the scheme;
- The participant's understanding of what the scheme entailed;
- The participant's opinion of the scheme;
- The participant's understanding of the term social value; and

- The participant's interpretation of the social value of the Ripon Rivers Flood Alleviation Scheme.

The nature of semi-structured interviews allows the discussion to be guided through specific topics of interest, but also the participants liberty to broach relevant, but different topics (Creswell, 2009; Hammersley, 2013). Interviews typically lasted between 30 and 40 minutes and were conducted at a location convenient for the participants, usually within Ripon.

Secondary data including the planning application (Harrogate Borough Council, 2011) and documents received from the Environment Agency and design team were also reviewed. This was carried out prior to conducting the semi-structured interviews in order to comprehensively understand and provide context for the scheme.

3.4 Data Analysis

The interviews were transcribed and analysed iteratively during data collection in accordance with the process of constructivist grounded theory (Charmaz, 2006; Urquhart, 2013). This allowed the identification of emerging theories to be examined and tested in the future interviews conducted. The data was coded using the Computer-Assisted Qualitative Data Analysis Software (CAQDAS) NVivo. Different levels of coding permitted the in-depth investigation of the relationships present in the data, which subsequently assisted in the identification and development of theories (Bryman, 2012).

4. PRELIMINARY RESULTS AND DISCUSSION

The preliminary results presented in this paper concern participant's interpretation of the term social value and how they articulated the social value of the Ripon Rivers Flood Alleviation Scheme. Other topics were discussed with participants (see Section 3.3), but for the purposes of this paper, analysis of participant's responses to this strand of discussion provides the most valuable data in terms of identifying how the social perspective can be considered in future flood alleviation design.

4.1 Social Value: A General Term

In order to open the discussion concerning social value, all participants were asked what they understood by the term social value. Only three participants out of 26 did not respond to the question. One participant explained that they could not provide an answer because they didn't know what the term meant and two participants did not directly answer the question that was asked. However, the remaining participants were all hesitant when asked the question and needed time to think about their response. This reinforces the argument of Cruz et al. (2009) and Penning-Roswell and Pardow (2012) concerning the lack of consideration of the social perspective in design through the identification that this term is not very well understood.

The majority of participants from all three groups explained that social value meant to them the benefits received on a community wide level, as demonstrated by the following illustrative quotes:

"Providing value to the community." (Interview 9a)

"It means of what use and for what useful purpose was it to the rest of the community in the day-to-day running of their lives." (Interview 14)

In contrast, only four participants explained they thought social value had economic implications ranging from land values, financial impact of flooding, or business revenue:

"Does it not break itself down into two parts? One is the economic value which obviously has social impact. Economic value is rarely principally either increasing the capital value of the houses that are likely to be flooded or preventing their dramatic decrease in value because if a house is uninsurable or because

it floods too often and all the rest of it, then you can't live in it. There is obviously quite an economic value…" (Interview I6)

"Well its public land I suppose and you have to value it." (Interview 13)

From the response of participants, in the context of this research, a general understanding of the term social value can be associated with community wide benefits, with an acknowledgment that although some participants believed there were financial implications associated with the concept. It is also interesting to note that there were no identifiable differences between the responses given by the local community and those responsible for the design and delivery of the scheme.

4.2 The Social Value of the Ripon Rivers Flood Alleviation Scheme

The discussion concerning the participant's understanding of the term social value acted as a foundation on which to develop this topic. Once participants had thought through the term and arrived upon an understanding of what the term meant, they were then able to answer the next question, which concerned the articulation of the social value of the Ripon Rivers Flood Alleviation Scheme. For participants that did not answer the question directly, the term was explained to them in the context of community wide benefits as articulated by the majority of participants. Figure 3 provides a graphical representation of the social value of the Ripon Rivers Flood Alleviation Scheme as cited by participants. Please note some participants cited more than one attribute.

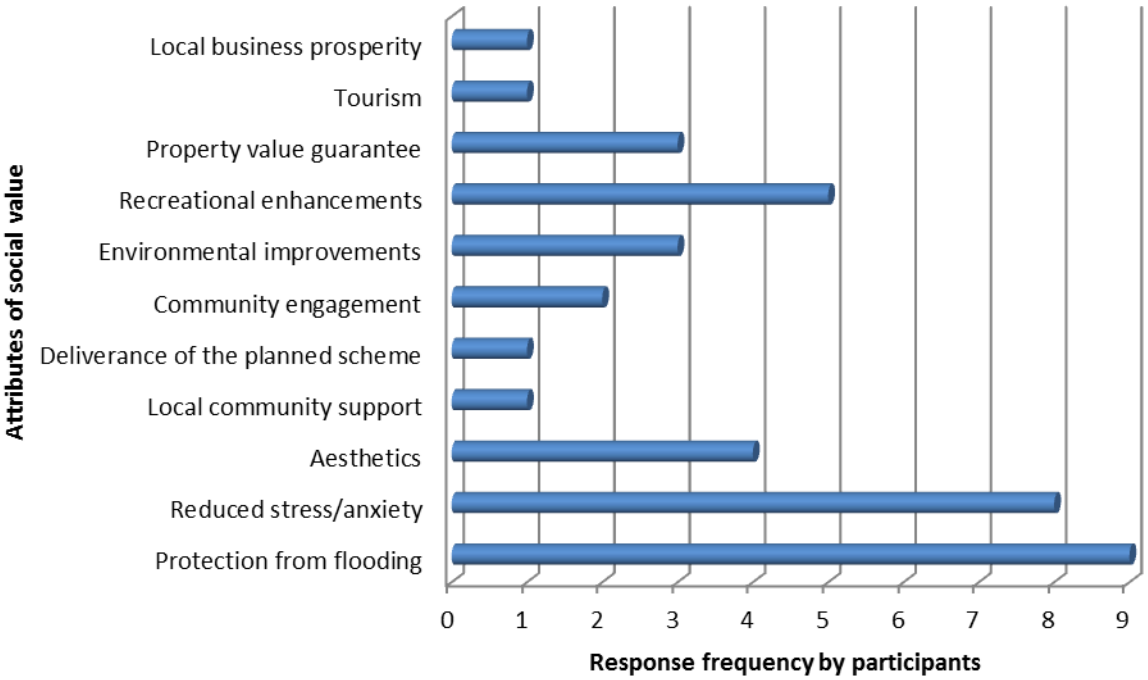

Figure 3: Social value as cited by participants

Figure 3 demonstrates that participants interpreted the social value of the Ripon Rivers Flood Alleviation Scheme in many different ways. This supports the work of Marshall (2012) and Star (1999) who argue that infrastructure is experienced in a number of different ways. Participants cited the attributes of protection from flooding and the reduction in stress and anxiety caused by the threat of flooding the greatest number of times. Recreational enhancements to the area such as footpath improvements and local amenity enhancements was also one of the most frequently cited attributes of the social value of the scheme. This was closely followed by the aesthetics of the scheme and the improvements to the look of

the area once the scheme had been completed. Cited three times were the attributes of environmental enhancements such as tree and shrub planting and the guarantee of property values once the threat of flooding was reduced. Less frequently cited attributes included;

- Local business prosperity from the reduced risk of flooding and the financial implications associated with such an event.

- Benefits to tourism from the attraction of visitors to the area now the threat of flooding isn't prevalent.

- The level of community engagement during the design of the project was cited as providing social value.

- The delivery of the scheme as planned, to the local community.

- The support provided to local community groups and initiatives from the design and construction team. For example, the offer of off cuts of materials to local groups, working with local schools on projects, and volunteering at community events.

4.3 Differences in Interpretation

Further preliminary analysis was conducted in order to identify where differences in interpretation exist, primarily between the local community and those responsible for the design of the scheme. There were no identifiable differences in the interpretation of the general meaning of the term social value. However, there were noticeable differences in the articulation of the attributes of the perceived social value of the scheme. The attributes of social value such as protection from flooding and the reduction in stress and anxiety from the threat of flooding were two attributes that were cited by both local community participants and those responsible for the design of the scheme. However, the design professionals and not the local community cited attributes that are scheme specific as seen in Figure 3 such as community engagement, delivery of the planned scheme and local community support. In contrast, more context and place specific attributes such as recreational enhancements, tourism and local business prosperity were cited only by the local community. The identification of this type of difference is interesting because it demonstrates a parallel understanding of what the social value of the scheme is. The social value the design professionals perceive to think they are delivering is not actually the social value that the local community perceives they want to gain.

Interestingly, there were also identifiable differences between local community participants concerning the level of social value personally gained from the scheme. Although all participants but one identified that the scheme delivered some level of social value, not all local community participants believed they personally gained significant social value, as the following quotes illustrate:

"I think it is quite limited [the social value gained]. The truth is, it affects a fairly small proportion of properties here in Ripon." (Interview 5a)

"Yes for Ripon as a whole, but not for us personally." (Interview 9a)

"But for us who have not been flooded, I think the social value is less than, for example, the people…who have been flooded a number of times." (Interview15a)

The difference in response by the local community reaffirms the arguments presented by the work of Becker and Vanclay (2003), Boztepe (2007), Marshall (2012), Sandstrom et al. (2008) and Star (1999). The local community participants experienced the Ripon Rivers Flood Alleviation Scheme and the services created very differently, resulting in a difference in perception of the social value gained. However, the value perceived to be gained by participants was not on an inclusive, community wide level, but in fact on a very individual level, focused upon others in the community and not themselves. This is in contradiction to how the majority of participants articulated the term social value. These preliminary

results emphasize the need for design professionals to be mindful that communities cannot be seen as one entity, they will experience the service created and the scheme in varying ways.

5. CONCLUSION

The consideration of the social perspective of flood alleviation design is an area often neglected in current practice in favour of the more tangible and articulated economic and environmental perspectives. However, the articulation and demonstration of this perspective is difficult and highly complex. This research sought to examine how a local community and those responsible for the design and delivery of a flood alleviation scheme in Ripon, Yorkshire, UK interpreted and discussed the social value. Data was collected through 20 semi-structured interviews with 26 participants between October and December 2013.

The preliminary results demonstrate that the social value of the flood alleviation scheme is perceived to refer to the community wide benefits gained. There was a common agreement between participants that specific attributes of the social value of the scheme included the protection from flooding and the reduction in stress and anxiety to those historically affected by flooding. However, an identifiable difference in interpretation exists concerning additional attributes of the social value discussed. The participants responsible for the design and delivery of the scheme articulated social value in such a way as to explain how they could provide social value to the scheme. For example, they articulated the social value of the scheme through good community engagement, delivering a scheme that was on time and as proposed, and involvement in local community initiatives. In contrast, the local community participants articulated the social value of the scheme using specific, place context examples such as the creation of a new footpath along the river's edge, environmental enhancements to certain areas of the riverbank, the restoration of local amenities. The identification of a difference in interpretation demonstrates a disconnect between what the local community perceives to be of value to them and what the industry professionals perceive they are delivering. This indicates that the omission of the consideration of the social perspective of the scheme could potentially result in a scheme that does not meet the needs of the local community. However, by taking into consideration and understanding the social value of a project from the perspective of the local community, those working in the area of flood alleviation design have the potential to enhance the social value of a scheme.

In addition to the difference in interpretation already identified, a dissimilarity exists within the local community concerning the level of social value gained from the scheme. These results suggest that during the design stage of a scheme, the community cannot and should not be treated as single entity. Local community members' experiences vary greatly and therefore the resultant social value gained differs. For this reason, industry professionals are required to acknowledge and identify the different groups within the local community, engage with them accordingly and deliver a scheme which provides the greatest social value to the whole community, not just one specific group. This in turn will benefit the vast majority of the local community and create a socially considerate, successful scheme.

The preliminary results and discussion presented in this paper contribute to the development of a possible approach for those responsible for the design and delivery of future flood alleviation schemes to facilitate the consideration of a social perspective. The ability to understand how local communities interpret and discuss social value, how this differs between local community groups and how this differs from industry perceptions is important for the success of future schemes. This knowledge and the ability to adopt this approach equips those responsible for future schemes with the knowledge of how to enhance the social value of a scheme, creating a socially acceptable and considerate scheme. As part of the wider research a further two UK flood alleviation schemes are being examined using the same approach with the aim of identifying where similarities and differences exist in interpretation across the three schemes. However, developing an international perspective in this area is beneficial and therefore an important future work stream is to understand how social value is interpreted and discussed on flood alleviation schemes across different continents, facilitating the development of an international perspective of the social value of flood alleviation schemes.

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