Title:

Flood Risk Management as a public or a private good, and the implications for stakeholder engagement

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Abstract:

A move to encourage partnership funding of Flood Risk Management (FRM) has resulted in current FRM measures providing both public and private benefits. Yet, the scales of service delivery associated with public and private goods are likely to influence the form and extent of public participation in FRM. We assess the range of goods provided by FRM, whether these services are considered to be public in nature by authorities and citizens, and the impact this has upon the level and form of public engagement in FRM. We separate the definitions of public goods into 'pure' public goods which demonstrate characteristics of non-rivalry and non-excludability, and public priority goods which are services deemed as essential to public wellbeing regardless of characteristics. We find that English FRM delivers a range of public goods beyond that of reduced water flows, and that when FRM is considered a 'pure' public good the emergent form of public participation does not increase public awareness of flood risk or encourage investment in private protection measures. When the benefits of FRM are solely considered public priority goods public awareness of flood risk increases, yet disputes arise regarding service provision and maintenance. Importantly, increased flood risk from climate change or increased runoff could lead to the capacity of the public good provision being exceeded, leading to problems of distribution of that service, and reactionary pressure group formation. We argue that the current preference for public goods which reduce individual costs at the expense of public awareness can discourage adaptation, which may be problematic in ensuring sustainable FRM.

Key words

Public private goods, stakeholder engagement, flooding.

1. **Introduction**

Flood Risk Management (FRM) in England is currently undergoing significant changes, and, as a result, it is unclear whether flood risk should be managed as a public good or private issue. If FRM is considered as providing a public good, as has usually been assumed to be the case, the implications are significant in determining who is responsible for the provision of FRM as a public good, how the public should and can be engaged in the FRM process, the appropriate resources which should be set aside to manage that risk and, consequently, the

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form of interventions which would most effectively deliver the public or private benefits of FRM. However, many barriers stand in the way of defining flood risk as a public good, including England's heterogeneous social, political and physical landscapes, diverse flood sources, magnitudes and characteristics, and, importantly, 'saturation points' which limit management options in terms of funding, space, and culture.

These barriers, alongside increasing moves towards devolution, mean that the scales at which public goods are delivered may be negotiable, or at least adaptable. Thus, imposing a national level management strategy of the scale traditionally associated with public goods (Tiebout, 1956) may prove impossible, resulting in an increasing share of FRM interventions falling under the umbrella of "club goods" (see Table 1). The task of defining FRM as a public good is further complicated as the sources of flood risk grow in variability, driven by climate change, the exacerbation of 'surface water flooding' (SWF), increasing population pressure, and the increasing value and vulnerability of assets located on the flood plain. Thus, the concept of FRM as a public or private issue is not static or clear, raising questions of the best scales of management for these forms of flooding, and how these align with current moves towards the devolution of responsibility and decision-making.

This paper analyses the position of FRM as an evolving public good. We first examine how various interpretations of the concept of public good influence FRM strategies adopted in England. From this we investigate whether the benefits of England's diverse portfolio of flood risk reduction measures should be considered public or private. Finally, we analyse how the emergence and form of public engagement varies in response to the categorisation of FRM as either a public or private good.

The clarification of the public nature of the wide ranging FRM interventions available supports decision makers in efficiently aligning public expenditure with public expectations, and informs the scales at which public FRM initiatives are least controversially and most effectively delivered. Central to this analysis is the assumption that the delivery of the good being provided (in this case flood risk reduction) is fundamentally affected by the public nature of this good, and that the changing scene towards private goods in this field has important implications for the process of stakeholder engagement and public participation. In this regard we have the advantage of researching the situation in a country where there is a long tradition of stakeholder engagement in flood risk management, enshrined in legislation originated in 1930, which gave stakeholder-based regional committees substantial responsibilities and powers in this area (Tunstall et al, 2004; Penning-Rowsell and Johnson, 2015). This is in contrast to the situation in many European countries where stakeholder engagement in flood risk management is at an embryonic stage, lagging behind for example such engagement with issues concerned with the Water Framework Directive (see, for example, Newig et al, 2014).

2. Key definitions and assumptions: public goods and stakeholder engagement

The theoretical groundings of public goods are multiple, and the consideration of FRM as a public good needs to be scrutinised with a knowledge of how the definition of public good varies between disciplines. Within the literature two definitions of public good preside: a definition established by economists, and a definition proposed by social scientists frustrated with the limitations of the former interpretation. Encompassing these views of public good, we have some sympathy with Karlsson's broader definition of a public good as one which fulfils three criteria: "culpability, capacity and concern" (Karlsson, 2007, p.103). Karlsson's

broad overview allows us to understand public good from the view of economists, social scientists, and practitioners.

Economists refer to public goods as a product that one individual can consume without reducing its availability to another individual and from which no one is excluded. They are also referred to as "non-rival" and "non-excludable". The classic example of a non-rival good is a newspaper, which can be read by several individuals without it being itself consumed, and the example of a non-excludable good is a lighthouse which benefits all those at sea, none of whom can be excluded from enjoying the safe passages that the lighthouse may indicate. In other spheres national defense, sewer systems, ocean fish stocks, public parks and basic television and radio broadcasts could all be considered public goods (see Table 1).

A variation on this categorisation acknowledges, first, that some public goods may also become subject to restrictions on access, rather than free to all, so that the park may become designated as private, or television broadcasts might be subject to payments of subscriptions or some other exclusion mechanism. These goods are not ‘consumed’ by those who make these payments, so are non-rivalrous, and the term “club goods” has been used here. Secondly, it is recognised that some public goods may become “used up” if overexploited, and hence lose their true public good character over time, such as fish stocks that become exhausted or coal reserves that become depleted: these are termed “common goods” or “common pool resources” (Cowen, 2007).

Table 1: The different types and levels of public and private good, showing both classic examples, and examples in FRM.

	Excludable	**Non-Excludable**
Rivalrous	**Private Goods** *Classic:* Food, parking spaces, property. *FRM:* Household property level protection, individual insurance policies	**Common Goods** *Classic:* Fish stocks, non-renewable energy. *FRM:* Emergency sandbags, flood plain protection.
Non-Rivalrous	**Club Goods** *Classic:* Cinemas, private parks, pay-to-view television. *FRM:* Community level/funded flood defences, community flood warden schemes.	**Public Goods** *Classic:* Free television channels, national defense. *FRM:* Flood Warning Systems, subsidized ‘affordable’ flood insurance.

In response to the socially restrictive definitions provided by economists, some social scientists have proposed a revised definition of public good, broadening the term to reflect

prevailing social values within a given society which are then expressed through the services that should be provided by non-market mechanisms (Duneulin and Townsend, 2007). That individuals could acquire these goods or services through the market is not of importance. As such, the goods are referred to as 'public priority goods' or as a 'public need'. In this paper we will borrow this terminology in order to ensure clarity between public goods defined by the public and those defined by economists.

The provision of both "public goods" and "public priority goods" may originate from either a public authority, the state, or a private organisation. Public goods, such as a newspaper may be provided by a private publishing house, and a lighthouse could be provided by a private landowner. Similarly a "public priority good" might be something that the public perceives as should be provided by a state authority but this does not necessarily mean that this is a public good as classically defined; the state might provide a particular good for a sub-section of society, and exclude others from its benefits (e.g. social housing). The state might also provide something which is consumed by the public, and therefore is used up by the first consumer (for example, an injection against influenza). We need to differentiate between public goods and those provided by the state in a way that is careful and commensurate with conventional definitions.

The concept of boundaries further complicates the delegation of FRM as either a public or private good. This is in part due to the typical spatial extent of forms of flooding and how these align with different levels of governance, and also as a result of the scales at which different FRM interventions are designed to function (e.g. flood forecasting/warning may be regional and catchment based, or even international, whereas spatial planning of floodplains is largely local). Therefore, we must consider where the boundaries of public good, and public priority good should sit if they do not align with national borders but delimit smaller scale activities and interventions. As a theory, the concept of public good is traditionally associated with the nation state (Tiebout, 1956; Miller, 2009). However, the geography of that state, the distribution of populations and physical features which influence flood risk mean that the borders of a country may inhibit the efficiency of delivering a public good even if positive externalities, such as public wellbeing and economic stability, are inhibited when that public good is redefined as a private issue.

A social science definition of public priority goods allows for a flexible and dynamic approach to a public good, which offers a strong argument for defining what a public good should be, regardless of its characteristics of non-rivalry and non-excludability. Yet, a sole focus on public priority goods can be criticised when assessing its merits in light of broader definitions of a public good. Specifically, when referring back to Karlsson's notion of "culpability, capacity and concern" (Karlsson, 2007, p.103) it is clear that a reliance on only social values is problematic, as, despite the existence of a public concern, the management strategies required in response to public demand may be impossible to implement in terms of responsibility delegation and resource acquisition.

The importance of correctly identifying public goods within FRM is particularly poignant when dealing with the notion of capacity. First, there may be a misalignment between the costs of the services expected and the willingness of the public to pay for a service which they perceive necessary to match their ideology of the 'public good'. Second, capital intensive flood defences are often preferred by flood risk communities (Geaves and Penning-Rowsell, 2014), but are not always appropriate as an isolated form of flood defence, being shown to reduce awareness when not combined with additional information, and therefore increase vulnerability to large scale floods with low return periods (Geaves, 2012). As such,

we examine not only the financial capacity of the public to manage flood risk, but also the behavioural capacity to ensure all aspects of risks are appropriately managed.

Despite a general public demand, public contribution is frequently an issue in the provision of public goods, manifesting itself as the free-rider problem. This problem says that a rational person will not contribute to the provision of a public good because (s)he does not need to contribute in order to benefit because (s)he can rely on the contribution of others to provide the public good. Herein lies a key problem for stakeholder engagement and public participation. We are assuming here that stakeholder engagement and public participation in decision-making concerning FRM is likely to lead to better decisions and is to be encouraged. We contend that the critical purpose of this stakeholder engagement is to build and maintain the conditions under which collaborative approaches between those at risk and those responsible for FRM will be achieved (Geaves and Penning-Rowsell, 2014). This requires that some of the individual interests of the former accept some form of loss in one choice, in the expectation that they will make gains in subsequent choices.

In this respect we see stakeholder engagement as the process by which an organisation or interested party attempts to involve people who may be affected by decisions made by itself or another or can influence the implementation of these decisions. As such, this engagement is much more than simply the participation of members of the public, important though this may be, but more the development of social relationships in the pursuit of some ideal, including the resolution of conflict or delegation of blame. Given that it involves a range of individuals or organisations, the process of negotiation for the individual stakeholder should be seen as part of a social process rather than individualistic bargaining, thus "widening the negotiation space for the individual stakeholder" (Green and Penning-Rowsell, 2010, 373), through dialogue and cooperation, from a focus on short-term narrow self-interest towards an attention to wider considerations. For the individual stakeholder this may mean a change in focus from this self-interest associated with the rational economic person (Frank, 2006), to the possibility of trading off this interest against either their long-term narrow self-interest or for some wider interest (Green and Penning-Rowsell, 2010, 373). Such a change could come about from the reconsideration of the diverse outputs of FRM interventions as either public or private goods, and the resultant incentives or barriers to individuals joining cooperative arrangements leading to consensual solutions.

In summary, by utilising the frameworks of both public goods and public priority goods we not only better understand the direct impacts of the FRM interventions, but also the externalities, which may be of equal benefit to society. We begin to understand how both interpretations of a public good hold their merits – one in terms of ease of quantification, the other in regards to democratic authenticity - and, as such, any study which wishes to clarify the position of FRM as a public or private good must account for several interpretations of those terms. Finally, in regards to stakeholder engagement, we hope to identify how the use of multiple interpretations of public goods influences the emergence and form of public engagement in FRM, and, thus, how varying interpretations may be the source of conflict within many FRM projects.

3. FRM measures

In Table 2 we list the common FRM measures, designed to prevent the build-up of flood risk, protect against that risk, or prepare for risks if they cannot be prevented or in any other way reduced. All of these measures are now used in the UK, both singly and – more usually - in combination (Defra, 2005), with recent moves away from an over-reliance on engineering

measures for flood defence, towards non-structural measures such as spatial planning for flood risk areas (Pardoe et al, 2011), near-universal flood insurance to compensate flood victims for financial losses (Penning-Rowsell and Johnson, 2015), and property level protection promoted where major flood defences are inappropriate or unaffordable. An emphasis recently has been on greater local community involvement in funding such interventions rather than a reliance on government investment (Defra, 2013; Geaves and Penning-Rowsell, 2014; Penning-Rowsell and Johnson, 2015). In Table 2 we also indicate whether these measures are "non-rival", or "non-excludable", following the classic and basic economic definitions of public good as discussed above.

Table 2. Common FRM measures compared to key characteristics of a 'pure' public good.

Measures	**Aim**	**Output**	**Non-rival (the 'good'/resource cannot be used up/consumed)**		**Non-excludable (the 'good'/resource is available to all who might benefit)**	
			Yes	**No**	**Yes**	**No**
Spatial planning	Prevention	Prevent exposure	Spatial planning is non-rival in that the benefits that the space reserved for flooding from the river /sea cannot be used up.	The benefits of spatial planning for FRM can be put under pressure by developers/ development, reducing the benefits that land provides: the open space may not last for ever.	Anyone can enjoy the benefits of spatial planning for FRM.	Spatial planning may unintentionally create high land values in flood-free areas which may price certain householders out of those areas.
Managed realignment		Prevent exposure	Managed realignment is non-rival in that the benefits that the space reserved for flooding from the river /sea cannot be used up.	The good may be used up if the flood problem becomes worse and re-establishes the edge of a flood zone at the (new) boundaries of the reserved area.	The entire area thereby reserved for the river/sea may benefit from the reduced costs of no longer protecting a flood risk area.	The high cost of this measure may mean that under a benefit:cost funding structure its use is only viable for high value areas, in effect creating a private good.
'Hard' engineering	Protection	Reduce exposure and risk	Benefits cannot be used up as long as the original specifications of the resource are adhered to, i.e. number of households protected for a flood of a particular magnitude over a particular time period.	Benefits may be put under pressure by exogenous changes, including climate change or increased impermeable surfaces increasing flood risk. Benefits can also decline as the defence deteriorates and no longer reaches the original standards.	Anyone in the area protected can enjoy the benefits of hard engineering, even if they need to move to gain these.	People may be excluded from this resource by the boundaries of the area protected, which are likely to be set on benefit:cost grounds which may exclude low value areas.
'Soft' engineering (SuDS)		Reduce exposure and risk	As above	As above	Can benefit entire communities within the area where risk is reduced	These measures may be applied at an individual property level rather than more generally, thus creating private goods
Natural flood management		Reduce exposure	As above	As above	Can benefit entire	People may be excluded from this

Measures	Aim	Output	Non-rival (the 'good'/resource cannot be used up/consumed)		Non-excludable (the 'good'/resource is available to all who might benefit)	
			Yes	No	Yes	No
		and risk			communities within the area where risk is reduced	resource by the boundaries of the area protected, which are likely to be set on benefit:cost grounds which may exclude low value areas.
Flood resistant buildings		Reduce damage	Flood resistant buildings will not be used up after use.	Resistance measures are designed for individual properties and cannot be spread further than their design standards.	Anyone is able to purchase a flood resistant building.	Once flood resistance is installed its access may be restricted by the property owner.
Infrastructural resistance		Reduce damage	As above	Exogenous changes can reduce benefits	Can be city wide or included in a whole new development	Some houses may be excluded by their location from this type of infrastructure improvement
Information and education	Preparedness	Awareness to promote action	Theoretically cannot be used up	Can become 'saturated' due to lack of adequate funds.	In theory accessible to all.	Some people may be able to access information more easily than others
Forecasting and communication		Awareness to promote action	Theoretically cannot be used up	Can become 'saturated' due to lack of adequate funds.	In theory accessible to all.	Some people may be able to access information more easily than others
Emergency planning and response		Awareness to promote action	Theoretically cannot be used up	Can become 'saturated' in the case of an emergency	In theory accessible to all.	Some people may be able to call on assistance more easily than others
Building/asset flood resilience		Improve recovery	No, flood resilience is specifically designed for one property	Flood resilience measures are often designed for one unit of property and are used up when installed.	Can be purchased by anyone, but is excludable once implemented.	Once installed in a property, the benefits of flood resilience are excludable.
Infrastructural resilience		Improve recovery	Theoretically cannot be used up	Infrastructure can become 'saturated' as increasing usage caused by additional users, change in use, or increased rainfall, leads to extraordinary usage becoming average usage, lowering the capacity of infrastructure to deal with revised 'average' scenarios.	All people using the infrastructure benefit	People paying for better drains may not be beneficiaries of any particular project.
Flood insurance		Compensate for losses and improve	Theoretically cannot be used up	If very many properties are flooded the insurer / reinsurer may be unable to pay the	In theory accessible to all.	People who cannot afford access may not be provided with cover.

Measures	Aim	Output	Non-rival (the 'good'/resource cannot be used up/consumed)		Non-excludable (the 'good'/resource is available to all who might benefit)	
			Yes	No	Yes	No
		recovery		full compensation costs		

We now turn to elaborate on Table 2, giving examples where possible of the nature and character of the public good, or variations on public good characteristics as shown in the FRM field. Clearly there are judgements being made here, rather than the analysis being based on unequivocal empirical information, but this judgement is based on many years of experience of evaluating FRM measures in terms of their output and those who might benefit (Penning-Rowsell et al, 2013; Penning-Rowsell and Pardoe, 2012).

3.1. Proactive 'preventative' measures

In the context of FRM, spatial planning is designed to restrict the development of "urban" land uses in areas liable to flood risk (or areas contributing to flood risk), on the assumption that this restricts the future build-up of flood damages and reserves space for the river to flood on to its natural floodplain or the sea to encroach landwards in storm and tidal surge events. In the United Kingdom (UK), this has been the subject of many government guidance Circulars (Tunstall *et al*, 2004) and, more recently, with a National Planning Policy Framework designed to restrict such development, although there are exceptions[3]. In general, we believe that this has been a successful policy, pursued since 1947, in that the majority of UK's major floodplains have been reserved in this way and no longer appear to be the locus of the most serious damaging flood events (see Chatterton *et al*, 2010).

We judge that spatial planning as a FRM measure, with its outputs as described above, is a good example of a classical public good. The areas reserved for the river and its flood water are not "used up" by this intervention, and can be available time and again – even if they are privately owned - to store water to protect the community at risk if they are not developed. All parts of the UK have the ability to use the available spatial planning system and its measures to restrict development into floodplain areas, and in that respect the "good" is non-excludable. Although, as noted in Table 2, spatial planning outside flood risk areas may lead to high values for all land, including the land in flood risk areas, threatening to promote the development of the flood plain. Moreover, each planning decision is taken on its own merits, and there is always the possibility that future decisions may compromise the reservation of floodplains in the way that is currently intended.

As far as managed realignment is concerned, this is rare in the UK, with the exceptions of some experiments on the coast where nature conservation areas have been created by the withdrawal of dikes or levees, with the objective of shortening the line of defence or not defending areas of rough agricultural land which would not warrant further investment with flood protection measures (Myatt-Bell et al., 2002; Ledoux et al., 2005). Again the resource created – room for the sea - is non-rival, but the provision of realignment can be compromised in future if, for example, sea levels rise such that the newly located dikes are again threatened and risk is increased. Also, in terms of its non-excludability, managed realignment is expensive, and might be restricted to areas of relatively high value, either for human occupation or nature conservation purposes. Thus this measure is not readily available

[3] For an example, see the Wapshott Road Planning Inquiry (Tunstall et al. 2009).

in these locations to all who might benefit from it, making it less of a public good than might otherwise be the case.

In summary, measures which affect the land use, and reserve "room for the rivers" (Rohde *et al*. 2006), are generally public goods (because all at-risk areas can benefit by this room creating flood risk reductions and that facility is not "used up"), and command widespread and favourable public backing in stakeholder engagement and public participation processes. The spatial planning system in the UK as a whole commands widespread support, as delivering accessible benefits for the whole of society (a classic public good outcome), from both environmental groups and within government, so that although decisions may be disputed, the results tend to be uncontested and "stick" (Marshall and Glasson, 2007). It is the non-excludability character of this particular FRM measure that commands support, in that everyone, everywhere, is treated more or less the same. This equality of treatment is what the public in general finds beneficial and therefore supports through its engagement in the decision-making process and its participation in the governance arrangements into which this is embedded. There are exceptions to this, particularly in areas with high land values, where the "escalator effect" means that development follows flood protection, and spatial planning decisions are made on the basis that such areas are "safe" (Parker, 1995); this a process and outcome that the public in general finds disquieting and many FRM professionals find profoundly unsatisfactory.

3.2. Measures to protect lives and property from flooding

The second category of FRM measures itemised in Table 2 are those designed to protect property and lives from flooding by reducing the exposure of areas to flood risk, and reducing the flood risk in areas currently exposed. These measures, of course, have been the traditional approach to FRM, involving engineering structures, but more recently have been extended to making individual buildings more flood resistant, and with "soft engineering" schemes such as Sustainable Urban Drainage Systems, and beach nourishment at the coast.

The outputs from these FRM measures are, again, in general public goods in that the areas protected can be protected for all time, assuming maintenance regimes and the replacement of flood defence assets continues, and therefore the resources are not "used up". As with the lighthouse example, anyone living in the area protected by engineering works or provided with flood resistant housing can benefit from that protection, even if they have not sought it. The whole community can benefit from ring dike embankments surrounding their properties or major investment such as the Thames Barrier or, again in England, from the Jubilee River protecting Maidenhead, Windsor and Eton (Adams *et al*. 2004). No one is excluded from this benefit if they live within boundaries of the benefit area, re-emphasising the importance of boundaries to the delineation of public goods.

However this again raises the question of the free-rider problem. Those living within the protected area have no choice but to be protected if a scheme is implemented. Yet, those individual beneficiaries also have no incentive to contribute towards its cost or its subsequent maintenance, in the knowledge that others, whether that includes the Government or otherwise, are likely to continue their existing contributions. This, in turn, makes the public participation and engagement process less than ideal, in that those who do not seek to benefit from such works, but will benefit when they are implemented, have little incentive to engage in the promotion of the kind of FRM measures that have this character.

The position of these FRM measures as a public good can change if flood risk increases. This occurs when the return period of an intervention is reduced, such that a 1-in-100 year flood is recalibrated, perhaps due to climate change, increased run-off or some other mechanism. The defence standards might decline, and therefore the capacity of those measures to protect the area once protected to a standard that was perceived as satisfactory will also decline. This means that the 'good' becomes "rival", using the economists' terminology, or it ceases to be of use, and therefore ceases to be non-rival. Importantly, this illustrates that there is the potential for a public good to become saturated even if the intervention and public behaviour remains the same. Such situations will need to be identified in order to reduce conflict between stakeholders and amicably revise the social contract in regards to the acceptable, and possible, level of public service provision (Geaves, 2012).

In the case of flood resistant properties, the good provided is private, regardless of any potential positive externalities. The increasing accessibility to devices to protect the public at household level must be considered beneficial, and when taken up illustrates an awareness of the home owner of flood risk. Yet, the exclusionary nature of this scale of intervention should be recognised in order to prevent property level protection (PLP) being considered as an equal alternative to community scale interventions.

The cost of PLP is, on average, some £4922 per domestic property for temporary seals to doorways and the like (Merrett, 2012), with limited state funded grant schemes available, meaning that the poorest of a community are priced out of this market-led form of flood protection. Such exclusion may be acceptable to a community if there are low levels of altruism or the damage to a citizen's unprotected property is not significant enough to influence the community's ability to function socially or economically. However, reliance upon PLP protection as an alternative to other measures fails when we challenge the assumption that a community is merely a conglomeration of properties. We know this assumption is false, and that in order to function economically, politically, and socially, community assets must be protected in addition to isolated properties, something which is not possible with a sole reliance upon PLP.

In response to a perceived infringement upon a public good by reliance upon private initiative, the larger community-level schemes, either fully funded by residents or in partnership with authorities, have been growing in popularity. In effect, these schemes are providing a public good on a smaller scale; all residents and property within the boundaries of the intervention are protected regardless of the extent to which they have contributed to the establishment and maintenance of the scheme. For areas where the flood problem occurs at a significantly smaller scale, and within a predictable area, such targeted delivery of a public good can be seen as beneficial. These benefits may be of particular support for low value properties which would otherwise not attract wider funding.

The growing use of in-community level interventions is one indicator of a pivotal change which is occurring in respect to engineered FRM schemes in England. This move devolves and diversifies the sources of capital for FRM schemes, and is embodied in the Partnership Funding initiative (Defra, 2013) which encourages, or even requires, local communities to contribute significant capital towards the funding of flood risk reduction measures. Thus, FRM policy in England rests on a hinge point where it is unclear whether FRM should be delivered as a public good or re-delegated as the private issue of property owners. This lack

of clarity in the position of community schemes as a public or private good is further complicated as, for the local community, part of the scheme they are promoting is in fact a private good, paid for by their own contributions, although the scheme itself provides public goods in that those not contributing can also benefit.

What is apparent, however, is that the Partnership Funding initiative has encouraged public engagement in decisions about all aspects of flood risk reduction, not just funding but also scheme design. Whether the policy itself initiated the process of public engagement is not entirely clear. Yet, current policy does encourage property owners to participate and has utilised the resources of the large number of "flood action groups" keen to have significant influence on the risk reduction policies of the organisations responsible for FRM in their area. Previous research has shown that the nature of this engagement varies between "contractual" relationships between these groups and authorities and "cooperative" arrangements whereby these groups work together with the authorities to promote risk reduction in a mutually reinforcing process (Geaves and Penning-Rowsell, 2014). In terms of the degree of engagement, the "cooperative" initiatives maximise this participation, whereas the "contractual" arrangements tended to focus on initial processes of interaction in order to secure their contract, followed by a less engaged process of monitoring progress by the FRM authority rather than active participation in scheme implementation.

In summary, physical measures to protect lives and property vary in their categorisation as public goods. Interestingly, Partnership Funding has meant that many FRM schemes, previously considered as 'pure' public goods, are now "club goods", made excludable by their geographic scale and by the distribution of culpability for their implementation and maintenance across a region. The trend of large scale, capital intensive schemes increasingly displaying traits of "club goods" is exacerbated as those areas with the pre-existing resources to form pressure groups to rally for the funds for defences draw disproportionate attention to their cause. Whereas, in deprived areas, in circumstances where there is a demand for flood defences, often there is not the knowledge of local governance processes or contacts to facilitate access to appropriate resources (Geaves and Penning Rowsell, 2014). Household and community level protection, though falling under the bracket of "private goods" and "club goods", increasingly offer a fair (Johnson et al, 2007) alternative to earlier FRM strategies. However, yet again, the access to these resources is constrained by the availability of funds. As such, FRM increasingly witnesses the semi-privatisation of previously considered "public goods", with this privatisation limiting the distribution of benefits across society.

3.3. Measures to enhance preparedness for flooding and subsequent recovery

In the last several decades there has been much greater emphasis within FRM to ensure that citizens are aware of the flood risk they may face, to warn them of events before they strike, and to enhance recovery after hazardous and damaging floods.

This is in part in recognition of the fact that we cannot protect ourselves by engineering works to an infinite design standard, and that there will be residual flooding which may become increasingly unpredictable in its geographic distribution and timing. The latter applies particularly to what is now in the UK termed "surface water flooding" (Pitt, 2008) which has a pattern related to individual localised pluvial/rainstorm events, the geography of which is to a large extent random. Although the UK now has flood risk maps for this "surface water flooding" they show that the locations of such events are widespread, small in scale,

and related to very low-lying relatively small areas where rainwater can accumulate. These areas are not nearly as predictable as the large floodplains of England's major rivers, and hence it is even more important that the public is aware that they may be at risk wherever they may live.

The types of preparedness measures are numerous (Table 2) and generally are "non-rival" in that they theoretically cannot be used up: the risk awareness raising through public education, or the flood warning available to one member of a flood risk community, are both equally still available to others. Generally, flood forecasts and warnings are provided for the whole population, and no one is excluded. The same non-rivalry applies to emergency response, where the efforts involved generally do not discriminate between different parts of the population but embrace interventions that are designed to help everyone. This is partly because these services are almost universally provided by the state, rather than by private enterprise, but also because emergency services generally are available free of charge for the whole population at risk (e.g. fire; police; ambulances), not just those who will benefit most from such measures.

However, in exceptional circumstances rivalry can occur within the provision of emergency services. When demand for these goods overwhelms the resources available, for that moment in time the "capacity" (Karlsson, 2008, p.103) to deliver that public good is reached. A further limitation to defining preparedness measures as 'pure' public goods is the accessibility to the media by which information is distributed concerning flood events and general flood awareness education. Of note here are the results of the Oxford Internet Survey Report (Dutton et al, 2013) which showed that almost 100 per cent of those in the UK with high incomes used the internet, while only 58 per cent of the population classed as poor had access. These vulnerable sectors of society are restricted from benefiting from the full range of flood forecasting and warning options. The information may be available through public hubs, such as libraries, but such individuals may not have the knowledge, awareness or timely access to fully exploit these resources. In essence, preparedness measures are almost universally public goods, but can become rival if demand exceeds capacity, or excludable if access is limited by an inability to connect with mainstream modes of media, such as the internet. This can lead to lower than desirable levels of participation in the take-up of these measures and their associated benefits.

The character of preparedness measures as public goods can also reduce public participation and understanding. For example, even though flood forecasting and warning systems are received by members of the public, they are poorly understood with little engagement in their delivery outside research institutions, professional bodies, and those communities which frequently need to manage flooding and therefore have maximum awareness levels. Generally the public has nevertheless come to react favourably to flood warnings but the exception comes where the service is deemed to have "failed" those affected, for example when warning systems deliver messages after the flood event has occurred; then there is a public disquiet. Meanwhile the public's general level of engagement in the proactive design of such systems, for example by helping to tailor the Environment Agency's arrangements to match local circumstances, remains rudimentary.

Of particular concern, also, is the lack of public engagement in the flood insurance industry. In England, flood insurance is available from private insurance companies and everyone in the UK can buy from insurance companies the requisite flood cover for their properties, designed to compensate them for the flood losses that they might incur, and to speed recovery after any event from which they might suffer. But consumers purchase the insurance uncritically, with little concern or awareness of any cross-subsidies to which they may be

contributing; a trend exacerbated by the fact that flood insurance is bundled in general household insurance policies.

Through a series of agreements between insurance companies and the UK government, there has been a tradition since the 1960s of cross-subsidising those most at risk by those who suffer almost no risk, so that insurance premiums for those at risk remained artificially low. The evolution of this arrangement has been minimal over the last 50 years (Penning-Rowsell *et al.,* 2014) owing to the coincidence of interests between the UK government and the insurance industry designed to support the role of the private sector and release the government from the obligation of paying compensation for flood losses incurred by private citizens across the country.

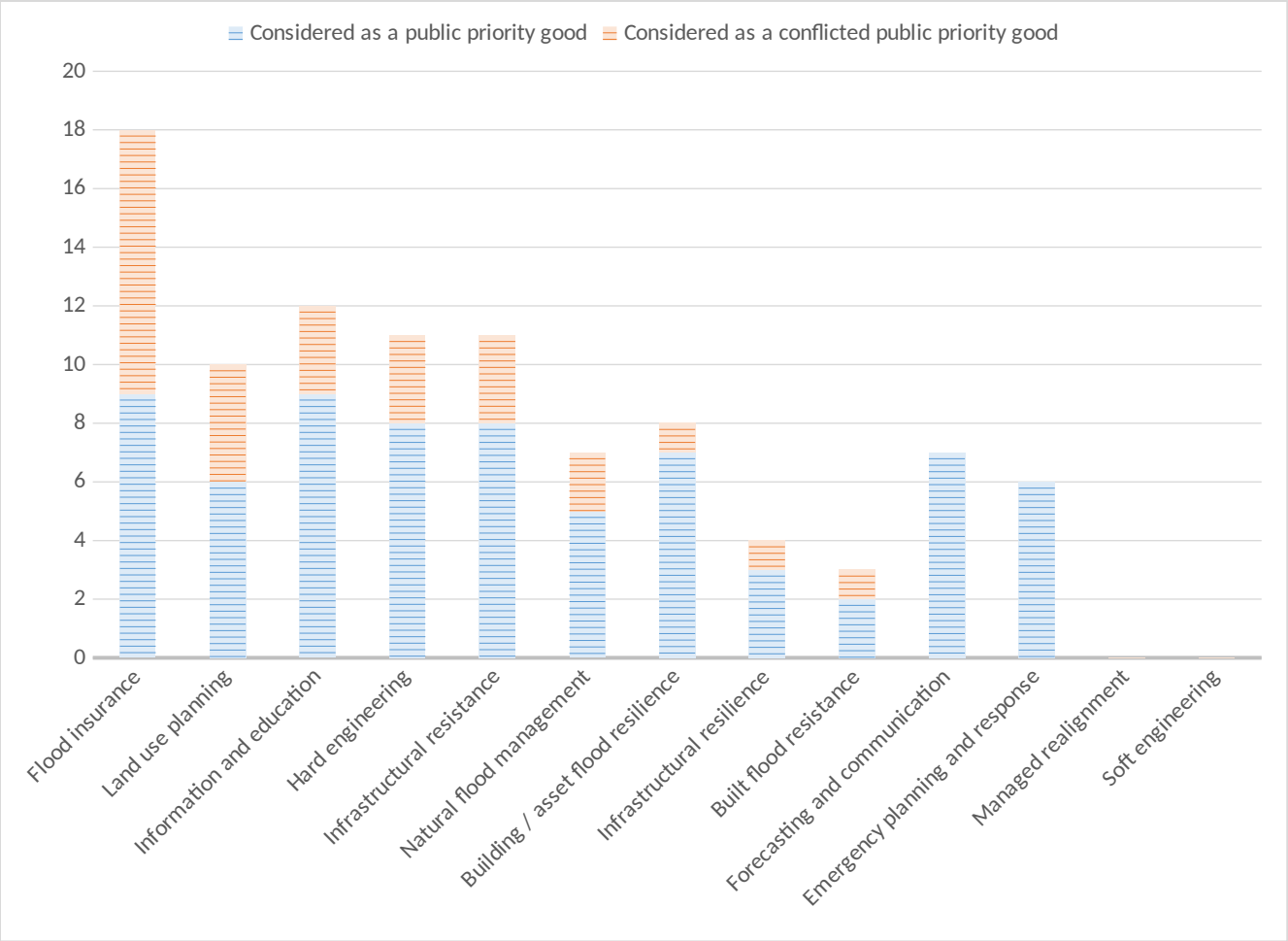
The cross-subsidy from those at low or non-existent risk to those within the flood risk areas has been formalised through the creation of an insurance "pool" termed Flood-Re (Defra, 2013). Flood-Re is the outcome of considerable and consistent pressure placed upon UK government by householders to ensure that the current situation of low insurance premiums continues, although these are insufficient in reality to cover the compensation claims made by those suffering flood damages. Everyone who is at risk will have access to this pool, and, in that respect, Flood-Re provides a public good. Strenuous efforts have been made to ensure that the pool is sufficient to cover all eventualities, such that its resources will not reach capacity and become rival in nature. The government will, however, be the insurer in last resort, but with their liability only triggered by very serious flooding, with a return period of greater than 200 years (i.e. this is the average interval between events of this magnitude). Thus, in defining insurance as either a public or private good, the insurance policy itself should be considered as private, but affordability of insurance should be considered as a public good as it redefines insurance as accessible (i.e. non-excludable), in addition to its pre-existing attributes of non-rivalry.

In some respects the cross-subsidy of insurance premiums will make stakeholder engagement and public participation less likely. The process of engagement will be opaque and those claiming from the Flood-Re pool will not even know that they are doing so; simply they will be aware that their claims are being met. The incentive for citizens to invest time or capital in self-help is minimised as the reduced cost of insurance premiums means that other interventions, which may require investigation and lead to increased awareness, are overlooked or considered unviable or unnecessary. By reducing awareness and stimulus to take responsibility for flooding, Flood-Re can be seen as running counter to the participatory form of FRM which current policy promotes. Despite this, the public involvement that there has been in the creation of Flood-Re would indicate that the subsidy is strongly supported, even by those providing the cross-subsidy, regardless of implications for sustainability. What can be seen from this conflict of awareness and financial wellbeing, is that FRM can provide more than one form of public good; however, those goods may not be complementary to one another as both cannot be delivered simultaneously within current frameworks of management.

4. Community attitudes to FRM as public or private goods

To reiterate, some social scientists consider a public good is a reflection of prevailing social values about the services that should be provided by non-market mechanisms (Deneulin and Townsend, 2007), and the goods are then termed ‘public priority goods’.

Figure 1. Public priority goods as defined by local action groups, and the level of conflict groups experienced in seeking or protecting the provision of those goods. Managed realignment and soft engineering were not considered as public priority goods, nor were they considered as issue of conflict, thus they are scored at zero.



We have surveyed attitudes towards FRM via a sample of 25 "flood action groups" across England and Wales, building on previous analysis of their emergence and governance structures (Geaves, 2012; Geaves and Penning-Rowsell, 2014), with these survey results providing more detail and insight here than in the preceding sections of this paper.

In regards to emergence, many of England’s flood groups have formed over the last decade or so and are generally quite small, involving a handful of self-selected community supported activists seeking to promote risk reduction locally by either their own efforts directly or lobbying for major flood risk reduction measures implemented by the Environment Agency (Geaves and Penning-Rowsell, 2014). As always, context is important here: in order to understand emergence of flood groups, the incubating context must be understood: major flooding has occurred in England and Wales in recent years, including events in 2000, 2007

and 2013/14, provoking public disquiet. In response, there has been a change in legislation, with the Floods and Water Act 2010, and thereby some shifting of responsibilities from central government to local authorities (Penning-Rowsell and Johnson, 2015). At the same time, as indicated above, funding is being sought from local communities (Defra, 2013; Thaler and Priest, 2014), while benefit:cost tests remain important for releasing central government resources, and there are moves as discussed above in the flood insurance field whereby at-risk property is formally subsidised so that insurance remains widely available and affordable: a special feature of UK's FRM. All these changes have enhanced the intended role of local community actors, bringing into sharper focus their attitudes and perceptions of the good provided by or to them in terms of flood risk reduction, in a hydrological context where locally designed and funded FRM schemes rarely enhance risk downstream owing to the absence of large rivers that can show this characteristic.

In terms of the understanding of the nature of public goods within these organisations, Figure 1 illustrates goods considered 'priority' or issues of 'concern' (Karlsson, 2007) by our respondents regardless of their purity as a public good, and those goods which display conflict in that their provision is inadequate or threatened (the darker shading in Figure 1). The presence of conflict (i.e. disagreement) in the provision of public goods is not surprising; as Tiebout (1956) describes, not all nationally accepted public goods can be provided across the entire nation – though concern exists, there is not the capacity -- resulting in local level adjustments and variation in provision. Such adjustments can lead to conflict as the public do not agree with the delegation of priorities among themselves, or between other stakeholders. Thus, understanding both the concept of "public priority goods" and "public goods" is important as the area beyond public goods is often an area where conflict arises, due to deficit in clear capability and capacity (Karlsson, 2007) to fulfil the local population's requirements.

For example, Figure 1 shows that the public recognise that a wide variety of public goods can be delivered by FRM interventions. The public goods noted for their importance by respondents indicate that the majority of groups are concerned about insurance, information provision, 'hard' engineering schemes, and infrastructural resistance (note: river dredging accounted for most citings regarding infrastructural resistance here). These public goods also displayed high levels of conflict. This conflict was a product of lack of provision or encroachment of other goods upon the provision, but more importantly, often these goods could be seen to have traits of excludability or rivalry, leading to conflict as to whose responsibility it is to provide them.

Insurance displayed the highest levels of conflict among all goods considered as a priority by the public. Respondents felt that the government should take action in order to ensure that householders could obtain affordable insurance. In other cases, the respondents felt that insurance premiums might go up if action, such as property development, took place. The establishment of the Flood-Re 'pool' of subsidised flood insurance premiums (Defra, 2013) may indicate that the impact of high insurance premiums has a negative impact on society as a whole, and this externality therefore justifies the redistribution of consumer bills away from risk-reflective prices through the kind of market adjustment which Flood-Re facilitates. None of the respondents considered that an insurance policy was a public good, however, the affordability of that policy, (i.e. eradicating the exclusion posed by cost), and the guarantee that a claim would be fairly treated (i.e. reduction of rivalry) caused by an excess of claims, made insurance as an industry a public good.

Following insurance, ‘hard’ engineering and infrastructural resistance were, relatively, the most conflicted public priority goods. Here the most common cause of conflict arose as the relevant authorities did not provide flood defences or infrastructure standards to the satisfaction of the public. As discussed in Geaves and Penning-Rowsell (2014), this conflict indicates a misalignment in the social contract between authorities and public over the standards of protection expected. The change may have been brought about by pressures such as climate change, increased population pressure or change in infrastructure usage, which reduced the return periods of serious floods. Here the public pressurised Authorities to provide defences or increased maintenance. In cases where the Authorities did not provide these goods, the public equipped themselves to take on the tasks independently (Geaves and Penning-Rowsell, 2014). Interestingly, hard engineering is more frequently considered to be a “club good” due to the spatial distribution of risk reduction and the Environment Agency’s claim that the average long-term value of being better protected is £20,000 per household (EA, 2009). By internalising previously considered external benefits, engineered solutions have been transformed from public to club goods.

Forecasting and communication, and emergency response were both considered unconflicted public priority goods. These goods, as far as our respondents are concerned, can be designated as ‘pure’ public goods due to their non-rivalry and non-excludability. The position of these goods as ‘pure’ public goods may explain the lack of conflict in their provision; both the relevant authorities and the public were in agreement over their provision and societal benefits, with that provision being accessible to all citizens across England. In comparison, conflicted public goods displayed less-than national scale provision, and were excludable in the boundaries to which they provided benefits.

In general, the provision of pure public goods was the least controversial among respondents, whereas public priority goods which were either excludable or rival in their nature, yet considered necessary by the public, displayed the highest rates of conflict. This conflict has had two notable public responses. First, the chasm between public priority goods and public goods has led to the emergence of flood groups. The form of these flood groups varies from pressure groups and fundraisers to warden schemes and hands-on groups, and is highly influenced by the level of support provided by authorities. The second output of conflict has been the growing space for the provision of “club goods”, such as community level defences and community warden schemes. Thus, as culpability for FRM realigns itself towards the homeowner, “club goods” may present a solution to mediate the increasingly controversial redistribution of funds between those suffering recurrent risk, and those whose susceptibility to risk is extraordinary and considered an emergency.

5. Conclusions: public goods, public priority goods and stakeholder engagement

In this paper we have shown that the benefits provided by FRM are generally to be categorised as public goods, as defined in classical economic analysis. This is because these goods are often freely available to the populations affected (no one is excluded) and/or because they are not "used up" or consumed by those who benefit from them. We have also shown, through a sample of responses from "flood action groups" that the public sees many

of the outputs from FRM measures as public priority goods, to be provided by the state rather than through private enterprise.

However, exceptions exist, which we have highlighted, with a general trend in FRM, in England at least, towards providing some of FRM goods as private or “club” goods (e.g. locally funded small-scale FRM schemes) through the intervention of individuals and local communities. This is partly because government wants less active involvement in this area, and partly because many communities and professionals see the value of local involvement in FRM measures, in order to attract "buy in" through a process of engagement by those who benefit in the provision of the relevant infrastructure and the favourable environments that this can provide.

Importantly, the classification of different forms of FRM interventions as public or private goods does influence the level and form of public participation and stakeholder engagement in FRM. Our survey of action groups showed that ‘pure’ goods did not encourage long term, sustainable participation in that they did not facilitate increased awareness, or associated uptake of individual risk reduction measures. In the case of ‘pure’ public goods which were national in scale, participation emerged from our research as a method to ensure levels of protection or high cross-subsidies remained. Those goods which were private or quasi-private in nature often encouraged participation forms which indicated increased awareness of those at risk. This result suggests that rescaling of the traditional national borders of a public good delivery by the central government’s funding of most FRM to a local level to encompass community scale private goods may be of benefit to sustainable and responsive FRM outcomes.

What we conclude, however, is that stakeholder engagement and public participation in FRM is both helped and hindered by some transition toward private goods from public goods. Where these goods are provided opaquely, as in the insurance industry, this engagement is not enhanced, because the critical social aspect of engagement is missing. But where communities are actively and transparently involved – thus socialising this process - in designing and implementing FRM measures, as public goods to those affected, then the stakeholder engagement there has been considerably strengthened. We would wish to see, and hence recommend, a progressive reduction in the ‘hidden’ or poorly understood provision of FRM services, and a progressive opening up of the access to insight and knowledge about their effects, so that the adverse effects of private goods (the individual or local small communities protecting themselves and perhaps exacerbating risk elsewhere) are minimised and the core character of FRM as a public good is maintained as much as possible.

How this is achieved will clearly depend on the nature of the flood risk reduction measures, and the scale at which they are implemented. So, for example, flood insurance arrangements are determined largely at a national level, and the insurance industry needs to agree with government ways to make their provision more transparent. Many small scale flood risk reduction measures, on the other hand, are local in character, and any attempts to protect just those communities which are actively involved in the process, and pay for the measures involved (perhaps turning them into “club goods” if not entirely private), should be subject to a wider scrutiny, probably by the Environment Agency, so as to ensure that they are not unduly restrictive. We recognise that in certain circumstances such restrictions may enhance stakeholder engagement, but we believe the losses involved are greater than these gains.

Indeed, we judge this process of opening up of the access to insight and knowledge to be in the interests of the greater positive involvement of the public in influencing the policies and practices that can reduce the flood risk that they face both now and into the future.

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