

# Case Study: Innovation in Water, Sanitation and Hygiene.

---

*Howard Rush and Nick Marshall*  
*May 2015*



This document reports on a project conducted by the Centre for Research in Innovation Management (CENTRIM) at the University of Brighton, funded by UK aid from the UK's Department for International Development (DFID). The views expressed are those of the authors and do not reflect opinions of DFID.

## Executive Summary

We report here the results of a case study undertaken as part of the Humanitarian Innovation Ecosystem project, funded by the UK Department of International Development (DFID). The case study provides an analysis of the functioning of the humanitarian innovation ecosystem within the sub-sector of humanitarian response known as WASH (Water, Sanitation and Hygiene). It is based upon twenty-five in-depth interviews with administrators, practitioners, and researchers, all of whom have long and deep experience of working in the sector, as well as both published and unpublished secondary source material.

To help us understand the WASH innovation ecosystem, we use two main conceptual frameworks. The first is an idealised model of the system dynamics of innovation, identifying the different stages and activities typically involved in innovation (recognition of need, generation of new ideas, creation of plausible inventions and solutions, development and implementation of potential innovations, and diffusion of innovations). The second, which we refer to as the Rs framework, seeks to uncover the detailed factors influencing how this system operates using the following headings: resources, roles, relationships, rules, routines, and results. Taken together, these frameworks allow us to characterise the main elements of the WASH ecosystem, as well as to detail the different influences that act either to facilitate or inhibit the successful movement of innovations through the various stages of the innovation process.

The main findings of this analysis are as follows:

Overall the WASH innovation ecosystem does function in a reasonably coherent way, allowing for the identification of needs to be translated into viable innovations through the targeted allocation of resources. However, there is a tendency for the system to encourage incremental rather than more radical innovations. While such innovation is likely to continue to make an important contribution to continually improving the WASH humanitarian response, it may not be sufficient to meet the increasing demands on the sector from the changing type, intensity, and frequency of disasters. There are also a number of significant barriers to innovation, especially in moving potential innovations into widespread use.

Although the general picture is one of incremental change, priorities have shifted between the three subsectors, leading to differences in the pace of innovation in the each area. This has involved a shift from focusing primarily on the *Water* subsector towards encouraging greater innovation in *Sanitation*. *Hygiene* promotion has been, and remains, a relatively small part of the overall WASH innovation effort. As well as showing the connection between resource allocation and innovation, this shift in priorities also indicates a degree of strategic direction in the innovation ecosystem. There have been direct efforts by key players in the WASH sector, through the HIF gap analysis for example, to evaluate where resources need to be directed to stimulate innovation. Nevertheless, the financial resources available for innovation are small and not especially well designed for supporting the whole innovation process. More resources

are provided for the front-end of innovation, fewer for development and testing, very little for diffusion and adoption.

In terms of roles and relationships in the WASH innovation ecosystem, there is the basis for coordinated activity between a core network of actors that drive the innovation agenda and make decisions about priorities. This provides coherence and leadership for orchestrating the necessary relationships, resources, and activities within the ecosystem, but there is the danger that some external actors and opinions are excluded from beyond the '*usual suspects*'. This may also reinforce the tendency of the system to pursue familiar and lower risk solutions. There are nevertheless some new actors on the scene (e.g. social enterprises, foundations, and mavericks) that have an important role to play in exploring potentially more radical new directions. However, the ecosystem also exhibits gaps and areas of disconnect, such as those between private sector suppliers or universities and agencies/users.

Although there is some level of coordination from key actors, the innovation ecosystem has been mostly ad hoc and informal. However, there have been some recent attempts to make it more systematic, especially in terms of understanding user needs and building up a comprehensive evidence base. There is nevertheless still a long way to go. The WASH sector exhibits innovation routines that involve both more closed and open search and development strategies. Each has their strengths and weaknesses: the former reduces risk and is more likely to result in implemented innovations, but are unlikely to result in radically new ideas; the latter may open up the search space for interesting new solutions, but the risks of failure are higher. Rules around funding, national government influences on humanitarian procurement, and the need to manage risk during humanitarian crises, all place limits on the type and degree of innovation. This again encourages an emphasis on incremental innovations, discourages potential innovators from becoming involved in the process, and limits the widespread diffusion of innovations that are developed.

The report concludes with a series of recommendations which correspond to the 'Rs' analysed in the case study and are aimed at improving both the efficiency and effectiveness with the WASH innovation ecosystem. These include:

*Recommendation 1:* Donors need to consider a substantial increase in innovation funding for the sector and assure an adequate distribution of such resources along the difference stages of innovation generation, development and diffusion.

*Recommendation 2:* Constraints associated with existing funding (e.g. length of project) need to be relaxed.

*Recommendation 3:* Consideration needs to be given by donors on how to provide risk capital in order to incentivise private sector and social entrepreneurs' participation.

*Recommendation 4:* To date, those innovations, which have diffused most widely, seem to have been developed and disseminated as a result of collaborations between innovators (in the private sector or public institutions) and practitioner organisations. Such collaborations have the benefit of combining experience with existing or new knowledge bases. Mechanisms need

to be developed by which new entrants can be linked at an early stage in the development process to those with the practical knowledge of how things work on the ground.

*Recommendation 5:* Ways in which to strengthen the resilience and openness of co-ordination mechanisms for innovation and diffusion need to be introduced.

*Recommendation 6:* There is a need to develop a highly respected system by which independent evidence can be established or validated. This probably should be decentralised and affordable in order for access to be available to innovators in all parts of the world and under different environmental conditions.

*Recommendation 7:* Consideration needs to be given to ways by which innovations applied in the field can be captured, disseminated and evaluated by appropriate agreed methodologies.

*Recommendation 8:* Continue to balance the targeted and open approaches to the identification of needs and solutions in order to attract both incremental and radical innovations to an evolving environment (e.g. urban disasters, long-term displacement, etc.).

# Table of Contents

<b>Executive Summary</b> .....	<b>1</b>
<b>Introduction</b> .....	<b>6</b>
<b>Concepts and frameworks</b> .....	<b>6</b>
<b>Overview of the WASH sector</b> .....	<b>9</b>
Water .....	10
Sanitation .....	12
Hygiene .....	14
<b>Main actors in the WASH innovation ecosystem</b> .....	<b>15</b>
Non-Governmental Organisations .....	17
Donors, Foundations and Funds .....	18
Governmental and United Nations Programmes .....	19
Universities and Research Institutes .....	20
Private Sector and Social Enterprise .....	21
Project champions, intrapreneurs, and affected communities .....	24
<b>Funding for WASH Innovation</b> .....	<b>24</b>
Sources of funding .....	24
Allocation of resources .....	25
<b>Innovation needs and how they are defined</b> .....	<b>28</b>
Perception of the need for innovation .....	28
Influences on the innovation agenda .....	29
Connecting innovations to the needs of users .....	32
<b>Generating, developing and selecting solutions</b> .....	<b>34</b>
<b>Testing, evaluation and the evidence base</b> .....	<b>39</b>
<b>Innovation diffusion and adoption</b> .....	<b>43</b>
<b>Implications for the WASH Innovation Ecosystem</b> .....	<b>46</b>
Insights from the conceptual framework .....	46
<b>Conclusions and Recommendations</b> .....	<b>52</b>
Strengths and weaknesses with the WASH Innovation Ecosystem.....	52
<i>Resources</i> .....	53
<i>Roles and relationships</i> .....	53
<i>Rules, routines, and results</i> .....	54
<b>Bibliography</b> .....	<b>55</b>
Other Sources Consulted.....	56

## Acronyms

ACF	Action Against Hunger
ALNAP	Active Learning Network for Accountability and Performance
CENTRIM	Centre for Research in Innovation Management
DFID	UK Department for International Development
ECHO	European Commission Humanitarian Office
ELRHA	Enhancing Learning & Research for Humanitarian Assistance
HERR	Humanitarian Emergency Response Review
HIF	Humanitarian Innovation Fund
ICRC	International Committee of the Red Cross
IFRC	International Federation of the Red Cross and Red Crescent Societies
IHE	Institute for Water Education
IRC	International Rescue Committee
MSF	Médecins Sans Frontières
NESTA	National Endowment for Science, Technology, and the Arts
NGO	Non-Governmental Organisation
OFDA	Office of the U.S. Foreign Disaster Assistance
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNESCO	United Nations Education, Scientific and Culture Organisation
UNICEF	United Nations Children's Fund
UNHCR	United Nations High Commissioner for Refugees
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organisation

## Introduction

We report here the results of a case study undertaken as part of the Humanitarian Innovation Ecosystem project, funded by the UK Department of International Development (DFID).<sup>1</sup> The case study provides an analysis of the functioning of the humanitarian innovation ecosystem within the sub-sector of humanitarian response known as WASH (Water, Sanitation and Hygiene). It is based upon twenty five in-depth interviews with administrators, practitioners, and researchers, all of whom have long and deep experience of working in the sector. They were drawn from the most important actors in the sector including major donors, governmental and United Nations agencies, international and domestic non-governmental organisations (NGOs), universities, research institutes, private sector companies and social enterprises.<sup>2</sup> In addition to the primary data obtained through interviews, a great deal of secondary source material (both published and unpublished) was reviewed<sup>3</sup>

Our aim is to identify the strengths and weaknesses within the WASH innovation ecosystem in order to be able to validate the overall humanitarian innovation ecosystem and to gain a finer-grained understanding of how it operates. Where possible, we filter our observations from a perspective of innovation management. The study describes and discusses aspects of the ecosystems such as:

- the background to innovation in the sector;
- provide an outline of the main actors;
- the availability of financial resources for innovation in the sector;
- discuss how innovation needs are defined;
- how solutions are generated, developed and selected;
- the testing, evaluation and evidence base;
- diffusing innovations and taking them to scale.

After discussing each of these in turn, we categorise our observations using the conceptual framework discussed in the following section.

## Concepts and frameworks

Drawing upon the research previously undertaken in the DFID supported Humanitarian Innovation Ecosystem project mentioned above (Bessant et al 2014, Rush et al 2014) a conceptual framework has been developed which represents the 'systems dynamics' of the

---

<sup>1</sup> The Humanitarian Innovation Ecosystem project is being conducted at the Centre for Research in Innovation Management (CENTRIM), University of Brighton. The views expressed here are those of the authors and other participants, and do not necessarily reflect the views of our funder, DFID.

<sup>2</sup> Although many of the interviewee hold senior positions in their organisation, the interviews were conducted under conditions of anonymity in order to encourage participants to express their own personal opinion.

<sup>3</sup> The authors are also grateful to Paul Sherlock who acted as the expert advisor to the case study.

innovation system and the components which influence the degree to which the system effectively functions. Figure 1 provides a representation of the 'system-map' for humanitarian innovation. For innovations to progress from first identification of need to successful, widespread introduction, they must pass through a number of stages.<sup>4</sup> At each stage, certain factors will help *enable* progress and other factors will be *barriers*, preventing or slowing progress. Innovations can also fail, be ignored, or otherwise drop out of the process for a variety of reasons. We present here a brief description of this generic model which we return to at the end of the WASH case study having first explored the enablers and barriers at each stage in the innovation process.

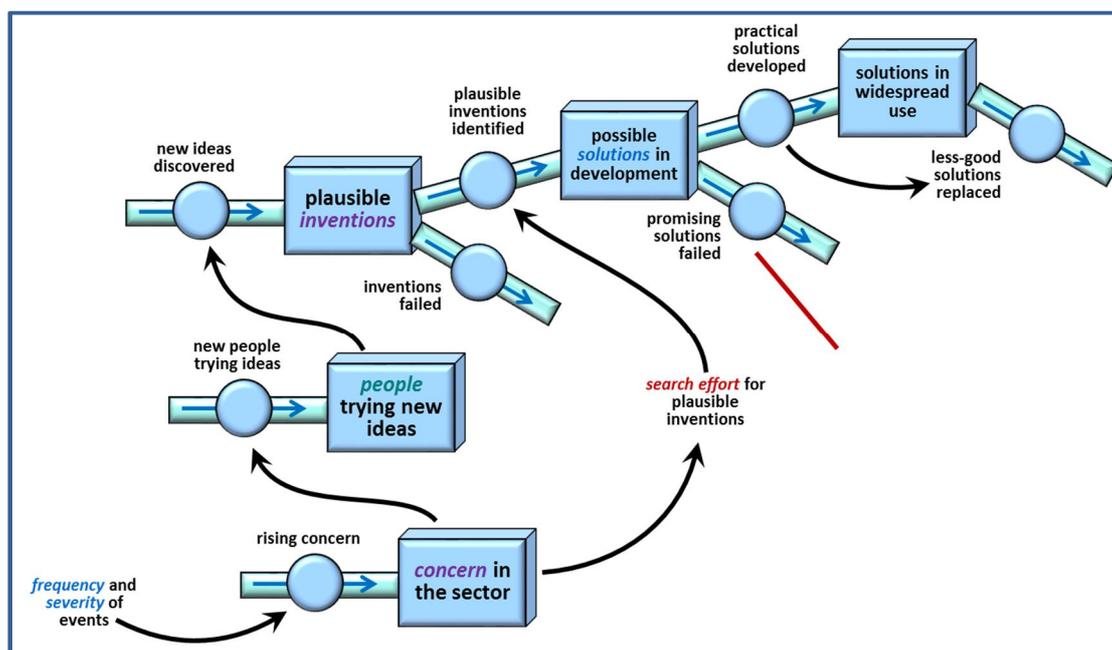


Figure 1: The system-map of innovation-development

In general, people will both look for potential new solutions to a challenge, and try inventing solutions **if there is substantial concern** amongst the relevant stakeholder groups. Typically, a substantial disaster event or situation will cause this level of concern to rise. The more frequent and severe are those events, the more the level of concern will rise, but if no such event has occurred for some time, concern will wane as those involved shift attention to other issues. The box is a "stock" of concern, and at its left is a "pump" creating an in-flow of increasing concern. The arrow indicates the causality – frequent, severe events drive a rising level of concern.

A high level of concern motivates new **people or groups to try new ideas** that may solve the challenge. These may include the affected communities themselves, aid workers directly involved, others with previous experience of the challenge, or groups with no direct connection but with sufficient interest and knowledge to work on new ideas (including academic and for-profit organisations). There may, of course, already *be* a stock of such people or groups trying

<sup>4</sup> Although the map may appear to depict a relatively linear process there are, in fact, numerous feedback loops and iterations that operate for most innovations and will differ for each individual innovation.

to find new solutions, but the level of concern drives a new people to join that number and add to the effort. If concern falls, due to a non-recurrence of severe events, then people may lose interest and stop seeking solutions.

The more people or groups who are trying to find new solutions to a problem, the faster **plausible inventions** are created. As yet, however, these inventions are unproven. In practice, it would be difficult to know how many such plausible inventions exist at any point in time, simply because the developer has not communicated its existence to others.

A rudimentary but plausible invention must be **developed into a solution** that is practical, reliable and economically viable. This is more likely to happen if there is a high level of concern in the sector regarding the issue to which the invention is a possible solution. Some inventions – whether physical products or processes – will simply fail even before being picked for further development.

Not all novel products or procedures emerge survive the development stage and go on to become **solutions that could achieve widespread use**. Some prove to be impractical or not economically viable, and so fail. Those that survive are candidates that *could* be adopted and add to the total number of solutions in widespread use. Some, however, may replace previously popular products or processes. Note that **adoption** is itself a multi-stage process that will not always succeed – practical and economic solutions can remain under-used.

Our review of the prior literature and the in-depth interviews previously conducted for the project provides clear evidence of exactly *where* in this system processes, policies and other factors help enable fast and effective innovation to occur to address any class of challenge in any domain, and also highlight exactly where in the system what barriers hold back innovation. In particular the case study explores six fundamental components of the ecosystem which influence the extent to which it operates in an efficient and effective manner. These include:

- *Resources*: what resources - finance, time, knowledge, technologies - are available for humanitarian innovation, and how are these deployed?
- *Roles*: who plays what roles in innovation efforts and processes? Are there observable patterns? What, specifically, are the roles of innovators, end-users, front-line workers, brokers, researchers, private sector and non-traditional actors?
- *Relationships*: what kinds of relationships and networks exist between actors in the innovation ecosystem (competitive, collaborative, contractual, commercial, etc.), and how do these shape innovation efforts?
- *Rules*: what formal and informal rules pertain to humanitarian work and humanitarian innovation specifically, and how do they serve to shape roles, determine relationships, resource allocations, and shape innovation processes?
- *Routines*: what are the specific ways in which innovation processes work in the sector, and how well do these work? What are the dynamics of these routines - e.g. linear, predictable; non-linear, unpredictable?

- *Results*: how do innovation results get determined, and by whom, and how does this impact on the success or otherwise of innovations?

Each of these components can be integrated into the systems map described above as a means by which the different elements and interactions (invention, development and adoption of innovations) of the innovation ecosystem can be better understood. By so doing, we can identify the strengths and weaknesses in each of the stages of the innovation process and make recommendations that might remove barriers and enhance enablers.

## Overview of the WASH sector

The Water, Sanitation and Hygiene (WASH) sector of humanitarian aid is, for all intents and purposes, really three distinct, although overlapping sub-sectors. Although typically thrown together under the same banner, their histories, actors, drivers, solutions, products, etc., vary and this is reflected in how well or poorly their respective innovation ecosystems function. While presenting challenges of analysis, the differences also provide opportunities to make comparisons between the sub-sectors and identify the extent to which they fit into different innovation management models and frameworks.

Many of the actors operate across two or more of these sub-sectors and attempt to co-ordinate their relief activities within the *Cluster*. Consequently, we retain the tripartite combination within this case study while drawing distinctions where useful. As two of our interviewees put it:

*"We used to rush in and just do water and then do sanitation if we had time. Now you don't go in unless you're doing all three. If you're not doing all three yourself, you're a part of a consortium of agencies."*

*"The WASH Cluster is quite a cohesive sector. It is a strong functioning Cluster compared to some others and there are recognised actors. There is a level of cohesion that lends itself to push forward innovations. There is a strong global structure."*

The very concept and realisation of the Cluster approach as a formal co-ordinating body is seen by many in the sector as an important innovation in itself. Notwithstanding the importance of the Cluster as a successful co-ordinating mechanism, innovation within both Water and Sanitation are typically perceived by those working in the sector as being dominated by product innovations resulting from an engineering dominated focus, whereas Hygiene is often described as behavioural in nature. While this might well be an oversimplification, particularly as cultural issues also influence innovation and diffusion in Sanitation, there were clear distinctions being made with Hygiene where the concept of innovation was more about good communication and the promotion of behavioural change.

Even within Water and Sanitation products, there is usually a division between those solutions employed for immediate use in the first days or weeks of emergency situations from those that are seen as being more appropriate for later emergency usage (1-6 months), or post-emergency, (i.e. of more than 6 months). Such distinctions, while always recognised by humanitarian

actors, have become even more important and widely discussed as the nature of emergencies and their frequencies have changed over time. Although it may have been a function of biases in our sampling (i.e., we were able to speak with many more from the Water and Sanitation fields than from Hygiene), it was regularly suggested to us that within Hygiene we were more likely to find innovative activities (or at least more funding) within the latter stages of emergencies or within the development sector and rather less within the early stages of humanitarian response.<sup>5</sup>

Several important factors were also identified as being of particular importance across the sector. These included:

1) The unprecedented number of major emergency situations (i.e., grade 3 and 4 emergencies) regardless of origin that seem to be occurring more or less simultaneously. Some practitioners interviewed for this case study point to the extreme problems faced in adequately dealing with the scale of recent emergencies in, for example, Haiti, Pakistan and the Philippines, to name but a few. They suggest that this has resulted in the recognition amongst many in WASH of the need for innovation.

2) Aligned with this is the increasing long-term nature of the need for humanitarian assistance. Although primarily intended as focusing on the immediate emergency relief needs following a disaster, interviewees, policy documents and secondary sources of literature, regularly refer to the long-term nature of the need for humanitarian assistance and the different requirements this results in for innovation, be they in product type or business models. A range of issues related to security, length of time before affected communities can return to their former homes and homelands, etc., has perhaps placed the humanitarian/development divide debate more firmly on the agenda of many within the sector. This inevitably will have, and perhaps is already having, an influence on the type and nature of innovative activity within WASH regardless of where in the timeline of humanitarian response and relief different agencies, donors, etc., locate themselves.

3) The immediate needs in WASH for the provision of clean water and safe sanitation may well have remained relatively unchanged over time – although there are always been significant differences from one disaster to the next depending upon the type of conditions faced - be they depth of water tables, access problems, proximity to pollutants. However, the increased urbanisation of global populations is presenting new problems for humanitarian relief in the sector to which those within the innovation ecosystem seem to have become increasingly attuned. Drivers here had much to do with lack of space and the need for security.

## Water

More than a few of those interviewed identified the long-standing emphasis on providing clean water (i.e., *the holy grail*) as the main focus for innovative activities in the sector dating back more than thirty years. This mission to find workable solutions is often considered to have been more-or-less accomplished. Although no definitive figures are available, it is regularly

---

<sup>5</sup> We did, however, find examples of Hygiene innovation originating in humanitarian response that is subsequently being taken up in a development context (e.g. Oxfam's use of mobile phones for disseminating cholera related information in Somalia in areas where due to security problems access was difficult, which is now being piloted by WHO and UNICEF for their polio campaigns).

estimated that more than 80% of money that has been spent in the WASH sector has been on Water, both in terms of purifying it (if necessary) and providing it in sufficient quantities. It is also assumed (and generally agreed by those interviewed) that this high proportion of total spend is also reflected in the amount of funding allocated to innovative activities across the three sub-sectors. Several interviewees commented on these issues. For example:

*“Water, in terms of innovation, gets more money than sanitation and more again than hygiene promotion. There is probably something about water being seen as essential for life, which it is, and people not wanting to talk about shit. It is easier to talk about providing good water provision in a refugee camp than it is about the needs for really good toilets.”*

*“Water was considered to be cool and sexy and sanitation isn’t but people are realising that sanitation is a challenge. With water people are realising that we kind of know how to do it, although there is still some research needed but the technologies are probably pretty much all there.”*

*“Water as a resource and providing water for humanitarian purposes is pretty much dealt with, although there is always more than can be done.”*

This is not to suggest that innovation is not still a regular occurrence on the Water side of the sector, or that the provision of clean water does not continue to be a problem on a grand scale. It is, however, suggested that because of its centrality to life and basic human health and the fact that it is required in every humanitarian response to any type of natural or man-made disaster, it has been the primary focus of attention in the sector for several decades.

We have already referred to the distinctions that have been drawn between different phases of humanitarian assistance between the first weeks through to months or years. In terms of Water needs, these phases are referred to as *immediate* (first weeks), *late emergency* (up to six months), and *post-emergency* (more than six months) (see House and Read, 2004). During the first period (often also referred to as the *Survival* phase) the emphasis on water use is with the saving of life with an estimated 1 – 5 litres per day being required by individuals for drinking and cooking. This then shifts into the *Stabilisation* phase with needs also including bathing, laundry and livestock, using somewhere between 10 – 60 litres per person per day. The *Relative Stability* phase is seen to require between 20 – 25 litres per person per day and sources of more *sustainable* water supplies are sought. These are typically associated with a different range of technologies than in the earlier phases. Supplies in early phases may simply be through the provision of bottled water or some form of bladder or tank system. Water testing devices and surface water treatment (referred to as packaged water treatment systems or kits) are also used for the bulk treatment of contaminated water.

Dorea (2014) usefully divides these water treatment technologies into three categories: *modular*, *mobile*, and *point-of use*, depending upon whether they are assembled at the site of the emergency, provided by some form of portable container, or to be used at the household level. Choice will often depend upon the specific situational requirements of the emergency or the preference for use of particular responding agencies. Water quality criteria is often based upon the recommendations of the Sphere Project and measured and analysed with specially designed

water testing kits.<sup>6</sup> A variety of technologies and techniques are available for each stage and cover a wide range of approaches from membrane filtration, ceramic or sand filtration, the use of coagulant and disinfectant tablets or sachets (for example those like PUR developed by Proctor and Gamble).

It is not the purpose of this case study to produce a comprehensive list, categorisation, or review of such products but merely to emphasize that there are a wide range of solutions on the market that have been developed over the last thirty years. Different types of actors or participants involved in these developments are described below and include both the private and public sectors, individual organisations and multi-collaborator efforts.<sup>7</sup>

New products are regularly appearing on the market with impressive claims being made for the quality or volume of water which can be treated or stored. Such claims are often unsubstantiated and rely on the manufacturers own tests, although some have been piloted by collaborating and interested agencies. These innovations typically represent incremental improvements on existing products and are well within the trajectories of dominant designs for the Water sector. The fact that no overarching organisations exist as yet to undertake independent testing of new or improved products coming onto the market is certainly a barrier to wide scale diffusion of such devices. Indeed, it was suggested by several interviewees that many are not nearly as effective they are claimed to be, and attract more attention because of successful marketing campaigns or are used because of vested interests amongst those agencies or governments which have supported their development. (This is discussed further in the section on Innovation diffusion and adoption).

## Sanitation

In comparison to Water, Sanitation has, until relatively recently, been described as the ugly duckling within the sector. Possibly because there is the belief, as described above, that Water is more-or-less *under control*, attention appears to have shifted. As with expenditure on Water, exact figures are not available but there is a perception that, if not now a majority, it is getting as much as 40% of the total money available for innovative activities in WASH. As one interviewee commented:

*"Sanitation is definitely catching up and there is more innovation now in sanitation than there is in water."*

However, the same interviewee also suggested that:

*"There's more now on sanitation than ever before but when I say there's more than ever before that's still miniscule compared to the innovations on water."*

Various suggestions are given for this shift in priorities. Some are associated with the argument referred to above that Water '*is sorted*' and that the more challenging problems in the sector are

---

<sup>6</sup> The best known of these is the DelAgua kit developed through collaboration between Oxfam and the University of Surrey, although there are many alternatives on the market.

<sup>7</sup> Those readers interested in a more detailed description are advised to see reviews such as prepared by Dorea (2014) for UNOCHA or the European Commission supported WASHtech project (2011), to name but two of many.

to be found in Sanitation. Others suggest that there has also been a societal change in that it is no longer as embarrassing for people to be talking about defecation. We are not in a position here to identify which of these factors most strongly influence the shift in emphasis and resources. We rather suspect that the lack of adequate (if any) sanitary facilities and appropriate solutions has reached such a level that it can no longer be ignored either for reasons of health, security or dignity. Those interviewed regularly mentioned the increased concerns caused by emergency situations in urban conurbations as being instrumental to this shift in thinking.

The problems facing the Sanitation sector are many and varied. Traditionally, providing good sanitation has been hindered in many emergency situations due to flooding, high water tables, hard geological foundations, and unsuitable soils. With emergency situations increasingly occurring in urban areas, problems such as lack of space and access for the building and emptying of latrines, combined with uncertain land ownership issues and inadequate de-sludging facilities, have increased the difficulties. Added to this have been problems of a lack of security often associated with using sanitation facilities at night. Such thinking is not just the preserve of UN agencies and NGOs. As one researcher working in product development for a private company stated:

*"It has just been in the last couple of years that the issue of sanitation has been raised. Talk about how dangerous it is for girls and women and children to venture out at night."*

There has also been an increased recognition of the importance of social and cultural factors to the success or failure of the diffusion of an innovation within Sanitation. We have already mentioned that in both Water and Sanitation there is a strong engineering focus. Within Sanitation, however, the added component of the need for human dignity as well as different religious beliefs and preferences must be as clearly and deeply understood as the physical environment challenges facing innovators. As one interviewee describe it:

*"Sanitation is a tougher one than water – you can do a lot with technology in water – but if you look at sanitation I think 90% is about human behaviour. So the innovations there has to be more around how you engage with people than with technology and science. There is technology and science that can make it easier and better but, more often than not, when I look at what is going on ... if people do not want to use it they are not going to us it."*

Interviewees also pointed to a range of specific initiative behind the recent raising of awareness and interest in Sanitation. Aside from the more general points mentioned above about how challenging the area is now seen to have become, there have been a series of needs identification and funding initiatives such as the Emergency Sanitation Project, the Humanitarian Innovation Fund WASH Project, and the EU's S(P)EEDKIT Project were all regularly mentioned as having been important drivers. Also considered to having been influential by some in our sample has been the Gates Foundation *Reinventing the Toilet Challenge*. Although not directed towards humanitarian assistance, it has, arguably helped to raise the profile of the Sanitation area (we return to this discussion in the section on Allocation of resources).

From an innovation perspective, Sanitation certainly still lags far behind Water. Pit latrines remain the traditional and dominant design in the sector, although raised latrines, new lightweight robust materials, easy to pack, provision of lighting, etc., are all innovations that are leading to continuous improvements. But increasingly, projects from entrepreneurs within and outside the sector – for example, Modified Biofil, Tiger Toilets, Peepoople Bags and other similar projects – there is now a sense of momentum to activity within Sanitation that had not been nearly as evident in the past. Furthermore, different approaches to innovation challenges, such as those put forward by the Gates Foundation (e.g. related to designs that do not require water or electricity, or the specification of service level rather than technical requirements) or new business models being explored by social enterprises, may have more *disruptive* implications for the humanitarian sector, although, as with Water, these may be more applicable to later phases of humanitarian assistance than in immediate emergency relief.

## Hygiene

While innovation within both Water and Sanitation are particularly biased towards product-based solutions, those within Hygiene, while increasingly seen as being just as important for maintaining and preserving health, are often perceived as being more the preserve of social science rather than engineering. Perhaps because, as mentioned above, our sample of interviewees was biased towards people working more specifically on Water or Sanitation, the views expressed tended to emphasise this divide:

*"Hygiene is a very different ball game, more about encouraging different types of behaviour for affected populations than of providing kit."*

*"Hygiene is mostly behavioural change and unless you have invented a new soap it is hard to look at ... it is not tangible as it is behavioural change. It is more opinion than stated fact."*

*"The promotion and communication side of hygiene is less tangible in terms of outcomes than for Water or Sanitation. We are often searching for the evidence for what we do works."*

Perhaps it is unsurprising that this humanitarian sector has received much less attention and resources than even Sanitation.

*"I think that it is incredible the progress that has been made on Sanitation in the last five or six years. I think Hygiene is still massively behind."*

*"And then comes hygiene promotion (after Water and Sanitation) which would include behavioural change in it. And we're trying to get bits of research funded on the triggers for behaviour change ... behavioural change in different contexts. And those are difficult to get funded and there's very, very little emergency (hygiene) research."*

While not receiving the same attention or funding as Water (historically) and Sanitation (recently), Hygiene is still perceived within the WASH sector as being highly relevant as indicated by the fact that two of the top ten priorities identified in the HIF gap analysis (discussed in the section on Influences on the innovation agenda) were from this sub-sector. Innovative ideas are being introduced both on the use of hardware, such as multiple-use taps

that fit into any type of water containers (product innovation), through to the use of mobile technology for data collection and interactive communications, and pilot projects on the use of social marketing approaches to reach large numbers of people (some with low levels of literacy) in emergency situations (process innovations).

## Main actors in the WASH innovation ecosystem

Most attempts at innovation ecosystem mapping tend to focus on identifying the main actors within the system. Within the WASH sector important actors can be categorised as:

- Donors
- Governmental and United Nations agencies
- Non-governmental organisations (NGOs)
- Universities and research institutes
- Private sector
- Social enterprises
- Affected populations
- Individual inventors and entrepreneurs.

In addition to the roles performed by different actors within each of these groupings, the collaborations and relationships between them, the routines by which they organise themselves, the ways in which they define their remits and how they draw the boundaries between themselves, all influence the ways in which innovation processes operate within the ecosystem.

The current international emergency co-ordination system is usually dated back to a UN General Assembly resolution from 1991 when the Department of Humanitarian Affairs was established. The aim of this organisations was:

*"...to mobilize and coordinate the collective efforts of the international community, in particular those for the UN system, to meet in a coherent and timely manner the needs of those exposed to human suffering and material destruction in disasters and emergencies. This involves reducing vulnerability, promoting solutions to root causes and facilitating the smooth transition from relief to rehabilitation and development."<sup>8</sup>*

An Emergency Relief Coordinator (ERC) was appointed and the Inter-Agency Standing Committee created (in 1992) as a forum for coordination, policy development and decision-making for humanitarian assistance. In 1998 this body was restructured into OCHA, although it wasn't until 2005 that the current formulation of eleven sectors or theme based *Clusters* were agreed, replacing the existing working groups as a result of the Humanitarian Response Review (2005)<sup>9</sup>. The WASH Cluster formerly began operating in 2006 under the leadership of UNICEF. The Cluster consists of 32 full-time members drawn from International Organisations, United

---

<sup>8</sup> General Assembly resolution 46/182

<sup>9</sup> The review resulted in the establishment of the cluster approach, the appointment of humanitarian coordinators and provided humanitarian financing.

Nations agencies, International NGOs. In addition a wide variety of civil response agencies, academic institutes and donor organisations play active and important roles. Its principal function is to provide effective coordination during emergency situations, support for national WASH coordination platforms as requested, to seek to improve emergency preparedness, to improve accountability and learning within the WASH sector and provide operational advocacy as an integral part of humanitarian response.

As previously mentioned many consider the Cluster approach to have been a highly effective innovation in of itself, and the WASH Cluster is seen as being one of the more effective partnerships between UN and non-UN actors.. However, it has no formal remit for the promotion of innovative activities and few of the stakeholders play more than a minor role in facilitating humanitarian innovation. Indeed, within the Cluster several of the members might more logically be identified as development actors given that a majority of their work is dedicated to longer-term development programmes around Water, Sanitation and Hygiene. Cluster meetings are typically focused on the process of response and do not actively promote product innovation (as was also the case with the work-group which preceded it), although the Cluster has played a role in the instigation and support of such activities such as the Emergency Sanitation Project.

Prior to the formation of the Cluster structure, a small group of stakeholders established the International Technical Group in 1993 (subsequently called the Inter-Agency Forum) where technology, kit, and innovation were central to their discussions. Member of the group included the ICRC and the IFRC, MSF (Belgium, Holland and France), ACF (France and Spain), Oxfam, UNICEF, UNHCR, and the IRC (in around 2000). The group was set up to develop trust and establish relationships between key actors in the sector. It met twice a year and their meetings were informal, although by no means secret.<sup>10</sup> Participating organisations could bring new equipment to the Forum and receive feedback on its use, thus performing a useful role in testing, dissemination of new equipment, and in providing pressure on manufacturers in being more flexible in their development of products which met the user (relief agencies) perceived needs. With the establishment of the Cluster approach this Forum has apparently become less active but still functions.

Another cross-cutting activity that was referred to in our interviews was the Sphere Project. In operation since 1997 this programme was established to provide standards for quality (both technical and approach), accountability, and training<sup>11</sup>. Working in a range of sectors including WASH their objective has been to establish a set of minimum standards for the provision of emergency relief. As with the Cluster approach, the project has no brief for innovation although their promotional material suggests that they can be a *force for innovation in upholding the right of affected populations to a life with dignity* (Sphere Strategy, 2015).

In general, however, these cross-cutting activities are likely to have played only an indirect role in the innovation ecosystem. With the exception of the Inter-Agency Forum, their lack of any

---

<sup>10</sup> These meetings were decided as informal in that minutes are not kept in order to encourage free and frank expression of views and to encourage attendance by groups that might not wish to be seen as interacting with governmental or UN organisations.

<sup>11</sup> The SPHERE Handbook set standards for both quality and quantity linked to key actions and indicators.

formal remit for innovation and the overriding importance of their main mission has meant that the establishment of the dominant designs and particular trajectories in WASH have largely been the result of activities of individual organisations or small group collaborations.

## Non-Governmental Organisations

A small number of the larger NGO are seen as being the most engaged in the WASH innovation ecosystem: primarily Oxfam GB, WASTE, IFRC, MSF and RedR India.

Amongst these, **Oxfam GB** stands out as having been the most active for the longest period of time. Established over 70 years ago and with widespread operations in over 70 countries, it has gained a reputation as being at the forefront on innovation in the WASH sector. Branded products such as the Oxfam Delagua water testing kit, the Oxfam water storage tanks, Oxfam pump kits, the Oxfam bucket, the Oxfam latrine slab, and more process oriented innovations such as the Oxfam hygiene promotion approaches have been in widespread use, not just in Oxfam relief efforts but throughout the sector. Their approach has been collaborative with, for example, the water testing kit having been developed by academics from the University of Surrey, or more recently the portable filter system (cube) developed with the private company Lifesaver. Other collaborations have been with Cranfield University, the London School of Hygiene and Tropical Medicine and the Centres for Disease Control in Atlanta. Furthermore, they have recently established their own internal WASH Innovation Fund in order to encourage innovative solutions from their engineering, public health promotion staff and local organisations they work with. Although operating with only a small budget (approx. £500,000), they have already provided seed funding for 13 pilot projects and are seeking to expand this programme (see section below on Sources of funding).

**WASTE**, the Dutch non-profit consultancy has joined forces with the International Federation of the Red Cross and Red Crescent Societies, and Oxfam, GB in the Emergency Sanitation Project (see needs identification section below), developing criteria for specific products including elevated toilets, de-sludging equipment and sludge disposal and treatment facilities. The programme, which began in 2012 with the support of the Office of U.S. Foreign Disaster Assistance (OFDA), has produced a number of feasibility studies examining alternative options and specifications and now has several prototypes being readied for testing. Part of the Emergency Sanitation Project has also been an attempt to open up the sector to new sources of ideas from actors outside into -the sector through its *Design a Bog Day* programme (organised by Oxfam).

**RedR India**, while primarily focusing on capacity building and technical support (via its registration of WASH engineers and training programme) has also developed hygiene promotion kits, collaborated on a project with the University of Laval on the development of an emergency water treatment system (*Plate Settler Project*), designed the light weight and the easily stackable *Nag Magic* sanitation slab used by Oxfam and UNICEF in India.

The **International Federation of Red Cross and Red Crescent Societies (IFRC)** is another active player in the WASH innovation field. Established in 1919 in the aftermath of the First World War, it is comprised of National Societies, of which there are currently 189. There is a Secretariat based in Geneva, whose role is to coordinate relief operations for international emergencies and encourage cooperation between the different National Societies. It also has

more than 60 delegations around the world whose job is to help and advise the National Societies. It is a member of the global WASH Cluster and the Inter-Agency Forum. IFRC has been particularly involved in promoting innovation on the sanitation side. It is involved in the Emergency Sanitation Project, a collaboration between IFRC, Oxfam GB, and **WASTE**, a Dutch non-profit consultancy specialising in sanitation and waste management (albeit mostly in a development context). This project involves developing criteria for etc. etc.

The **International Committee of the Red Cross**, whose mandate is to protect victims of international and internal armed conflicts, is another member of the WASH Cluster and the Inter-Agency Forum. As well as having a range of their own kits for deployment in emergencies, they also have strong engineering capabilities for restoring or replacing infrastructure damaged by conflicts, especially those needed to deal with more complex systems in urban areas.

Other NGOs who are seen as playing an active role in the innovation ecosystem include **MSF International** and in particular national programmes in Belgium, Spain, Switzerland, and Holland. As might be expected, given the remit of the organisation, their efforts have often focusing on the water treatment needs for emergency hospital facilities. **ACF** (France and Spain) also has a reputation for building an evidence base and innovation in drilling. A relatively new entrant into the NGO field but one with an interesting approach to innovation is **Field Ready**, which is attempting to apply some *open innovation* principles by encouraging practitioners to put forward their ideas and is experimenting with in situ 3-D printing in the WASH area for the production of, for example, pipes and hygiene items. As this NGO has only been in existence since 2013 it is, perhaps, too early to assess their long-term impact. However, their approach is noticeably different from many of the more traditional service providers. Their website suggests that the organisation embraces a vision of "*radical transformation in the way that needs are met in domestic disasters*" and "*were founded on a belief that the right application of appropriate and disruptive technology, coupled with a keen understanding of real-world problems can lead to profound and transformational breakthrough.*" While adhering to the traditional values of the humanitarian sector, they are attempting to apply lessons and approaches from Silicon Valley, using such concepts as exponential thinking, lean-start-up methods, practices related to failure and sharing, etc.

## Donors, Foundations and Funds

Within recent years foundations and funds have begun to play a more important role within the WASH ecosystem. Only in operation since 2010, the **Humanitarian Innovation Fund** (with support from ELRHA, ALNAP, UK Department of International Development, the Canadian International Development Agency, and the Swedish Ministry of Foreign Affairs) has always been open to WASH related projects via its small and large(er) grant schemes.<sup>12</sup> Through these responsive mode funding programmes a number of projects on water filtration technologies, water disinfection protocols, kits for menstrual hygiene management and a project targeting WASH services for children were funded, although these are all still early in their development. However, in 2014 the HIF launched a multi-faceted initiative, funded by DFID, which was specifically aimed at stimulating innovation in the sector. Having funded a wide-ranging consultation to identify and prioritise needs with the assistance of Oxfam (see section on

---

<sup>12</sup> The HIF Small Grant Scheme accepts applications for proof of concept proposals up to the value of £20,000, while the Large Grant Scheme provides funding up to £150,000.

Influences on the innovation agenda) two parallel funding routes were established. *The Open Innovation Challenge* and the *Accelerated Innovation Pathways*. Two projects related to latrine lighting and a new faecal sludge management kit have recently been funded. The latter is seen as being of particular interest as it is a collaboration between an NGO (**Goal**) and a Social Enterprise (**Sanergy**).

Perhaps at the other end of the foundation spectrum is the **Bill and Melinda Gates Foundation**. Although more commonly seen as a foundation that supports development projects, their *Reinvent the Toilet Challenge* aimed at developing *aspirational next-generation toilets* (see section on resources) is seen by some as having an important indirect impact in the emergency side of the WASH sector by raising the profile of sanitation as an area in urgent need of innovation. Follow-up programmes/fairs in India and China, which may also be more in the development stream of the WASH sector, also help to raise the profile of the sector as a location for innovation as well as highlight the needs that urban settings require in terms of *market structures and service models*.<sup>13</sup> More directly related to humanitarian interests, has been a survey of managing waste in refugee camp settings and a collaboration with Oxfam Senegal which has recently initiated a tender process for sanitation innovation in flood-prone areas. This collaboration is piloting a service level provision approach rather than specifying any particular technological solution, preferring to leave those decisions to the service providers themselves. Also more directly related to humanitarian activities has been the Gates funded development by the Bristol Bioenergy Centre<sup>14</sup> of microbial fuel cells able to generate electricity from urine. This project, with input from Oxfam, offers the potential for an independent, sustainable and economical power source for providing latrine lighting.

### Governmental and United Nations Programmes

Many government funded innovation programmes seem to have been located within the development sphere of WASH and have been criticised as creating silos that tend to restrict the flow of good ideas and cross-fertilisation between the two. Nevertheless, governmental funding has been used to facilitate or support innovation in the WASH emergency response area. We have already mentioned the funding of the HIF by DFID and the Emergency Sanitation Project by the OFDA. The European Union's current Seventh Framework programme is funding the *S(P)EEDKITS* programme which includes a work package on water and sanitation which aims to produce a long-lasting, lightweight, adjustable, multifunctional slab for a latrine or toilet, as well as new low tech, low cost water supply and treatment solutions for households, small and large communities. These WASH projects are being project managed by **WASTE** and have systematically moved from detailed requirements assessment, design, early prototyping and, most recently, field testing by students from **UNESCO IHE** and **TU Delft** in Malawi.

Several large UN agencies such as **UNICEF** have recently established units or laboratories dedicated to innovation, but there do not seem to have been any that are focused on emergency WASH applications. UNICEF has gone through an internal exercise to catalogue all of the challenges that their lead WASH sector staff have faced during emergencies and discussed these

---

<sup>13</sup> Although unlikely to provide answers for rapid onset emergencies, they may well have something to offer the changing and longer-term requirements in which the previously distinct lines between humanitarian assistance and development are becoming increasingly blurred.

<sup>14</sup> The Bristol Bioenergy Centre is part of the Bristol Robotics Laboratory, a collaboration between the University of the West of England (UWE) and the University of Bristol.

with investors as well as engaged in collaborations (often student-based) with universities to come up with solutions. The most recent UNICEF annual report now includes a dedicated section on *Innovations, New Technologies and Best Practices* and outlines partnerships with both the private sector and academic organisations. Still in varying stages of research, development and testing, emergency oriented projects from the last few years include a child-friendly/disabled accessible latrine slab, a portable chlorine generator (now in testing in Lebanon and Uganda), a flexible, collapsible jerry can. The use of cash vouchers for use during and following level 3 disasters is also being tested in various locations. An interviews conducted with staff from one of the the major UN agencies working in this sector also referred to the need to innovate *on the ground* as each emergency demands but that there was rarely time to test, capture or disseminate, leaving diffusion to be more a matter of word of mouth than a systematic activity.

In addition to the type of programmes and initiative mentioned above, governments also assume a role of support for innovation within the private sector,. A variety of national government agencies (in, for example, the UK and Norway) have, for example, been active in supporting small companies in the sector through various procurement and promotional activities (e.g., at trade fairs). Such support received mixed comments from our interviewees. While some suggest that these initiatives provide important support for small firms to both enter and survive in this sector, others raised concerns about procurement practices whereby national agencies tended to purchase from local suppliers and the negative impact this might have on innovation and diffusion of best (or better) practice (as discussed in the section of Innovation diffusion and adoption).

### Universities and Research Institutes

It is inevitable that a sector whose knowledge base comes primarily (although not exclusively) from engineering and science disciplines will need to incorporate academia into its innovation ecosystem. We have already mentioned several successful collaborations on Water and Sanitation which exist between International NGOs with Universities and Research Institutes such as:

- the University of Surrey
- the London School of Hygiene and Tropical Medicine
- the Centres for Disease Control.

Other internationally-renowned groups which have also been active in collaborative efforts include:

- the Water Institute at the University of North Carolina, Chapel Hill
- the Rollins School of Public Health at Emory University in Atlanta
- the Loughborough University Water, Engineering and Development Centre
- the UNESCO-IHE Institute of Water, Delft
- Université Laval
- the University of Barcelona's Water Research Institute

On the Hygiene side, Oxfam have been collaborating with Tufts University and the State University of New York at Buffalo.

A full list of academic institutions that are doing relevant research would be long. However, with the exception of some notably collaborative successes, there exists a significant culture or attitudinal clash between academics and practitioners. This is acknowledged by those academics that we interviewed, who criticised their own colleagues for not being sufficiently interested in applied research, claiming that much of the research in his field will never be used in practice and who suggested that their colleagues work in a *bubble*, and were not thinking of practitioners. The criticism also extended to the sources for academic funding, which are seen as neither problem nor initiative based. Where research was problem oriented (often part of student projects), the practitioners we interviewed complained that because of the lack of field-based experience, the proposed solutions are usually not practicable or just not addressing any real needs.

Practitioners also came under fire for not really understanding the nature of academic research. One interviewee argued that they had a different interpretation of what is meant by research, suggesting that the NGOs he had worked with were satisfied with anecdotal evidence and didn't have the time to do it properly – *"they just want the answer"*. Others concurred, suggesting that NGOs want definitive answers but need to realise that this takes time: *"they are looking for magic bullets which don't exist"*. (See section on Testing, evaluation and the evidence base).

Further compounding the difficulties in collaboration between practitioners and academic researchers is that the conditions underpinning such collaborations are undergoing significant changes. This is caused by the changing nature of funding within Higher Education and the ability or willingness of emergency agencies to pay for their services. What was once seen as a cosy relationship with universities has undergone a sea-change as university finances have been stretched. As one NGO WASH leader reported:

*"Maybe ten years ago they started to get more obsessed about money. We used to go to them, have a good old day exploring things with the right professor and maybe put a proposal for funding together. They have changed and say if you want this guy for a day then you're got to pay some ridiculous fee for him. So we changed directions. We use to say to them that we have these four filters, can you test them. And they would say, yeah no problem, just get a few students on the job and get an answer. Now it's a lot more difficult for us to casually say, look we've been contacted by a supplier, they think they've got this game-changing technology, can you try it? It's a lot more difficult ... it is phenomenally expensive. So the landscape has changed. It is not so easy to have a casual relationship with a department in a university because no one's got any spare cash to quietly say, yeah, we'll test it for you and get some students on it."*

We return to this issue in the section on testing, evaluation and the evidence base.

## **Private Sector and Social Enterprise**

The private sector has, of course, always been deeply involved with providing much of the infrastructure and technologies required for emergency WASH assistance. As participants within the innovation ecosystem involvement with the sector has included giants such as

**Procter and Gamble** (whose water purification packets have been provided over 7 billion litres of clean water for both development and emergency humanitarian relief through their Safe Drinking Water program since 2004) and **Unilever** (who are working with Oxfam on investigating the social marketing approaches for hygiene promotion in an emergency context). It also has involved numerous small companies who provide a range of WASH products, such as the Swedish company, **Peepoople**, who have developed an innovative type of disposable defecation bags and **Bear Valley Ventures** who are developing the Tiger Toilet (using earthworms for decomposition).

However, despite the participation of companies such as those mentioned above the motivation from within the private sector to be a leading innovation actor is often missing. Even those that profess to want to innovate complain that there is a lack of incentive to undertake much product innovation. WASH suppliers complained that this is down to the lack of market mechanisms and uncertainty of demand.

*"The problem with the aid sector is that demand is very uneven and inconsistent, infrequent, we never know when business will come in, nothing for six months then every week and every month, so really we respond to what the commercial market requires first."*

*"The company is always looking for a market for new ideas but the non-profit sector is not a dominant source of new ideas."*

Alternatively, those with responsibility for procurement in NGOs and agencies complain that while they are regularly approached by companies with the latest forms of filtration devices for the purification of water, they are not in a position to verify the claims made or to choose between competing approaches. Companies in the Water sector are also criticised for simply trying to sell technologies that they developed for domestic use in developed economies which usually purify water to standards and prices that are not cost-effective for humanitarian purposes. On the Sanitation side, a former senior agency staff member complained there was very little new coming from the private sector, with innovation being perceived *"as a pit latrine coming in fifteen different varieties – but basically pit latrines!"* One interviewee who has recently been conducting a survey of private company involvement in Sanitation, found fewer than ten companies that were doing any significant product development.

Unsurprisingly, companies in the sector tell a different story. They complain that both donor agencies and NGOs:

- are often prescriptive in their approach
- adopt an attitude that they have seen it all and know best
- are risk adverse and prefer to continue doing it as they always have

They feel that they are continually struggling against the *'not invented here syndrome'*, which disinclines many NGOs and other agencies from adopting solutions they have not developed themselves, and that they cannot find their way through the maze of bureaucracy. Some also

complain of a lack of long-term thinking amongst NGOs and agencies, which dampens their enthusiasm for spending on innovation.

Given that it not seen to be the role of those with responsibility for agency procurement to facilitate innovative thinking in the private sector, there is clearly a lack of understanding that can only be ascribed to poor communications. As one academic researcher in this field pointed out:

*"There needs to be better understanding within the sector between different actors about why a humanitarian aid agency might not be buying particular products. Quite a number of companies do not get responses from aid agencies. A few of them understand it might be because agencies concentrate on responding to emergencies and might not have the time to get back to them but other companies think that they are just being rude. From the agencies' point of view a lot of them think that the companies are just out to make money."<sup>15</sup>*

This lack of understanding is also reflected in the comments of one innovation fund manager who observed:

*"I am still trying to navigate my way through the sector but I think there are some big barriers. We have to be careful how we categorise the private sector. We have Unilever, whose motivation will be very different from a small company who produced filters. We have **Sanergy** in Kenya who are a social enterprise – all with different motivations to participate in the sector. Something is not working. There seems to be difficulties in communications between agencies and these companies in what is wanted and what is needed in terms of product development."*

Another interviewee lamented that the problem wasn't just in a clash of culture between emergency humanitarian agencies and the private sector, although there is certainly a degree of this occurring. Rather, he believed that the dearth of innovation in the sector was due to the lack of a market or the ability of firms to identify one. As he pointed out:

*"The private sector isn't going to go in just for the sake of helping. There may be people who don't care about a profit but ultimately that is what motivates them and until they can see the humanitarian sector as a market it is hard to get them on board."*

While there is certainly some truth in that viewpoint, it is also the case that there are successful collaborations going on between those NGOs who have identified and are able to articulate their needs and private sector companies. And, it is hardly surprising that NGOs will tend to stay involved with those companies with which they have developed trust in their abilities to deliver. These relationships, however, can result in the exclusion of those outside such relationships who believe that they may have better products to offer but do not have the opportunities to work with the emergency relief organisations to test their innovations. (We return to this issue in the section on Innovation diffusion and adoption)

---

<sup>15</sup> This reflects a view that is certainly held by some practitioners that the profit motive and the principles adhered to by humanitarian aid workers are incompatible.

In addition to private sector companies, there are a growing number of social enterprises in the WASH sector. These include organisations such as Loowatt who have developed a mechanical sealing unit for toilets in order to contain human waste or Sanergy who have developed an innovative business model for franchising toilet services. Although primarily operating within a development context, there seems to be an increase in interest in the role that social enterprises might be able to play within the humanitarian sector as illustrated by the HIF funded collaboration between Sanergy and Goal in developing a faecal sludge management system for use in the humanitarian sector. It was suggested by more than one interviewee that such collaborations might lead to alternative and innovative business models which many humanitarian practitioners would be more comfortable with than the more commercial approaches of the private sector.

### **Project champions, intrapreneurs, and affected communities**

The humanitarian aid sector is no different from any other in having its share of innovation mavericks. Within WASH we have come across a number of leaders and project champions within NGO and inter-governmental organisations who are located within the established WASH organisations and are important in setting agendas and driving through changes. They are representatives of their specific organisations, but they also seem to work somewhat outside the core organisational direction and have allegiances that span multiple roles, such as participation in the Cluster.

In addition there are *creative mavericks*, who identify a particular solution and make every effort to ensure that this idea is taken through to implementation (potentially without listening to whether or not there is a real need for this product or process). This is the standard story of the individual entrepreneur as the generator of innovations, but we also need to think about how the larger, more established organisations become more entrepreneurial with a systematic approach to innovation.

Finally, there are also network leaders or catalysts who operate as nodal points in the network, drawing towards them and orchestrating different bundles of people and resources. And, although there is discussion within the sector about the role within an innovation agenda for affected communities themselves, there are few examples of end-user inputs into innovation other than for receiving feedback.

## **Funding for WASH Innovation**

### **Sources of funding**

With more than 4,400 NGOs working around the world providing humanitarian assistance (ALNAP 2012) calculations of humanitarian aid expenditure are difficult to estimate. Within the small group of dominant actors an estimate of \$2.7 billion has been suggested. In OCHA annual reporting on humanitarian data (UNOCHA 2014) it is reported that for the WASH sector over \$631 million had been requested and \$333 funded (48%). UNICEF, the Cluster lead, reported that in 2012 its expenditure for emergency coordination and response in the WASH sector alone was \$146 million (UNICEF 2012).

No one has even attempted to calculate the proportion of this that is spent annually on innovation within the WASH sector. While some of the larger actors have started to budget money for innovative activities, created specific roles for *innovation managers* or *Heads of Innovation*, established labs or *innovation spaces*, no total figures exist for such expenditure and even within individual organisations there are no reliable estimates of what proportion may have gone to WASH related innovative activities. In our interviews, as we have already noted, rough estimates were made by knowledgeable sources that historically 80% of such expenditure will have been on Water, although within the last five years there has been a significant increase in spending on Sanitation to, perhaps as much as 40% of the total. Innovation spending on emergency Hygiene has been described as being "*minuscule*". When asked if WASH humanitarian innovation spending might be as high as 1% of total expenditure, only one large donor interviewed thought that this seemed like a reasonable assumption. Most felt it was considerably less.

Nevertheless, as one interviewee reported, "*there is a proliferation of innovation funds at the moment*". Upon close examination of expenditure from those mentioned most frequently were, in fact, more within the development arena than for humanitarian response. Of the funding programmes that were within the humanitarian sector, the ones usually referred to as the most important were the Emergency Sanitation Project which has received \$1.2 million in support from OFDA and is credited with dramatically increasing the number of innovations being developed in that area, the European Union's S(P)EEDKIT project (for which we could not find published figures for the WASH component of this programme), and the Humanitarian Innovation Fund which received £3.5 million from DFID for WASH innovation (of which £587,00 was allocated in 2014) but have also funding WASH projects from its core grants programme. Organisations such as Oxfam have created their own Innovation Fund (which, as reported earlier had approximately £400,000 and had funded thirteen pilot projects with more being sought). Internal innovation funding from other NGOs does not seem to be separated from overall operating budgets but is, nevertheless, likely to be rather small.

### Allocation of resources

In spite of a perception amongst those interviewed that there has been an increase in funding, there does not appear to have been any major allocation of funds for WASH innovation. In all likelihood, the perception is caused by the raising awareness of the importance of innovation which has resulted in the new job titles and creation of *innovation spaces* and the few larger programmes mentioned above.<sup>16</sup> Furthermore, it was suggested that there were often constraints on such funding that did exist on several levels including:

- having short timescales for completion;
- the propensity for donors to over specify their requirements (which seem to differ from the directions that NGOs strategies wished to go); and,
- a tendency to go for *low hanging fruit* (due to risk aversion and to assure quick success).

---

<sup>16</sup> These, of course, do require additional resources.

Such limitations certainly seem to have contributed to the dominance of incremental innovation in the sector. There was also the oft-repeated concern expressed that money that was available was too often limited to the development of innovations to a prototype stage but no significant provisions made to promote or propel innovations into widespread diffusion. Comments which reflect these concerns included:

*"A lot of projects try to get a prototype but there is no funding for manufacture or up-scaling. I think aid agencies expect companies to do the up-scaling, they are not really committed to funding it."*

*"There's more funds out there than we've got the time for to actually write proposals. And then you get to realise that what they're calling for is not quite what we want to do. So it is tricky. I think it's tricky for all organisations because some of the funders and Gates included have got more picky, or they've got more distrustful or somehow they're been hoodwinked into having all their own specialists and you get five WASH people in the room and they get five different ways of addressing the WASH problem."*

It was suggested that it wasn't just the tendency for innovation specific funding to be short-term in nature but also the annual funding of operational programmes that were an inhibiting factor for innovation.

*"A lot of people might say there needs to be more innovation funding but I don't really think so. We just need more space to work within a freer environment. If you look at South Sudan, one of the worst case scenarios, with one year funding over and over again there isn't time to do it differently. You do one twelve months cycle and you are already writing your next proposal after nine months. You are stuck. There is no space to innovate."*

Some larger funding programmes such as the aforementioned Gates Foundation's *Reinventing the Toilet* may have a more dramatic impact on the Sanitation sector, given its criteria for toilets that do not need to be linked into sewers, use water, or electricity. However, the extent to which such an approach will be feasible in the near future within a humanitarian emergency setting, let alone a development one, is questioned by some of our interviewees, even those who appreciate the high profile nature of the programme and potential boost to interest in Sanitation, emergency or otherwise.<sup>17</sup> It was suggested that there was a difference in approach between foundations such as Gates and most state or agency funding organisations which have to be publicly accountable for their spending. Comments which reflect such sentiments included:

*"Our project is something new which is very high tech. Obviously it is a different approach from that of (name of a government donor), they (Gates) have the freedom to spend their money in any way they like."*

---

<sup>17</sup> While criticised by some commentators as being hi-tech solutions that are unlikely to see the light of day anytime soon, they can be perceived as analogous to the concept car approach of the automotive sector in which automotive companies attract attention via futuristic cars that include many ideas under development in their R&D labs but are unlikely to be available for mass production for many years.

*"Gates now have this little counter-area of kind of technical advisors for WASH, they've got their own little things that they fancy which may not be the same as what the organisations like Oxfam or ACF or someone else fancy."*

*"Their (GATES) approach is that they will fund a lot of high risk projects in the hope that they are going to get one that works. Their view is that all you need is one game changer. You don't need ten games changes, you just need one at that level of innovation."*

This approach was contrasted with the Canadian government's approach, which was described as the "*poor brother*" of the Grand Challenges as they adopted more conservative criteria. These alternative approaches were mentioned without any judgement being ascribed to either as being more valuable than the other.

The Gates Foundation was, however, also praised for its two-stage approach to funding in which an initial six months or a year's worth of funding was provided to develop the concepts before a decision would be taken on a full proposal. Although not on the same scale as this the HIF divides its responsive mode funding into small and large grants with the former being specifically for the testing and developing of new ideas. As referred to above, the Gates Foundation is experimenting with supporting service level models of provision (and thinking of WASH more in terms of a utility service), leaving the technological decisions to the service providers. This in itself may be an innovative way of addressing the problem, although its impact on product development remains to be determined.

Other people interviewed did, however, have strong views that conveyed the conservatism of some in the sector. While not necessarily against innovation, they called for an approach which was "*anchored in operations and reality*". This viewpoint is reflected in the comments of one highly respected senior operations programme manager who complained that:

*"One of the things I fear with innovation is it has been handled lately is that it can overshadow things that are core in humanitarian aid. Sometimes it is picked up at the highest management level as 'the thing to do' at the expense of very important things that we have been doing for years and have to continue doing. In an age when funding is very limited, it shouldn't come into competition with some of the other things which are core, otherwise you will seed a conflict."*

While it is unlikely that at the present level of innovation funding that any operational funding is being diverted from emergency requirements, it is also true that many working on the ground during an emergency appreciate the incremental approach if they solve the problems that they experience on a daily basis. As mentioned earlier in the section on Actors, it was also suggested that such innovation occurs regularly "*in the field*" as needs require (which some might consider as the testing of new ideas) but that there just isn't time to "*capture*" them or to do research on their effectiveness – nor do they have the capabilities to apply a rigorous methodology for assessment purposes even if they had the time. Others suggested that even if more money was made available for WASH innovation that "*the ideas just aren't out there*".

## Innovation needs and how they are defined

### Perception of the need for innovation

A key assumption of our model is that, particularly in the absence of market mechanisms, the key driver of the innovation ecosystem is the high level of concern within the humanitarian aid sector resulted from the occurrence of an increasing number and severity of emergency situations the sector is faced with. The rationale behind this is that the perception of need serves to focus people, activities, and resources on innovative efforts. In the case of WASH, there is a widely held view that without innovation, the sector will not be able to meet the increasing and shifting demand for emergency response.

Not only is there an increasing trend in the number, frequency, and severity of humanitarian crises, but it is also generally acknowledged that the nature of disasters themselves is changing. This change has implications for the types of emergency response that are appropriate.

The worldwide growth in urbanisation is a key factor here. The proportion of people living in urban areas is estimated to increase to 67% of the global population by 2050, compared to 47% in 2000 (UNOCHA, 2013). Much of this shift will be in the least developed countries, with the proportion set to double to 50% over the same period. As several respondents suggested, many of the current solutions employed by the WASH sector were designed for non-urban situations and may not be appropriate for the future. The Haiti earthquake in 2010 was identified as an important turning point in recognising the need for different solutions in responding to urban disasters.<sup>18</sup> In the words of some of our respondents:

*"Haiti [was] a wake-up call – the product, processes and programming modalities that we have are no longer fit for purpose. The number of horror stories that you hear on the WASH side in Haiti - people trying to build pit latrines in concrete or where there was a very high water table, or people getting caught in contracts with Portaloo companies ... with no cost recovery mechanisms or exit strategy, nowhere to put the slurry, I could go on and on. It made us realise that we didn't have the tools that we need. And donors and agencies recognised that."*

*"In Haiti the problem was space, how and where you put latrines ... people have moved out of areas and you've only got a limited space to do things. In a refugee camp that is not a problem. Refugee camp problems are more about careful planning and security. It is less about the technology because when you've got space you can do what you like. You just need to make sure that your security side, particularly for women is correct. In an urban environment that's not so easy to do, if you've got a damaged building or lots of damaged buildings around either due to an earthquake or due to a civil conflict situation, how do you provide safe latrines and protection of that so it's not going to pollute anymore."*

---

<sup>18</sup> While Haiti was clearly a landmark in terms of channelling efforts for innovation in the WASH sector, one respondent cautioned against *learning too much from Haiti*. Although this might seem like a controversial statement, the point being made is that the specific context and needs vary from disaster to disaster. If there is too much focus on generating innovations for one type of disaster, then there is a risk that the sector will be left vulnerable and unprepared in the face of future events that do not correspond to this blueprint.

It is evident that the historical progression of particular kinds of humanitarian crisis has had an important influence on shaping the overall pattern of innovations in the WASH sector. This includes not only the type of innovations generated, but also the intensity of effort, resulting in ebbs and flows in the innovation ecosystem over time. For example, the serious problems in coordinating the humanitarian response to the Indian Ocean earthquake and tsunami in 2004, and similar problems in dealing with the crisis in Darfur in 2004 and 2005 prompted the development of the Cluster approach (Stoddard *et al.*, 2007; UNICEF, 2008). The implication is that the innovation ecosystem as a whole tends to evolve in response to different humanitarian events. This historical trajectory appears to take the form of what has been termed a *punctuated equilibrium* with bursts of concentrated activity punctuating longer periods of less intense development (Gersick, 1988, 1991).<sup>19</sup>

Thus, specific disasters cast a historical shadow of varying length, with new events adding to and sometimes transforming the humanitarian agenda. It remains to be seen, but it is likely that this punctuated equilibrium will become more compressed as the incidence of disasters increases and offers more and more experiences from which to learn. However, there is by no means a straightforward linear connection between humanitarian crises, perceptions of need, innovation activities, and innovation outcomes. As we shall see in the following sections, the processes of identifying needs and deciding on appropriate solutions is complicated by such things as the numbers of stakeholders involved, competing perspectives on priorities and how to tackle them, uncertainties about the specific conditions presented by different disasters, and limits on knowledge flows from the point of need to those seeking to develop innovations in the WASH sector.

### **Influences on the innovation agenda**

As we have already discussed, the WASH innovation ecosystem involves a diverse range of actors occupying different roles. Given this diversity, an important challenge is how to negotiate across a wide range of competing perspectives and interests. The general view is that the WASH sector has been rather more successful in this respect than some of the other areas of humanitarian response.

According to one respondent, however, the apparent consensus in the WASH sector is not so much about social or political cohesion between the actors, but more to do with the problems and challenges faced by the sector lend themselves to a more closely circumscribed range of possible solutions about which it is easier to arrive at some sort of agreement.

*“And then they did make that comment that you might be able to come up with a consensus in the WASH field because you're more together. I would say well actually it's not because we're more together. It's because actually. ... It's the product argument again. Because there's products and we all agree on the products we need, so it's a lot easier.”*

---

<sup>19</sup> One interviewee pointed out the although he felt that the lessons had been learned from emergency situations in more urbanised setting and that these had begun to influence innovation thinking, that this had, to some extent, been sidetracked by the long-term and large-scale problems created for the humanitarian sector by the Syrian crisis.

Nevertheless, there were also some concerns from respondents about whether the apparent cohesion of the sector is necessarily always a good thing. Certainly in terms of offering a more consistent and coordinated response to crises, the leadership provided by the Cluster is generally welcomed. However, as has previously been pointed out, discussions on new kit were general held within the Inter-agency Forum. This had a smaller membership (between seven and nine organisations) and some concern was expressed that it was primarily an established *old guard* that were involved in those discussions.<sup>20</sup> Although this has probably been useful in generating discussion around innovation amongst those who were really interesting in moving that agenda forward, it may limit the potential for new ideas to emerge if it limits the ability for new voices be heard.

More clear cut, in terms of agenda-setting, have been a number of important initiatives in the WASH sector aimed at making the process of identifying and meeting needs more targeted and systematic. For example, the gap analysis commissioned by the Humanitarian Innovation Fund, which involved extensive consultation with a wide cross-section of actors, was “... a targeted effort to identify different stakeholder perspectives of the gaps and spaces for innovation in emergency WASH.” (Bastable and Russell, 2013). Overall, 57 areas were identified as requiring attention, of which 12 were judged to be particularly significant (see Table 1).

1. Latrines in locations where no pits are possible (urban, high watertable or prone to flooding)
2. Community participation and empowerment of vulnerable groups, including monitoring and evaluation from the outset
3. Latrine emptying and de-sludging
4. Hygiene promotion and the importance of understanding context, including socio-anthropology issues
5. Community Led Total Sanitation (CLTS) and sanitation marketing
6. Urban alternatives for excreta disposal
7. Exit strategies and sustainability issues from the outset
8. Final sewage disposal options after desludging and treatment
9. Further development of non-toilet options/ early response/mobile
10. Hand washing hardware and promotion and sustainability (including soap) and non-soap options
11. Water Treatment, particularly bulk and point of use household filters, including cost and sustainability issues
12. The need for low-tech WASH solutions acceptable and sustainable by locals

**Table 1: Priority needs identified by HIF gap analysis for WASH**

The aim of the gap analysis was to allow resources and efforts to be directed at what are considered to be the most significant areas of need. It is intended as the first stage in facilitating “... a structured innovation process to identify the strategies, methodologies and technologies that can be used to address the gaps which are not already being dealt with by other initiatives.” (Bastable and Russell, 2013).

The Emergency Sanitation Project, funded by OFDA, is another initiative designed to identify specific areas of need. This is a collaboration between IFRC, WASTE, and Oxfam GB. According to one respondent:

<sup>20</sup> It was, however, also suggested to us in interviews that *the old guard* were now changing

*"This came out of a few meetings and there was a lot of kind of discussion in the corridors at Cluster meetings or whatever saying Sanitation is a problem, we're not really getting the results we want from suppliers and things like that ... And I think there were some high aims on that trying to get some different voices into the discussion."*

The inclusion of the Dutch-based organisation, WASTE, in the consortium was an attempt to bring in alternative ideas by seeing how far their experience in the development area could be applied to emergency settings. The project also sought to make contact with a wider base of suppliers by presenting a number of design *challenges*. Compared to the rather high-level priorities identified by the HIF gap analysis, the challenges presented by the Emergency Sanitation Project are based on quite detailed design specifications.

The use of challenges to attract solutions for the WASH sector has grown in recent years. One respondent offered the following example:

*"We started the issue of innovation based upon challenges and this resulted in new products coming into the market ... What we did at the time was to catalogue all of the challenges that lead WASH sector colleagues were facing during emergencies and presented that to investors."*

HIF has also used Open Innovation Challenges to try to attract ideas from as wide a range of potential contributors as possible by using the crowdsourcing platform Innocentive. Previous challenges have focused on latrine lighting, solid waste management in emergency response, and a collapsible jerry-can. Other challenges, such as the ones funded by the Gates Foundation that we described in the previous section, can be contrasted to the more specific problem focus of the challenges outlined above. These are about trying to push the boundaries of what is possible, even if the risks of failure are arguably higher.<sup>21</sup> Part of the thinking behind this challenge is to incorporate viable business models and service models within which the kit would operate – thus incorporating both product and process innovation.

In terms of defining innovation needs, there is some disagreement about whether these challenges should be narrowly prescribed or whether this limits the field of possible solutions. One respondent was critical of top-down approaches for potentially excluding input from smaller NGOs and local groups and thus limiting innovation. However, others took a pragmatic stance in suggesting that it is easier to attract the necessary resources by adopting a more targeted approach which, they suggest, also suits the preference of donors. As was suggesting in the section of Allocation of resources in the view of one interviewee:

*"I think it reflects low hanging fruit. The donors like things they can get their hands on that have ... you know ... a problem with a solution and you can get your hands on it and you can show it to your back donors."*

This dilemma raises an important issue about which actors (or combination of actors) in the innovation ecosystem are best placed to identify and meet the needs of users and beneficiaries. However, it should be noted that, due to the nature of the humanitarian sector, neither of the

---

<sup>21</sup> While the solutions may appear to be expensive, some argue that they may ultimately be lower in costs when life-cycle costings (including maintenance and health costs) are included.

approaches described above are based upon *market competition* or *market selection* of end users (i.e., affected communities) as would be the case in other sectors of the economy.

### Connecting innovations to the needs of users

The ultimate success of the innovation process depends on being able to make connections between the needs of users and the potential innovations able to meet those needs. How this is achieved typically sits on a spectrum between demand-pull and technology- (or solution-) push, although the emphasis in the innovation literature more recently has been on approaches that combine elements of both through co-design and a more interactive engagement between users and producers. However, as suggested in the literature on user innovation, it is not always obvious who users are, let alone what their needs are (Flowers et al 2010; von Hippel, 1986, 2005). In the case of the WASH sector, several of those interviewed identified NGOs as the primary users of innovations as they are the ones who deliver the innovations on the ground when responding to emergencies. As such, they are in a suitable position to be able to specify what solutions are needed and whether they work in practice.

Having said that, it is evident that there are potentially multiple types of user, including both large and small NGOs, UN agencies, governments, community groups, the armed forces, and affected populations themselves. As one respondent put it, *"It's difficult to define the real needs because there [are] many people and organizations involved"*. It would appear that there are three main challenges in attempting to define innovation needs in the humanitarian area:

- firstly, it is not always clear who is the main beneficiary;
- secondly, there is the issue of who is able to act as an effective voice for beneficiaries (e.g. local community leaders, governments, NGOs); and,
- thirdly, it is uncertain whether those representing beneficiaries have a deep understanding of needs in response to any particular humanitarian crisis).

There is nevertheless a clear recognition that successful innovations are those that ultimately meet the needs of those affected by humanitarian crises on the ground. However, there are important variations in the extent to which actors engaged in innovation have direct experience of such needs and, therefore, there is a potential disconnect between affected communities, those that deliver emergency responses, and those that generate innovations.

*"Agencies seem to view that there is no need to involve end users that much but some think the other way. I think there is some uncertainty of how to involve them"*.

Even given these difficulties, some actors in the WASH ecosystem engage much more with end-users than others. For NGOs with direct experiences of responding to emergencies, there is the potential to learn from deploying particular solutions in the field, thereby influencing the future understanding of needs. A number of respondents describe attempts by NGOs to make this process more systematic, as in the following example.

*"I would say that first we are operationally driven and then comes the research. So all the research we do is normally operational research."*

Not all innovation actors have the same opportunity to connect directly with the field of operations. This is especially so for many of the suppliers of WASH technologies who are frequently reliant on intermediaries for their understanding of what is needed. In the case of one supplier, they rely on agencies and NGOs to feed back information from the field about the particular conditions of any given crisis. However, being distant from the point of need, they were unsure about the quality of this information and how far it is an accurate representation of actual needs. In other instances it appears that there is not even this level of connection, with many being critical of solutions being developed without any detailed understanding of the needs of those who are supposed to be using them. As one interviewee commented:

*"A lot of these academics have never been in the field and have never smelled shit from a latrine – until you do, you don't know what you are doing. You need to calibrate your ideas to the reality ... I guess in terms of identifying need I value field experience a lot."*

As suggested earlier, there is a critical issue about the changing type and context of humanitarian disasters that means that the innovation landscape has to be constantly shifting to respond to this. It was suggested that many in the humanitarian aid community were primarily experienced with working in rural settings and that solutions designed for such environments are not appropriate for a more urban setting. A recurring theme in the interviews was also the need to be sensitive to the particular social, cultural, political, economic, and environmental conditions of humanitarian crises occurring in different parts of the world. Without an understanding of these complex differences, it is easy to offer solutions that do more harm than good. There are, nevertheless, also pressures to offer standardised solutions so as to achieve efficiencies. As one interviewee commented:

*"... when we are talking to NGOs they usually ask us to find a universal solution. When we find universal solutions there is always someone who says, 'In the South of Sudan it wouldn't work'."*

As such there is clearly a tension between providing solutions that are more generally applicable and ensuring that the particular requirements of emergency response are met. A barrier to managing this tension, according to several respondents, is the tendency to provide solutions that are too complicated to be usable in the context of most disasters. For one interviewee, *"... innovation is the most simple direct means of serving needs"*. Indeed, the general view was that many WASH related problems in emergency situations can be addressed through relatively simple solutions, yet there is often an impetus for developers to offer complex solutions that are not necessarily appropriate for the emergency context. In some instances this is driven by the nature of the funding process and how decisions are made about the allocation of resources. As one respondent suggested:

*"... there are some areas where people have come up with some magical devices when there are things that are really very simple and doing the job very effectively ... If you speak to Water Aid, for example, people are approaching them every week with a new magical device which is going to solve the whole world water crisis - it is usually a solar pump or water filter - and these devices, some go on to win competitions and get significant funding [when] in the end they are essentially not that appropriate."*

The temptation to pursue high-tech and complex solutions also appears to be strong.

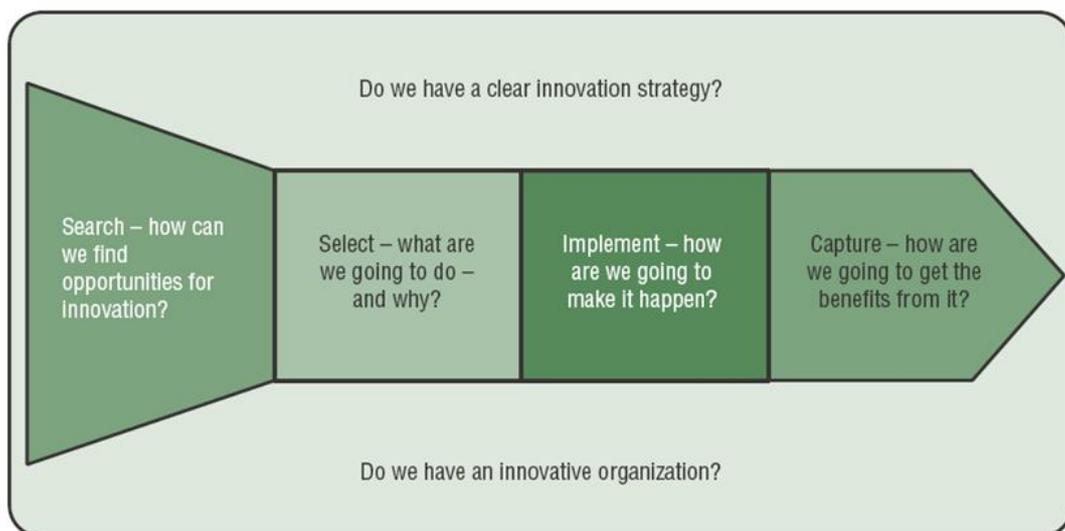
*"We would like to think we are taking a low-cost approach to what we are doing. We have colleagues who are throwing a lot of money to building machines that go ping and very complicated molecular biology but are not the sort of approaches to be useful in those parts of the world where water quality impacts upon people's lives rather than on quality of life necessarily."*

Similarly, according to Dorea (2014: 2):

*"Water treatment technologies exemplify the slow or non-existent effective uptake of new developments in humanitarian emergencies. Many novel 'high-tech' processes that are efficient in the removal of particular contaminants in controlled conditions do not become effective solutions in practice. Field experience suggests that some of the commercially-available treatment 'kits', many do not seem to be compatible with humanitarian relief requirements. Some of the common shortcomings are the inability of these technologies to cope with field conditions typically encountered in resource-limited humanitarian emergency contexts. Arguably, this is also a shortcoming of the development process of these technologies."*

## Generating, developing and selecting solutions

The innovation process is often conceptualised as a funnel whose wide part is the front-end of innovation where there are multiple ideas and potential solutions that could be pursued (see Figure 2). This part of the innovation process is about generating new ideas, deciding which ones should be developed further, and then selecting from a more or less broad range of possible solutions.



**Figure 2: Simplified model of the innovation process (source: Tidd and Bessant 2013)**

Having an idea or a concept is usually seen as the first step in innovation, but ideas can vary considerably in terms of where they come from, how developed they are, why they are

developed, and who comes up with them. In the WASH sector there appear to be a number of different trajectories for the generation and further development of ideas.

One trajectory involves attempts to focus the idea generation process on targeted areas of need. There have been several initiatives to bring together key actors to generate new ideas to solve problems that are reasonably well defined in the sector, or at least readily identified and agreed upon. Examples of this include the two-day Stoutenberg Conference in 2011 and a workshop on emergency sanitation in Delft in 2012 organised by the Sustainable Sanitation Alliance (SuSanA). The former helped to narrow down the focus on priority areas for improvement, while the latter took these further to develop more detailed specifications, which have been subsequently taken forward by the Emergency Sanitation Project. Another example is the 'Design a Bog Day' organised by Oxfam in 2013, which aimed to generate ideas for specific solutions to four areas of need (McBride, 2013):

- A household level, water-saving hand-washing device
- A foldable or flat-pack latrine superstructure for providing shelter, privacy, and security
- A trench lining for difficult soil conditions
- A raised latrine for situations where it is not possible to dig a pit latrine due to rocky ground, high water table, or other problems

Although this was altogether quite a targeted process, purposeful efforts were made to attract participants from beyond the usual suspects, resulting in a range of attendees, including representative of manufacturers and suppliers, product designers, academics, and NGOs. According to McBride (2013), the rationale was "... to bring together people who would approach things differently and meant networks could be built between people who might not normally meet". This resulted in a proliferation of ideas which were then subjected to a process of filtering and closer investigation.

*"The most promising sparks of ideas were fanned into embers by considering how the products must perform at each stage in their life: in use, for maintenance and installation, in selection by the project team, being transported, being manufactured, and right back to the design stage."*

This illustrates some inherent tensions and dilemmas in the process of ideation (generating new ideas). The first is about how widely to cast the net in the search for new ideas. There is an understandable temptation to seek ideas from familiar places; these often fit more closely with existing beliefs and priorities, they may be more closely connected to a detailed understanding of the needs and challenges of the sector, and there may be a higher level of trust between the parties involved. However, this also means that the field is potentially restricted to the familiar, which can result in limiting assumptions being left unchallenged. As one interviewee expressed it: "If you've been in something a long time you may not see stuff that's new and exciting". This is where it is useful to bring people in from outside the usual network of participants so as to challenge entrenched assumptions.

*"Of course there are many good solutions that come from the sector but it can be good to look at the problem from the outside with different eyes and not be so ... the WASH sector has used the same methods for a very long time and sometimes it works and sometimes it doesn't work but I think it was good for someone from the outside to come in and look at the problems and come up with new ideas and come up with something else?"*

However, the challenge here is that those unfamiliar with the area may not necessarily have a good grasp of the realities involved. For this reason it is helpful to combine perspectives from both more established and external actors, as in the above workshops, in order to achieve an appropriate balance between what is possible and what is feasible. One respondent, reporting about another forum for generating WASH related ideas, suggested that it is nevertheless useful to suspend the normal rules and restrictions and proceed as if they did not exist.

*"When we were sitting down and talking about these ideas it was very much done in a non-committal fashion. It was good because we could just talk about what we thought was needed not about what we thought we could do. Often what we think we can do is different from what we think we should do."*

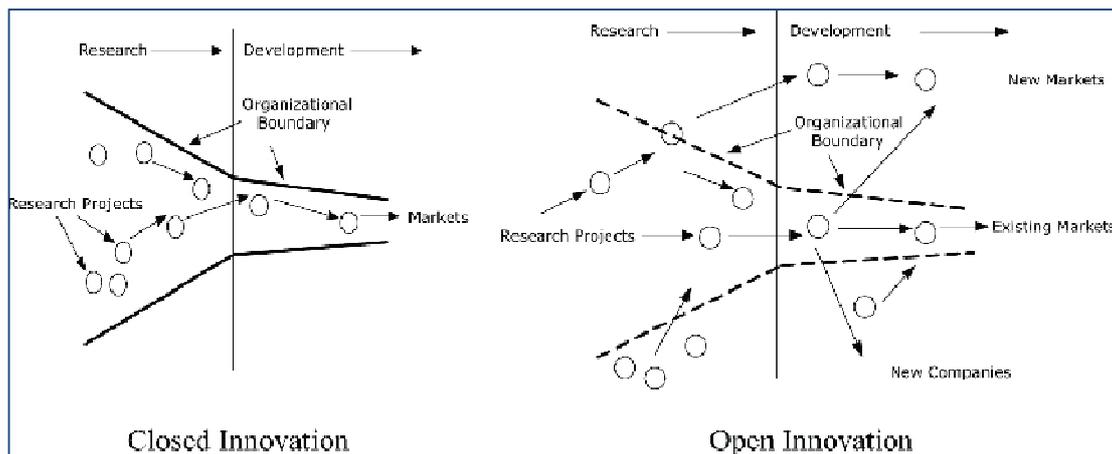
However, it is still important that this sort of blue-sky thinking is, at an appropriate point, subject to scrutiny in terms of how practical the solutions are likely to be in use. When is the appropriate point to do this is not always easy to judge. If the search process is closed down too soon then there is the danger that potentially better solutions will be excluded. The idea generation process does not necessarily follow a predictable and linear path.

Such multi-party forums can be a useful source of inspiration and creativity, as well as places where solutions are selected and consensus achieved. In terms of the latter, however, there are powerful tendencies in the WASH sector to tie things down and go for the solutions that are closest to being achievable. According to several respondents, this means that it is not always the *best* solution that wins.

*"In the Innocentive challenge on latrine lighting, for example, the one that scored highest was basically solar lighting on a pole - an off the shelf solution with some very minor adaption to make it a bit more difficult to steal. That is not innovation as far as I am concerned. There was another solution which was a gravity-based solution that wasn't quite there - it needed a bit more development and more thought to how much light needed to be generated, did it need to be on all the time, could you calculate on a camp of a certain size that there would be enough through-put, etc. It is a bit more radical, more speculative technical endeavour, might be cheaper but it is a higher risk."*

While it is perfectly reasonable to include risk and time-to-deployment in the selection criteria, along with all the other things that needs to be considered such as functionality, usability, up front and long term costs, durability and reliability, size and weight, and so forth. On this basis it makes sense to bring in "... *the people that we already knew were nearly there*". It needs to be recognised that there are limitations in always going for the safe option, but there are clearly pressures in terms of making decisions about how to allocate limited resources to innovation and questions of accountability that steer the system in this direction.

In contrast, there is another trajectory in the front end of WASH innovation that is much more open to a wider and potentially more radical range of ideas. To return to the funnel analogy, the wide end of the funnel is larger with the aim of selecting from a broader set of possible solutions. This is one of the key features and rationales of open innovation (Chesbrough, 2003; Chesbrough *et al.*, 2008; see Figure 3). As we have seen above, the more targeted approach to developing ideas does not necessarily mean that it is closed to input from external sources. However, in comparison with more developed forms of open innovation, the number of potential participants and the scope of the problem space are typically smaller.



**Figure 3: Closed and open innovation (source: Chesbrough, 2003)**

The open innovation model is heavily biased towards private sector business and technology-based innovation, but the overall message is still useful in pointing towards the diversity of actors, knowledge, and ideas that may contribute to the process. Indeed, this concept has explicitly influenced some directions taken by the innovation agenda in WASH, especially in the use of challenges and competitions for attracting ideas from a wider base of contributors. The HIF crowdsourcing initiative using the Innocentive platform is a good example of this. These more wide ranging competitions are potentially valuable in their ability to generate an extensive set of ideas to choose from. However, their success ultimately depends on the quality of the contributions that they attract and how the competitions are structured.<sup>22</sup> Mechanisms need to be put in place to ensure that the initial ideas coming out of competitions and challenges are given the opportunity to be developed further so that iterative co-development can occur.

Targeted innovation forums and open innovation challenges are both examples of idea generation and selection that are steered and orchestrated by the users of innovations in the

<sup>22</sup> One respondent was critical of the Innocentive approach because it limits the possibility for the iterative development of ideas between relevant parties. According to the interviewee, the innovation process needs to work in the following way: "... you identify the supplier who's most close to the concept you want because no one's actually there and then you work with them backwards and forwards, backwards and forwards, and it might take a couple of years to get what you want and that's a lot of backwards and forward." In the case of Innocentive this is not possible because the identity of the contributors is not revealed until the competition is finished, meaning that there is limited scope for potentially interesting concepts to be clarified early on.

form of NGOs in combination with donors. However, other pathways to creating and developing ideas can occur without working closely with users. Several respondents talked about concepts being created by suppliers and the research base and being taken to a quite advanced stage of development before being presented to NGOs and other potential users for assessment. This clearly runs the risk of producing innovations that are disconnected from the needs of the users. Indeed, in some areas, such as water purification, numerous comments were made about there being a proliferation of alternative offerings from suppliers that NGOs are bombarded with and do not have the time and resources to evaluate. From the suppliers' perspective, there are often difficulties in getting responses from NGOs, which mean that the ideal of collaborative development involving users as early as possible in the innovation process is not feasible. As such they are left little option than to take their ideas forwards on a speculative basis and hope that these can subsequently be marketed successfully. Whether this represents an effective use of resources in the innovation ecosystem overall is open to question. It also raises wider issues about the engagement of the private sector and the use of more arms-length market mechanisms to drive the innovation process. This is not to say that it is not possible to engage suppliers early in the front end of innovation, although one interviewee suggested that this works best when the NGOs and agencies contact suppliers themselves rather than the other way round. This is what the targeted innovation forums in Stoutenberg and especially Delft were about. However, there can be difficulties in aligning the interests of the different parties. As one respondent commented about the Delft workshop:

*"That had pretty much 80% or 90% suppliers and then there were only a few of us there for the practitioners. That was interesting because what we hoped there were so many of them that they would get out of being a salesman for their products and actually start looking at the sector and what needs to be improvised. And they couldn't. The finding was that whichever group you stepped in, whichever challenge you gave them, they were there to sell their product. And their products seemed to fit everything. And it was a joke and kind of set the agenda back with trying to involve the private sector in innovation ... I still haven't given up hope that there must be a way of having creative minds and private sector to come up with solutions but we need to find the right people."*

Nevertheless, there are examples of suppliers being involved in the joint development of innovations. For instance, the latrine slab initially developed by Oxfam was further refined and adapted through interactions between the members of the Inter-Agency Forum working closely with the manufacturer. Equally, it is not always the case that developers and suppliers are distant from the needs of those who their products and services are seeking to address, although some evidently engage more closely than others

It is clear that an understanding of end-user needs and the specific contexts of emergencies should be an important driver for the front end of WASH innovation. For this, there needs to be links between those delivering emergency response and those identifying, selecting, and developing innovations. Several respondents described processes through which learning from the field are taken up by NGOs, but this was often not seen as a very systematic process. These boundary-crossing activities need to be facilitated, not just within NGOs and delivery agencies, but across a wide range of participants. As one respondent commented:

*“Ecosystem is a good term. It’s not just about one organisation. You need to create a whole environment – donors willing to fund, suppliers willing to supply, academics to feed in knowledge. It’s most likely to succeed when you have those players ... It works best when you’ve got people working together.”*

## Testing, evaluation and the evidence base

Having looked at the generation, selection, and development of promising ideas and inventions, we now turn our attention to the testing and evaluation of potential innovations. Given the possible risks of deploying inappropriate innovations in emergency responses, it is important that new products, processes, and approaches in the WASH sector are based on a suitable regime of testing and evaluation which allows for decisions on further development and/or adoption to be made based on appropriate evidence. While our interviews indicated that there are some efforts to make the collection and dissemination of evidence more systematic, there are a number of challenges and barriers that need to be overcome. As eluded to earlier, these include issues about the resource available for testing and evaluation, the difficulties of conducting effective research in emergency situations, and the potential inefficiencies and duplication of effort in the testing regime.

It is clearly important for an innovation to be tested for its suitability and efficacy. For larger NGOs and other organisations that have their own stocks and catalogue of standard equipment, the evaluation of alternative solutions is ideally part of selecting what is to be included. As one interviewee explained:

*“... we look at the market to see what WASH products are out there and look at our programmes and which products can serve the needs of our interventions. Based on that we do a thorough technical review before we adopt that product as a standard item into our catalogue.”*

Another respondent commented that their organisation was seeking to make the process of testing and review more systematic than it had been. This NGO has introduced a specific initiative to improve the collection of field evidence by preparing a series of research protocols to be followed when the next opportunity arises to validate new products and approaches in an emergency setting. However, in many cases it is important to have data on the efficacy of products and equipment before their deployment. Depending on the type of product and the capabilities of the NGO or agency, this may be conducted in-house, but for solutions with a more specialised technical or scientific base, it is often necessary to bring in expertise from outside, including universities, research centres, and private sector testing facilities.

As mentioned in the section on Actors, NGOs frequently develop close relationships with particular research groups and tend to rely on the same ones to conduct their testing. This partly reflects the relatively small number of institutions with specialist expertise on the WASH area, but it is also about building up longer term relationships where those involved are able to appreciate their respective priorities and ways of working. Several interviewees spoke of the divide between NGOs and universities that can make communication between them difficult.

The two sets of actors tend to have different perspectives on the degree of accuracy and level of rigour required by research and the time required to conduct it. As one interviewee commented: *The time frame for NGOs is very different from the time frame for scientists. If we were just doing research it would be longer.* Another suggested that there are *different standards of evidence and accuracy between NGOs and universities*, describing the evidence collected by NGOs as being more anecdotal. However, from the NGO perspective there is a question about how much evidence is actually needed to serve their purposes. The full standards of scientific practice may not be necessary to provide sufficient grounds on which to make decisions about alternative products or approaches.<sup>23</sup>

According to one interviewee, the Inter-Agency Forum provides an opportunity for sharing technical information about the efficacy of interventions without having to meet the higher evidence requirements of publication.

*“And that’s where we have also been putting onto the table non-official research or innovation in terms of strategies and things like that ... things that are not really scientific but that would be of interest, or things that we have initiated ... it was an operational improvement but it was not in the context of true research which implies that you have all the protocols, the potential publishing, and peer review and all that stuff. But at least people are aware that this was tried.”*

Because of the informal nature of this group’s organisation, it encourages a more open form of discussion. This can, however, also work to the detriment of the diffusion of information beyond those in attendance. Another respondent also identified the importance of multiple sources of evidence, over having to rely entirely on full scientific studies.

*“... the scientific rigour to validate one’s research has now gone up a notch. It’s no good for us just to say I’ve spoken to twenty people about this approach we used in an emergency and then give a presentation. So, yeah, even in that sector everything’s become a bit more ... better in an evidence-based way, but I think you lose something in that the informal feedback is also valuable.”*

However, while there are suggestions that both the standards and practices of collecting evidence are becoming more formalised, the overall picture that emerges from the interviews is that the evidence base is still quite limited. As one researcher commented:

*“I got an email the other day from someone running the WASH cluster out in Cambodia and he was looking at distribution of small packets of chlorine for water treatment and he asked what is the evidence behind that, especially if you are distributing them and not giving people any training in how to use them. He was shocked that there basically wasn’t any evidence at all.”*

And yet another noted:

---

<sup>23</sup> This is the logic behind the Minimum Evaluation Procedure developed by the WHO in the 1980s (Cairncross, 1990; WHO, 1983).

*"Companies say that they find it very difficult to get feedback on their products. Even when agencies test the products they tend not to use any methodology. I would agree that the evidence base is quite poor."*

There clearly are important limitations here in terms of the practicalities of conducting research and evaluation in emergency situations as illustrated by comments such as:

*"One of the challenges is that in emergency situations it is not deemed appropriate to do research and that can be very true but if it is always deemed inappropriate to do research than how can we actually get to evidence based practice because no one is ever doing any research because the situation is always so critical."*

*"What we have not come [up] to speed with is the reporting side of innovation where we report that technology doesn't apply. We have not been able to tap into that fully to map the different innovations but we are looking at that to see how we might be able to have more real time information on what we do and how we are doing it and the impact we have."*

The problem of building an evidence base is just as problematic in Hygiene as it is proving to be within Water or Sanitation. As one public health practitioner indicated:

*"The other main issue is the quest to know what works in Hygiene. What promotion works in emergencies? What works with communities? Can outcome be measured in terms of adoption? We can build facilities for people but if they don't use them it won't have the impact on health, so how do we engage with communities in order to maximise their impact – so it is still a bit of a challenge knowing what works and how it works. Finding out about that in an emergency situation is challenging in itself."*

Especially in rapid onset emergencies and in the early stages of responding to humanitarian crises, research evidently needs to take lower priority than providing assistance to those affected. There are also ethical considerations in terms of ensuring that the proposed study is not going to have an adverse effect on participants.

*"... if you do research, you really need to have all kind of things like an ethical review board and everything. If you think about just this simple process that takes four weeks, in an emergency setting for a cholera response, for example, if you don't have the papers and the protocol signed beforehand you will never manage to do it. This is what happens a lot of the time is that we are doing things but it's too late to try to make it [into] research afterwards once the things have been started."*

Given these difficulties it is not surprising that much of the feedback on different solutions is considered to be anecdotal. As one respondent suggested, *"a lot of the decisions are taken based upon the opinions of the agencies, the aid workers, who give feedback. But there is no proper methodology, it is all opinion"*.

Gathering more systematic evidence is important, even if it does not necessarily have to meet the sometimes unrealistic standards of academic scientific practices. In many cases this is essential for justifying the adoption of a particular solution to the donors. The larger NGOs have increasingly found it necessary to document what they are doing and collect evidence to show the suitability and effectiveness of a given approach or piece of equipment. For example, Oxfam

GB has been conducting cost analysis and testing of solar powered water pumps to evaluate their feasibility in emergency contexts. This resulted in technical data on the pumps – data that can be used to allay any concerns of donors about the predictability of the technology and/or whether the higher upfront costs sufficiently offset the lower running costs compared to traditional solutions.

While the cautiousness of some of the donors certainly acts as a brake on the adoption of what are considered to be untried solutions, the NGOs and agencies also face other constraints on their willingness and ability to evaluate alternative products and approaches. There are switching costs involved in trying substitute solutions which means that existing interventions continue to be used even if there are potentially better alternatives. As one interviewee explained:

*“We have a very high adoption cost for any new tool, product, or approach ... We get a lot of offers for water treatment plants, but we’ve already got 200 people trained on the existing one, so the new one would have to be really good.”*

Another respondent argued that the engineering orientation of the Water and Sanitation areas encourages a preference for tried-and-tested solutions rather than experimenting with new ones. This is in contrast to the Health area where, it was suggested, there is greater willingness to try new ideas in the field and collect data from these tests, arguably reflecting more closely the norms of medical practice.

There are, of course, direct costs associated with testing and evaluation and, given constraints on resources, there needs to be a good initial case to make it worthwhile testing any new solution. According to some, this is exacerbated because of the increasing expense of conducting tests, particularly where external parties are involved. In the case of universities, as discussed earlier (see section on Actors) the system has become much more formalised, requiring specific contracts and payments for work undertaken.

It is also not easy to attract funding from donors to carry out pilot tests on promising innovations, although some are more prepared to support this work than others. Reflecting the general fluctuation of resources relating to humanitarian aid, one interviewee commented that *“peacetime money is harder to get than emergency money”*. This places constraints on piloting new approaches in lower-risk environments in preparation for implementation in the next emergency response. Given these limitations, there is a good rationale for pooling resources and having shared testing facilities. This idea has been proposed to the WASH cluster on more than one occasion. However, as one interviewee recounted:

*“... there wasn't a lot of take up of that. There are too many vested interests with organisations all saying that they want to do their own bit of research. And it's a funny one because ... the emergency agencies aren't actually doing a lot of their own research.”*

What is clear, however, is that there has to be an effective validation process to ensure that potential innovations are indeed effective and suited to emergency response. Without this, there is a danger of deploying suboptimal and potentially damaging solutions. This needs to be

an independent process, or at least validated by those organisations procuring the equipment, as it appears that many offerings are made on the basis of less than reliable evidence.

*"... there are many technologies that get used and there is absolutely no evidence that they work and all the academic studies say that they don't and still they are heavily promoted."*

*"And we do get this a lot with water filtration and it often turns out to be too good to be true. And the other sector is bio-additives. Every few months now somebody comes with a good bio-additive that you can put in latrines that will eat all the solids. And then we try them and never had any that have worked. So there's a lot of people winging it out there now they realise there's money to be made from the humanitarian sector."*

## Innovation diffusion and adoption

In order to qualify as an innovation, whether in product, process, market position, or overall paradigm, an original concept needs to be taken all the way through from inception to implementation. Moreover this implementation needs to add value in some respect. However, this leaves a key question about how widely an innovation needs to be diffused and adopted for its value to be realised.

In the humanitarian space there is a definite emphasis on the reach of innovation in delivering the greatest benefit to the greatest number. This is reflected in the ubiquitous use of the term *scaling up*, which captures the importance of taking proven equipment and approaches and extending their coverage to meet the needs of affected populations. Since the numbers involved are large, scalability is understandably seen as a key characteristic of successful humanitarian innovations. This applies as much in the WASH sector as other areas of emergency response. The emphasis on scale is evident in the definitions of innovation used by humanitarian and development organisations. For example, the recently established USAID Global Development Laboratory has set a quite specific (and challenging) definition of innovation as *needing to reach a minimum of 250,000 people and to be shown to have worked* in order to qualify as a proven solution. However, the main message coming from our interviews was about the multiple challenges and barriers to the wider diffusion and adoption of innovations. As one respondent commented:

*"The route to diffusion is quite unclear."*

According to several interviewees, as mentioned in the section on Allocation of resources, the support for innovation is skewed, with much more emphasis on generating ideas, and to some extent testing them, than on encouraging their more widespread adoption:

*"The money is to pilot ... to develop and pilot it, and then it stops."*

*"Another criticism of innovation funds is what they want to see is the development and come up with something, and then they're off on the next adventure. To have the follow-on to say well actually now we want to pay for enough money to get it in the field and get it used that doesn't happen. That's a real challenge".*

This is to a large extent a function of the system of resource allocation and how funding priorities are decided. According to one respondent, this results in a funding gap for scaling up innovations.

*"... it's not quite funding what's in a programme and it's not quite funding innovation. It's sort of in the middle and it's not that sexy. But that's where we see our funding gap at the moment, not in the actual development but in the wider dissemination."*

To some extent this may also be an implicit influence of more conventional approaches to innovation policy based on traditional assumptions about the role of market mechanisms. The logic behind these approaches is to create the conditions for the supply of potential innovations and then let the market decide which of those are selected and adopted. Notwithstanding the limitation of these assumptions in how markets work for private sector innovations themselves, they are arguably even more constricting given the nature of incentives and decision making in humanitarian sectors such as WASH. For some there is a degree of serendipity (or even arbitrariness) in why certain products and approaches are adopted instead of others.

*"And the reason why some products totally take-off is actually due to all sorts of weird and wonderful quirky reasons that may not be logical at all. And that we're not in control of all those quirky things that go on about the right person being in the right place, seeing this thing and knowing the person with the money and they want to get a good few more."*

The diffusion of innovations is certainly non-linear and unpredictable, but there are nevertheless features of the WASH ecosystem that make certain channels more amenable for diffusion than others. For example, there are key actors in the WASH community who are continually scanning for new ideas, wherever they come from – e.g., by coming across new approaches in the field, seeing them at trade fairs and exhibitions, or having them demonstrated in forums such as the Inter-Agency Forum. This raises issues about the visibility and observability of different innovations. Not all innovations are as visible as others. Moreover, the benefits of many innovations are not always readily observable, either because they need to be seen under their actual conditions of use or because they require specialist testing to reveal their real functionality (which links back to the issues covered in the previous section). Although designed for use more for a development setting, one initiative aiming to help in this respect, and which might provide interesting lessons, is the EU-funded WASHTECH project (WASHTECH 2011).

*"The project went on to develop a tool called the Technology Applicability Framework which was a tool to help decision makers decide whether a technology was applicable. It was not a technology selection tool it is a tool that if you had a pilot of a technology how would you decide whether it was a technology to try to scale up. Or as a technology developer how do you decide whether to scale it up. It is principle for national decision makers to decide what technology to use in that country and also for local governments or NGOs to use to decide about technology".*

However, even if an innovation is highly visible, its benefits have been clearly demonstrated, and the criteria for selecting it have been clarified, there may still be a number of limitations to its uptake. Thus, despite a number of attempts to standardise products and approaches across

agencies, these have only been partly effective. For example, the WASH Cluster has its own set of standard equipment that is available for use, but there nevertheless appears to be a tendency for different organisations to want to have their own specific products and processes. As one regular attendee of both Cluster and Inter-Agency Forum meetings described:

*"I've tried to say, look the whole Cluster has agreed on what kit should be in the Cluster module, so why don't you just take the Cluster module instead of trying to reinvent everything yourselves."*

In other cases it is difficult to come to agreement about which standard product or approach to adopt because there are differences of opinion between different groups.

*"I think the closest we come to it is the Household Water Forum, a WHO forum, and they really tried hard. And still because you could say there's four or five different groups of fanatics in the WHO forum, some saying ceramics is the answer, some saying membranes is the answer, some saying chlorine, and some saying there's sodas. So they're all fighting for their particular technology. Therefore for them all to agree on this is what we want. I think they've made most progress, but they're not all in agreement. And for the agencies to use it, well ..."*

As we saw in the previous section, there are sources of inertia that limit the take-up of new products and approaches. Given the risks, there is an understandable reticence to try unproven solutions:

*"... there's still scepticism about [any] new product because it's new and they haven't used it before."*

However, even if there is the evidence base to support adoption, there are other influences on how receptive potential adopters are to any given innovation. One respondent described how being involved throughout the development of a solution helps to increase the sense of ownership and thus the willingness to adopt:

*"... it's a useful thing to want to really consult widely and I think there are some cases where you really need to because you need the buy-in. Just because you're told this is a good approach or this is a good product you're not going to believe it unless you've somehow been part of it."*

Another important constraint on standardisation and the wider diffusion of innovations concerns the political forces shaping the innovation ecosystem. Different national interests have a strong role to play here, often promoting their own suppliers and/or limiting the use of alternative sources. As one respondent explained, many national-based agencies face strong incentives to use products and equipment from their own country:

*"[They] work with suppliers that give them lots of free goodies so they pretty much take what their country's suppliers give them. They're not interested in the best perfect product. They're interested in the best they can get out of their country. So there is this partisan behaviour which is strong."*

## Implications for the WASH Innovation Ecosystem

### Insights from the conceptual framework

As mentioned earlier, our conceptual framework is based on the categories of Resources, Roles, Relationships, Rules, Routines and Results, which provide a useful way of characterising the WASH innovation ecosystem and understanding its particular features and dynamics (Rush et al, 2014). Using the systems map presented above, the Humanitarian Innovation Ecosystem can be conceptualised as a pipeline containing five key components, each representing a different stage in the innovation process. . This is shown graphically in Figure 4.

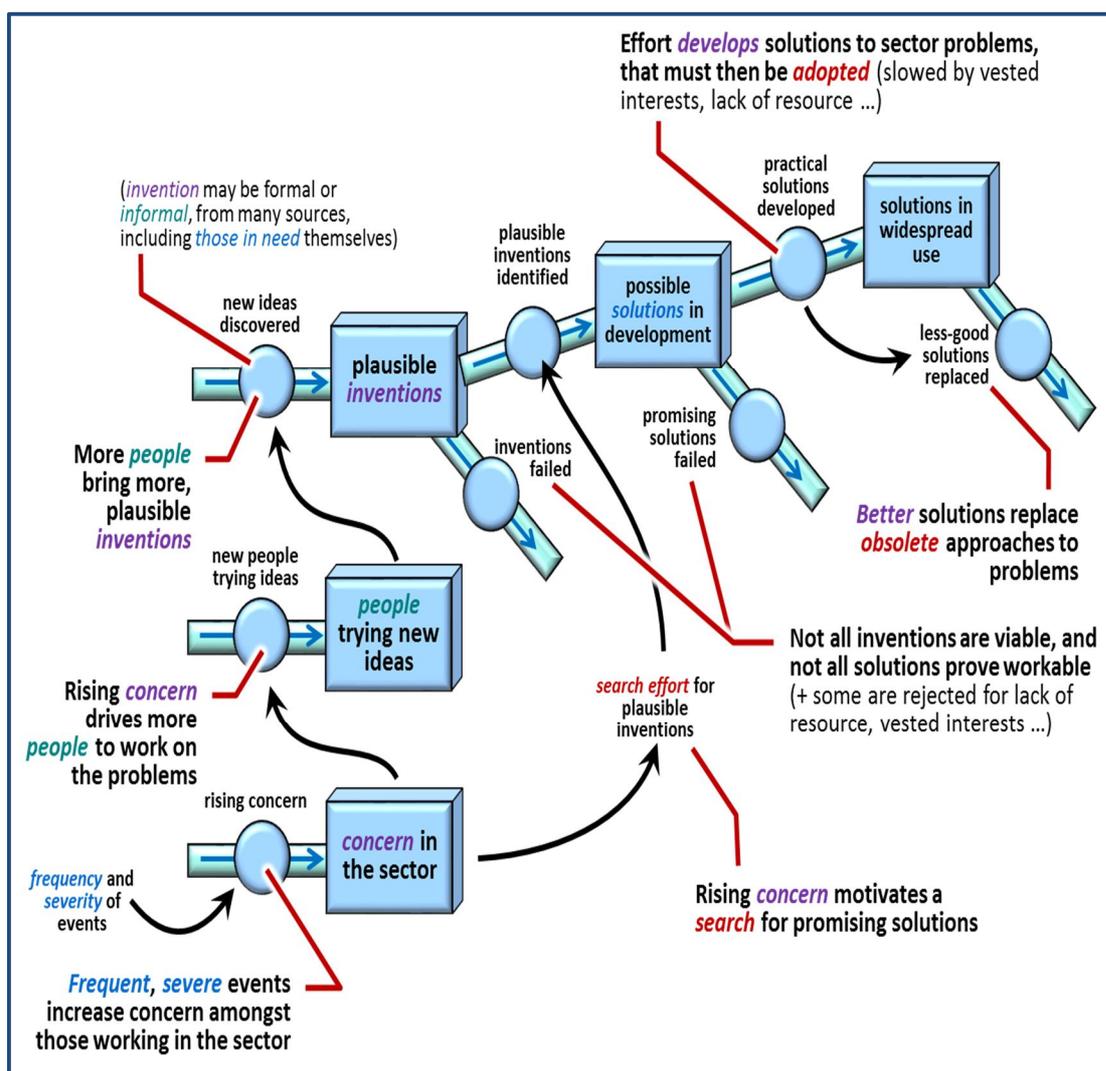


Figure 4: The Humanitarian Innovation Ecosystem

In what follows, we outline the main outcomes of this case study in terms of the key issues that have been identified in our analyses of the interviews. We also identify the enablers and barriers, as they relate to the various 'Rs' of our framework. For ease, we present them separately for each five components (see Figures 5-9).

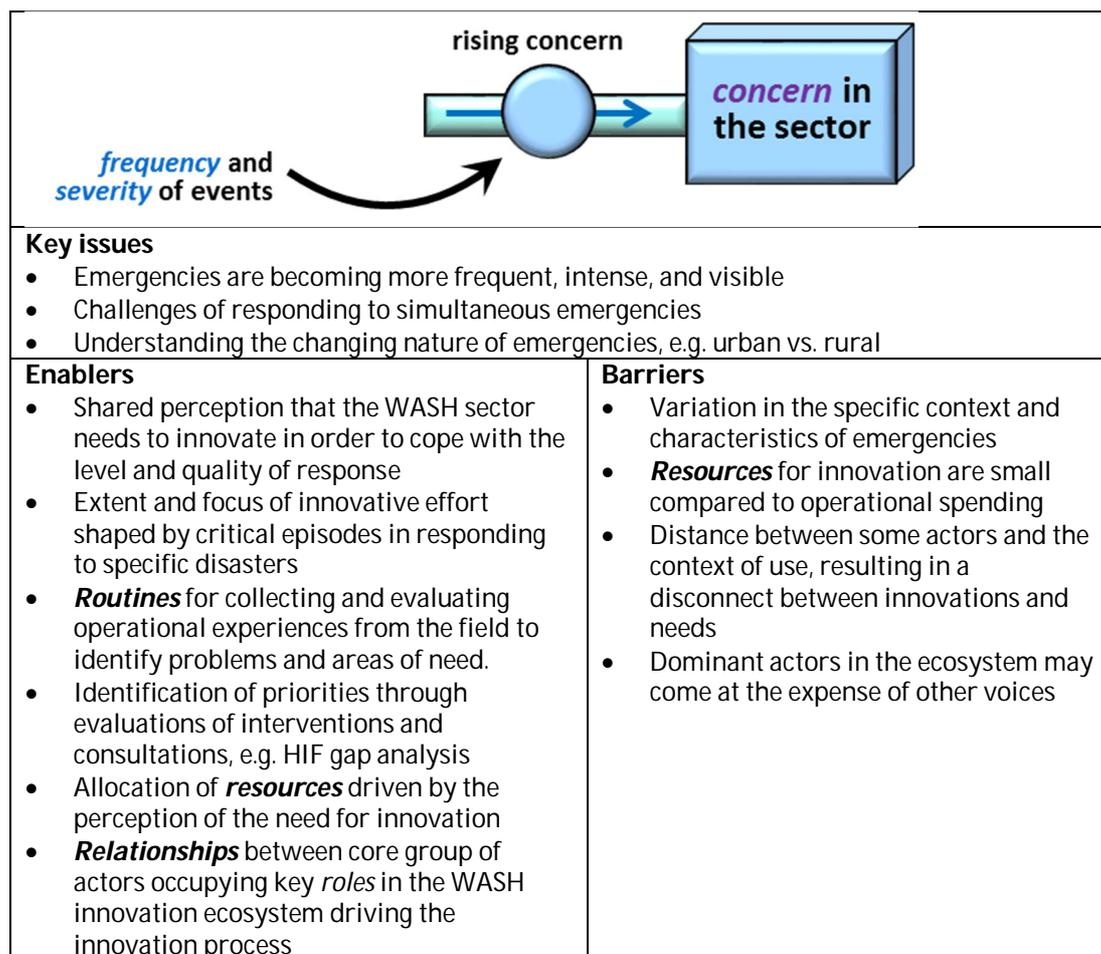


Figure 5: Concern in the sector

The first component of the innovation systems model suggests that the overall ecosystem is driven by a threshold level of concern about the need for innovation. Our case study of the WASH area indicates that there is indeed a widely shared sense of the importance of innovating in order to meet the increasingly difficult challenges of responding to more frequent, intense, and visible emergencies. The innovation agenda is also being shaped by an acknowledgement of the changing character of disasters, especially with the growth in global levels of urbanisation. However, the relationship between the perception of need and innovation is not simple, linear, or direct. Key events in disaster response, particularly those where failures are identified, provide the impetus for seeking new solutions, but this is filtered through different organisational, institutional and political interests and concerns, as well as following alternative trajectories over time. In the WASH sector, the general level of concern has been translated into a quite specific blueprint for the types of innovations that should be pursued. This has been the result of increasingly systematic processes of consultation and evaluation. There is also a core network of individuals and organisations that have a key influence on identifying the priority areas for innovation. Nevertheless, there are real challenges in learning from particular emergencies given the constantly changing contexts and conditions presented by any disaster. It is also clear that certain parts of the innovation ecosystem are more closely connected than others in terms of understanding what innovations are required. An example of this is where suppliers seek to enter the WASH market with limited knowledge of the requirements for products and processes suitable for emergency response. Another potentially important barrier

to driving the front-end of the innovation process is that the perception of concern does not necessarily translate into extensive and dedicated resources for innovation, notwithstanding the recent growth in WASH related innovation projects and funding. The evidence from the case study is not able to answer questions about the appropriate level of innovation finance, but it is evident that the overall levels are infinitesimally small compared to spending on operational priorities.

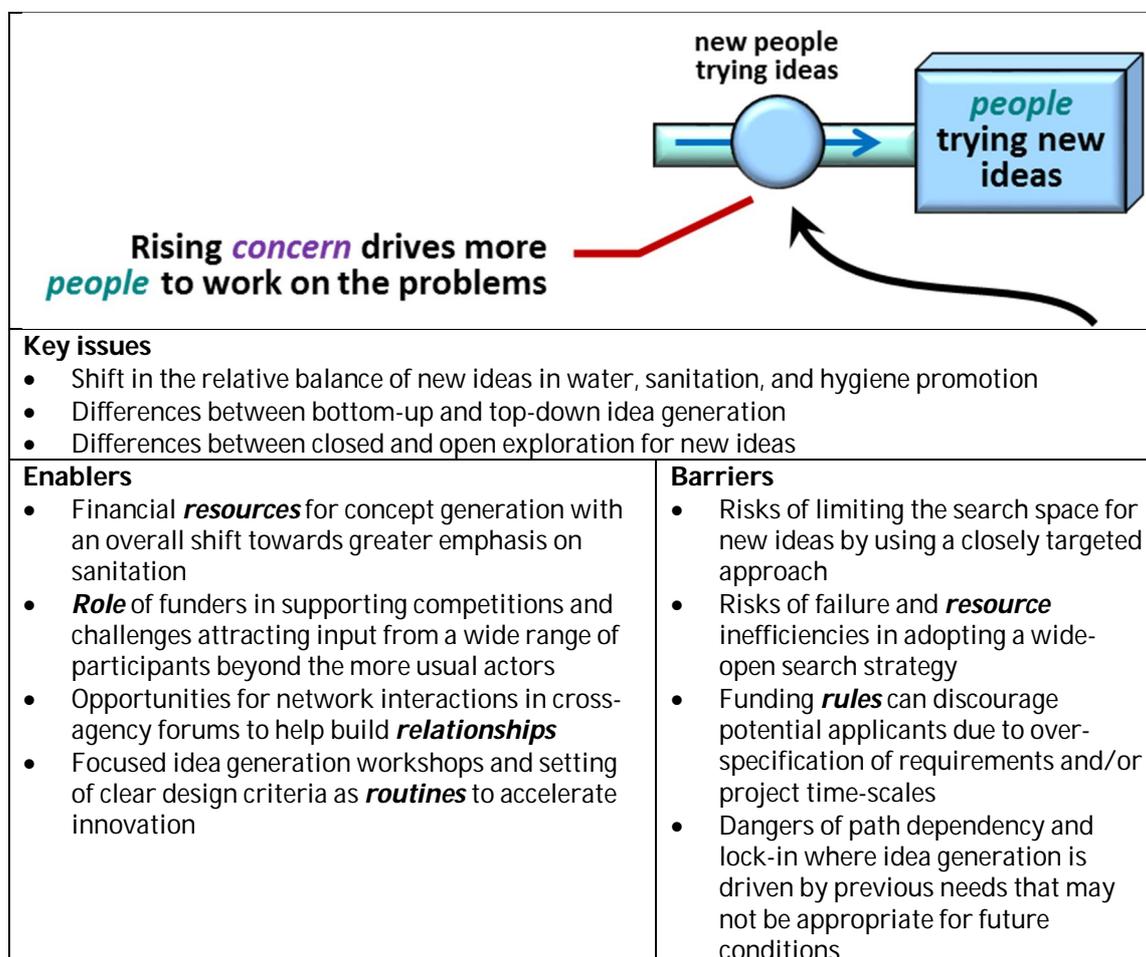


Figure 6: people trying new ideas

The second stage of our idealised innovation pipeline relates to the search for new ideas that have the potential to meet the needs of the sector. These ideas may be generated from a range of sources and involve differing interactions between the actors in the innovation ecosystem and between the developers of innovations and the varied and changing context of need. The WASH area exhibits a number of alternative approaches to the generation and identification of new ideas. Some of these come from the bottom-up, with practitioners in the field recognising problems and areas for improvement and improvising ways for dealing with them. In other instances there is a more top-down strategy seeking to identify specific priority areas and setting processes in motion for generating ideas through competitions, challenges, and joint workshops. In these more directed attempts to promote new solutions there is variation in how open or closed the search process is. This is reflected, for example, in the number and type of actors who are being encouraged to take part. At one extreme, open innovation challenges and crowdsourcing initiatives have been introduced to try to cast the net for new ideas as widely as possible. This has the benefit of potentially increasing the likelihood of attracting radical

solutions, obviously depending on those who are actually motivated to participate. However, this wider search strategy can also create challenges in terms of evaluating which are the most promising ones to take forwards and increase the risks that the solutions offered are impractical or too difficult and costly to develop. This is even more so where new ideas are developed without any real connection to end user needs, as appears to be the case with parts of the supply chain. Although the overall funding for stimulating new ideas is not that extensive (albeit larger than for other parts of the overall innovation process), it is interesting that available resources are not necessarily taken up fully. According to respondents, this is because the rules surrounding funding can be too restrictive and there may be a mismatch between the priorities pursued by potential innovators and those supported by funders.

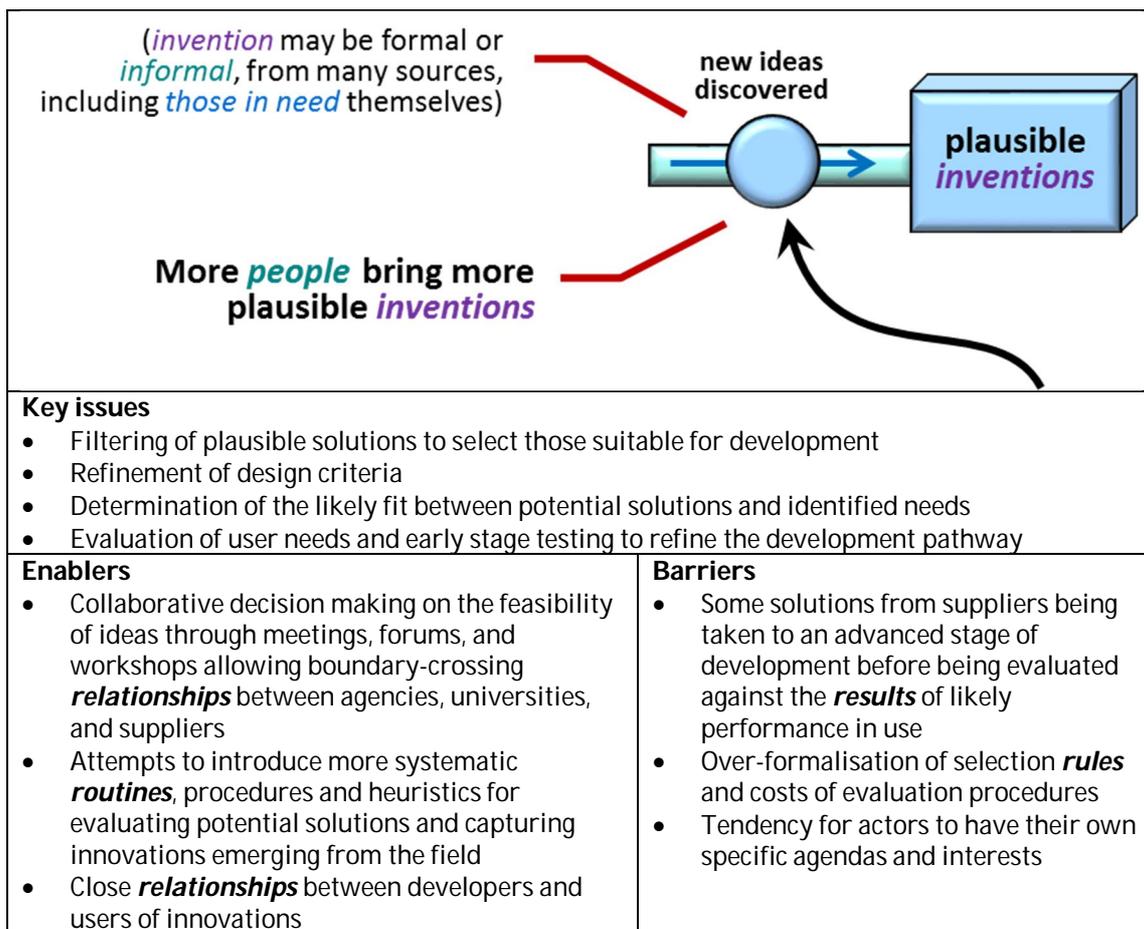


Figure 7: Plausible inventions

In our model, the innovation ecosystem ideally operates like a funnel, selecting and filtering plausible solutions that have the potential to be developed further. This is a critical stage because decisions at this point can have major and often costly implications for the later stages of the innovation process. Much depends here on how well the desired end-point of innovation can be envisioned, influencing the likely fit between potential solutions and identified (or indeed uncertain or unknown) needs. The WASH innovation ecosystem demonstrates a number of favourable conditions for encouraging an effective selection process. There have been a number of forums and workshops specifically aimed not only identifying particular areas of need but also starting the process of selecting potential solutions based on their likely feasibility. A key feature of these initiatives is their multi-organisational character involving actors from different parts of the WASH innovation ecosystem. When they work, such boundary

crossing activities have the benefit of allowing knowledge and ideas from different stakeholders to be integrated. However, there are also challenges here in breaking down the barriers caused by organisations following their own narrow interests and agendas. The filtering and selection process has also been helped by the efforts of some agencies to introduce more formal and systematic approaches to evaluating new products and approaches. These help to connect the innovation process more strongly to the context of need and create a communication channel between the users and developers of innovations. However, this connection is not always effective in the WASH innovation ecosystem. There are numerous instances of innovators taking potential solutions to an advanced stage of development before subjecting them to any real feasibility testing or evaluation against needs. Although systems of testing and evaluation are clearly an important mechanism for ensuring the right solutions are selected, they also come at a cost in terms of time and resources. There are many more potential solutions than it is possible to evaluate.

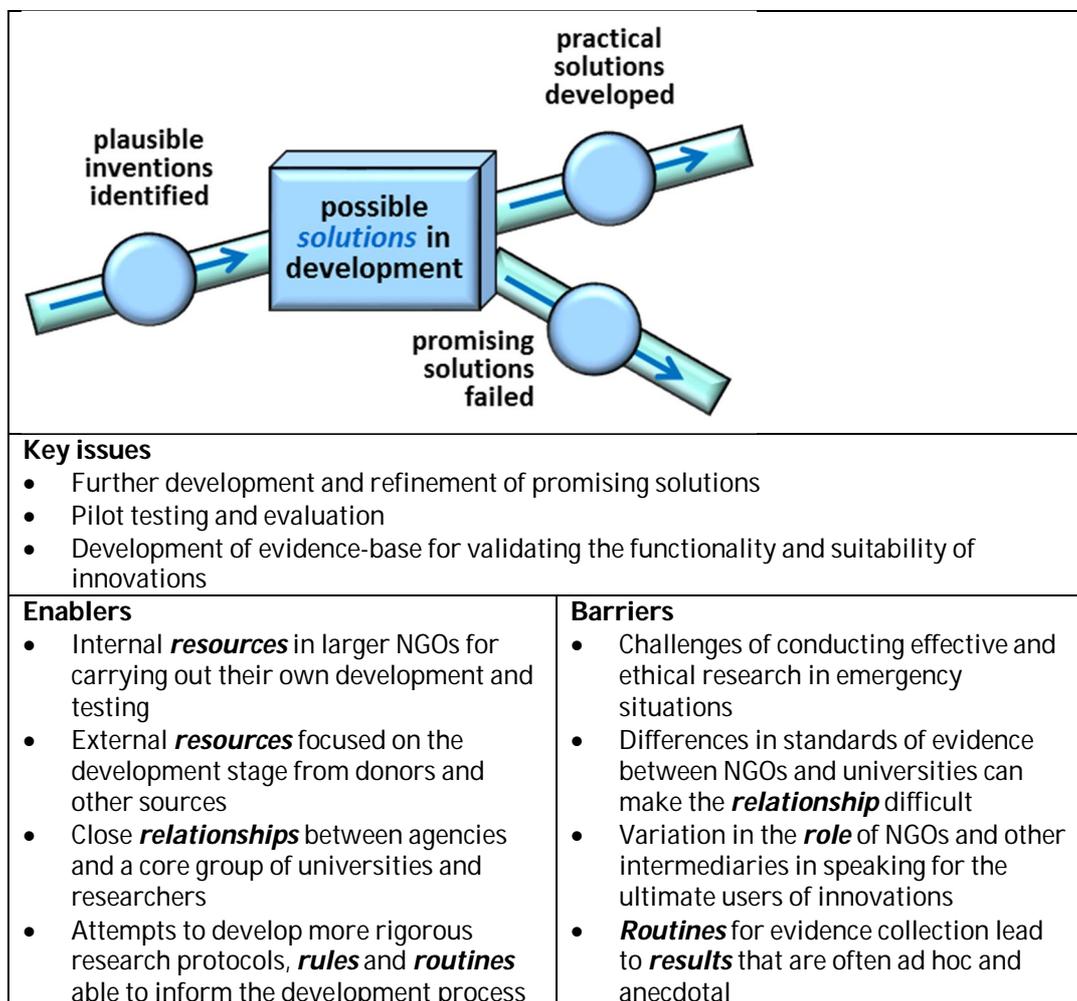


Figure 8: Possible solutions in development

Having identified plausible inventions and solutions, the next set of activities involve developing these further and taking them to the point where they can be implemented. The role of testing and evaluation shifts from a focus on feasibility and selection to an emphasis on refining and validating the proposed solution. Although respondents often felt that the evidence base for the effectiveness of innovations in the WASH area is under-developed, ad hoc, and anecdotal, there are efforts to introduce more rigorous protocols and processes for pilot testing possible

solutions in the field. While effective and ethical testing under emergency conditions is always going to be a challenge, such barriers are not insurmountable providing there are the resources and the will to undertake such activities. Several interviewees spoke of a funding gap for development and testing, but there are positive signs in terms of the internal allocation of resources by larger NGOs and some availability of external funding specifically designed to support this often neglected part of the innovation process. As well as financial resources, knowledge and capabilities are crucial for the effective development of innovations. A small core of university and research centres play a significant role here with the WASH innovation ecosystem displaying well developed relationships between agencies/NGOs and the research base. Even so, such relationships can be difficult to establish and maintain because of differing priorities and ways of working, for example, around the standards of evidence.

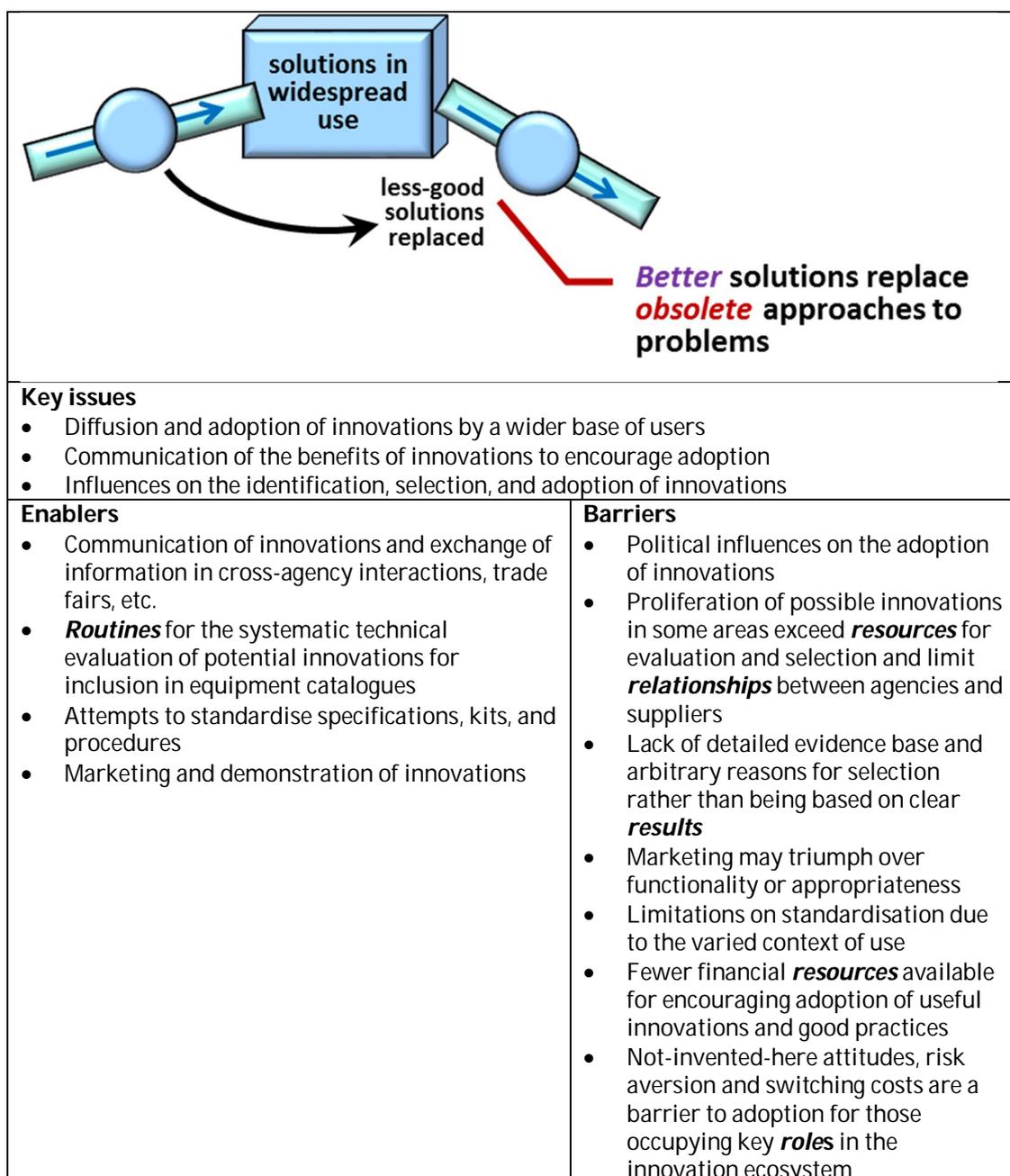


Figure 9: solutions in widespread use

The possible benefits of innovations are limited unless they are more widely diffused and adopted. In our investigation of the WASH area these activities came across as the least developed components of the innovation ecosystem. There are some mechanisms to help bring innovations to the attention of potential users through trade fairs, cross-agency interactions, marketing, and product demonstrations. Attempts to agree standardised specifications, kits, and procedures have also encouraged the diffusion of some innovations. However, overall the barriers to diffusion and adoption appear to outweigh the enablers. These include national governmental influences on the use of certain equipment and materials, the strong tendency for agencies and NGOs to select their own preferred products, and the high switching costs of changing equipment where the benefits are unclear. Again, the lack of a well-developed evidence base places limitations on the decision-making process surrounding adoption. In some cases, the sheer number of potential innovations competing for the attention of users means that there are too many to evaluate properly. As a result, those innovations with the most effective marketing may diffuse more widely even if they do not necessarily represent the best or most appropriate functionality.

## Conclusions and Recommendations

The case study provided an analysis of the functioning of the humanitarian innovation ecosystem within the sub-sector of humanitarian response known as WASH (Water, Sanitation and Hygiene). Our aim was to identify the strengths and weaknesses within the WASH innovation ecosystem and to gain a finer-grained understanding of how it operates. In this concluding section of the report we summarise some of our main observations and put forwards several recommendations for consideration.

### Strengths and weaknesses with the WASH Innovation Ecosystem

Although, as we made clear in our introduction, there are large differences between the three components of this Sector in terms of their innovative activities, one (of several) common threads was that where innovation occurs, the overwhelming tendency is for it to be incremental in nature. This, in and of itself, is not necessarily a bad thing (there are numerous major corporations that have been successful in their markets based upon continuous improvement via incremental innovation). It is also an approach that many practitioners within a risk averse sector are comfortable with for ethical considerations – i.e. adhering to the *do no harm ethos* prevalent in the humanitarian approach. Whether it is sufficient, however, to address the increased burdens facing the sector due to the high number of crisis situations being faced on a yearly basis, or the changing nature of such emergencies (e.g. urban locations, length of time affected communities remain displaced, etc.) is uncertain and doubtful.

In any case, the analysis reported in this case study indicates that while there are many aspects of the ecosystem that function well there are numerous parts of the ecosystem which can and should be improved, either as a means of increasing the flow of incremental innovation or in developing and diffusing more radical approaches.

Rather than addressing the enablers and barriers for each stage of the innovation ecosystem, which we have already identified in the previous section, here we concentrate on summarising

the findings relate to the Rs used in our analysis and on a series of recommendations for improving the ecosystem.

## Resources

Priorities have shifted between the three subsectors of WASH, leading to differences in the pace of innovation in the different areas. As well as showing the connection between resource allocation and innovation, it also indicates a degree of strategic direction in the innovation ecosystem. There have been direct efforts by key players in the WASH sector, through the HIF gap analysis for example, to evaluate where resources need to be directed to stimulate innovation. Nevertheless, the financial resources available for innovation are small and not especially well designed for supporting the whole innovation process. More resources are provided for the front-end of innovation, fewer for development and testing, very little for diffusion and adoption.

*Recommendation 1:* Donors need to consider a substantial increase in innovation funding for the sector and assure an adequate distribution of such resources along the difference stages of innovation generation, development and diffusion.

*Recommendation 2:* Constraints associated with existing funding (e.g. length of project) need to be relaxed.

*Recommendation 3:* Consideration needs to be given by donors on how to provide risk capital in order to incentivise private sector and social entrepreneurs' participation.

## Roles and relationships

In the WASH sector, there is the basis for coordinated activity between a core network of actors that drive the innovation agenda and make decisions about priorities. This provides coherence and leadership for orchestrating the necessary relationships, resources, and activities within the ecosystem, but there is the danger that some external actors and opinions are excluded from beyond the 'usual suspects'. This may also reinforce the tendency of the system to pursue familiar and lower risk solutions. There are nevertheless some new actors on the scene (e.g. social enterprises, foundations, and mavericks) that have an important role to play in exploring potentially more radical new directions. However, the ecosystem also exhibits gaps and areas of disconnect, such as those between suppliers or universities and agencies/users.

*Recommendation 4:* To date, those innovations, which have diffused most widely, seem to have been developed and disseminated as a result of collaborations between innovators (in the private sector or public institutions) and practitioner organisations. Such collaborations have the benefit of combining experience with existing or new knowledge bases. Mechanisms need to be developed by which new entrants can be linked at an early stage in the development process to those with the practical knowledge of how things work on the ground.

*Recommendation 5:* Ways in which to strengthen the resilience and openness of co-ordination mechanisms for innovation and diffusion need to be introduced.

## Rules, routines, and results

The innovation ecosystem has been mostly ad hoc and informal. However, there have been more recent attempts to make it more systematic, especially in terms of understanding user needs and building up a comprehensive evidence base. There is nevertheless still a long way to go. The WASH sector exhibits innovation routines that involve both more closed and open search and development strategies. Each has their strengths and weaknesses: the former reduces risk and is more likely to result in implemented innovations, but are unlikely to result in radically new ideas; the latter may open up the search space for interesting new solutions, but the risks of failure are higher. Rules around funding, national government influences on humanitarian procurement, and the need to manage risk during humanitarian crises, all place limits on the type and degree of innovation. In addition, the diffusion and adoption of promising innovations is by no means frictionless. Taking on a new product or approach can incur heavy switching costs, for example, in terms of the investments made in training and procedures related to existing approaches.

*Recommendation 6:* There is a need to develop a highly respected system by which independent evidence can be established or validated. This probably should be decentralised and affordable in order for access to be available to innovators in all parts of the world and under different environmental conditions.

*Recommendation 7:* Consideration needs to be given to ways by which innovations applied in the field can be captured, disseminated and evaluated by appropriate agreed methodologies.

*Recommendation 8:* Continue to balance the targeted and open approaches to the identification of needs and solutions in order to attract both incremental and radical innovations to an evolving environment (e.g. urban disasters, long-term displacement, etc.)

## Bibliography

ALNAP (2012). *The State of the Humanitarian System 2012 Edition*, Overseas Development Institute, London, July.

Bastable, A. and Russell, L. (2013). *Gap Analysis in Emergency Water, Sanitation, and Hygiene Promotion*. Humanitarian Innovation Fund, July 2013.

Bessant, J., Ramalingam, B., Rush, H., Marshall, N., Hoffman, K., and Gray, B. (2014). *Innovation Management, Innovation Ecosystems and Humanitarian Innovation: Literature Review for the Humanitarian Innovation Ecosystem Research Project*, CENTRIM, University of Brighton working paper.

Cairncross S. (1990). Health impacts in developing countries; new evidence and new prospects, *Journal of the Chartered Institution of Water and Environmental Management* 4 (6): 571-577.

Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Cambridge, MA: Harvard Business School Press.

Chesbrough, H., Vanhaverbeke, W. and West, J. (eds.) (2008). *Open Innovation: Researching a New Paradigm*. Oxford: Oxford University Press.

Dorea, C.C. (2014). *Examining the Disconnect Between Research and Innovation for WASH Technologies*. OCHA Research and Innovation Grant Programme, Report 001, September 2014.

Flowers, S., von Hippel, E., de Jong, J. and Sinozic, T. (2010). *Measuring user innovation in the UK: The importance of product creation by users*. London: NESTA.

Gersick, C. (1988). Time and transition in work teams: Toward a new model of group development, *Academy of Management Journal* 31: 9-41.

Gersick, C. (1991). Revolutionary change theories: A multilevel exploration of the punctuated equilibrium paradigm, *Academy of Management Review* 16(1): 10-36.

House, S. and Read, B. (2004). *Emergency water sources: Guidelines for selection and treatment*. Third Edition. Water, Engineering and Development Centre, Loughborough, UK.

McBride, A. (2013). Conference report: Design and Bog Day. *Waterlines* 32(4): 349-352.

Rush, H., Marshall, N., Hoffman, K., B. Gray, B., Ramalingam, B., and Bessant, J. (2014).: *Components of the humanitarian innovation ecosystem: Interview Summary for the DFID Humanitarian Innovation Ecosystem Research Project*, CENTRIM, University of Brighton working paper.

Stoddard, A., Harmer, A., Haver, K., Salomons, D. and Wheeler, V. (2007). *Cluster Approach Evaluation*. OCHA Evaluation and Studies Section, November 2007.

Tidd, J. and Bessant, J. (2013). *Managing Innovation: Integrating Technological, Market, and Organizational Change*. 5<sup>th</sup> Edition. Chichester: Wiley.

UN Emergency Relief Coordinator and Under-Secretary for Humanitarian Affairs (2005). *Humanitarian Response Review*, August.

UNICEF (2008). *Humanitarian Action Report 2008*. New York: UNICEF.

UNICEF (2012). *Water, Sanitation and Hygiene 2012 Annual Report*, WASH Section, Programme Division, New York.

UNICEF (2013). *Water, Sanitation and Hygiene 2013 Annual Report*, WASH Section, Programme Division, New York.

UNOCHA (2013). *World Humanitarian Data and Trends 2013*. New York.

UNOCHA (2014). *World Humanitarian Data and Trends 2014*. New York.

Von Hippel, E. (1986). Lead Users: A source of novel product concepts.' *Management Science* 32(7): 791-805.

Von Hippel, E. (2005). *Democratizing Innovation*. Cambridge, MA: MIT Press.

WASHTech (2011). *Africa wide water, sanitation and hygiene technology review*, Cranfield University, Skat, WaterAid and IRC International Water and Sanitation Centre.  
<http://washtechafrica.wordpress.com>.

WHO (1983). *Minimum Evaluation Procedure for Water and Sanitation Projects*. Geneva: World Health Organisation.

## Other Sources Consulted

*A practical response to MSF's report Where is Everybody? Global Development Professionals Network*, The Guardian (2014)

<http://www.theguardian.com/global-development-professionals-network/2014/jul/23/msf-where-is-everyone-report-emergency-response>

Action Contre La Faim (2005) *Water, Sanitation, and Hygiene for Populations at Risk*. Paris: Hermann. [https://portal.uah.es/portal/page/portal/GP\\_EPD/PG.../wsh\\_acf.pdf](https://portal.uah.es/portal/page/portal/GP_EPD/PG.../wsh_acf.pdf)

ACF, Action Against Hunger

<http://www.actionagainsthunger.org.uk/>

Bastable, A. (2014). *Latest Trends in Emergency Sanitation*, 14th Sanitation Community of Practice (SanCoP) Meeting: Sanitation in Emergencies, <http://www.susana.org/en/cop/sancop-uk/2014>

Bear Valley Ventures, Social Ventures Incubator for Sanitation and Hygiene,  
<http://www.bearvalleyventures.com/>

Bill and Melinda Gates foundation, Reinvent the Toilet Challenge, *Strategy overview*  
<http://www.gatesfoundation.org/What-We-Do/Global-Development/Reinvent-the-Toilet-Challenge>

Brown, D. (2011). Building effective partnerships: Local views. *Humanitarian Exchange* 50: 10–13.

Brown, J., Jeandron, A., Cavill, S. and Cumming, O. (2012) *Evidence review and research priorities: Water, sanitation, and hygiene for emergency response*. London: SHARE/DFID.  
[http://r4d.dfid.gov.uk/pdf/outputs/sanitation/Evidence\\_review\\_WASH\\_for\\_emergency\\_response\\_March\\_2012.pdf](http://r4d.dfid.gov.uk/pdf/outputs/sanitation/Evidence_review_WASH_for_emergency_response_March_2012.pdf)

Burkle, F.M., Martone, G. and Greenough, P.G. (2014). The changing face of humanitarian crises. *Brown Journal of World Affairs* 20: 25–42.

Capacity building project: Stimulating local innovation on sanitation for the urban poor in Sub-Saharan Africa and South East Asia – Resources, SuSanA (n.d).  
<http://www.susana.org/en/resources/library/details/1788>

Cocking, J. and Bastable, A. (2010) Water, sanitation and public health in post-earthquake Haiti: Reflections on Oxfam’s experience. *Humanitarian Exchange* 48: 20–22.

Cranfield University (n.d.) Nano membrane toilet: treating human waste onsite without external energy or water,  
<http://www.nanomembranetoilet.org/>

dezeen (2009). *Peepoo bag* by Anders Wilhelmson  
<http://www.dezeen.com/2009/03/16/peepoo-bag-by-peter-thuvander/>

DFID (2012). *Promoting innovation and evidence-based approaches to building resilience and responding to humanitarian crises: A DFID Strategy Paper*, London, February.

Doria, C., C., (n.d.) *High-science in low-tech emergency settings: a foreseeable horizon or height of folly*, ELHRA Small Grant Project Final Report, University of Glasgow and Oxfam.

*Does selling to the developing world put the brakes on innovation?* - Telegraph [WWW Document], (n.d.) <http://www.telegraph.co.uk/finance/businessclub/8379268/Does-selling-to-the-developing-world-put-the-brakes-on-innovation.html>

DRR in WASH (for emergency and reconstruction situations) - Member website, (n.d.)  
<https://sites.google.com/site/waterdrdrr/resilient-wash>

Emergency Sanitation Project,  
<http://www.emergencysanitationproject.org/>

eSOS Smart Toilet recognized as innovation with an impact by the Federation of Dutch Creative Industries | UNESCO-IHE [WWW Document], (n.d)  
<http://www.unesco-ih.org/news/esos-smart-toilet-recognized-innovation-impact-federation-dutch-creative-industries>

European Commission (2014). *Water, Sanitation and Hygiene, Meeting the challenge of rapidly increasing humanitarian needs in WASH*, DG ECHO Thematic Policy Document no. 2, May,

Eyrard, J. (2011). *Emergency Sanitation at the 35th WEDC conference*, July.  
<https://susanawg8.wordpress.com/2011/07/22/emergency-sanitation-at-the-35th-wedc-conference/>

Field Ready, humanitarian supplies made-in-the-field,  
<http://www.fieldready.org/>

HIF, (2014). *Integrating social enterprises into emergency faecal sludge management*,  
<http://www.humanitarianinnovation.org/projects/WASH/GOAL>

HIF (2013). *Progress Report 2013*, London.

HYDRATELIFE, Eco-Latrines of the Future,  
<http://www.hydratelife.org/?p=539>

Global WASH Cluster (2009) *Water, Sanitation and Hygiene (WASH) Cluster Coordination Handbook: A Practical Guide for all Those Involved in the Water, Sanitation and Hygiene Cluster*. New York: Global WASH Cluster/UNICEF.  
[http://www.unicefinemergencies.com/downloads/eresource/docs/WASH/WASH\\_Cluster\\_Coordination\\_Handbk\\_FINAL\\_VERSION\\_Jan09.pdf](http://www.unicefinemergencies.com/downloads/eresource/docs/WASH/WASH_Cluster_Coordination_Handbk_FINAL_VERSION_Jan09.pdf)

Grand Challenge Canada  
<http://www.grandchallenges.ca/>

Healy, S. and Tiller, S. (2014) *Where is everyone? Responding to emergencies in the most difficult places*. London: Médecins Sans Frontières. [www.msf.org/sites/msf.org/.../msf-whereiseveryone-def-lr-july.pdf](http://www.msf.org/sites/msf.org/.../msf-whereiseveryone-def-lr-july.pdf)

ICRC (2009) *Water and war*. Geneva: ICRC.  
[https://www.icrc.org/eng/assets/files/other/icrc\\_002\\_0969.pdf](https://www.icrc.org/eng/assets/files/other/icrc_002_0969.pdf)

IFRC (2008). *Water and sanitation: Meeting water, sanitation and hygiene promotion needs in emergencies - a guide to standardized tools for rapid response*. Geneva: IFRC.  
<http://www.ifrc.org/Global/Publications/disasters/eru-watsan.pdf>

IFRC (2010a). *Haiti: From sustaining lives to sustainable solutions - the challenge of sanitation*. Geneva: IFRC. [www.ifrc.org/Global/.../199600-haiti-sanitation-report-july-2010-EN.pdf](http://www.ifrc.org/Global/.../199600-haiti-sanitation-report-july-2010-EN.pdf)

IFRC (2010b). *The global water and sanitation initiative: A 10 year initiative further contributing to the UN Millennium Development Goals - Mid-term summary*. Geneva: IFRC.  
<https://ifrc.org/.../1217000-GWSI%20MidtermSummary-EN-LR.pdf>

IFRC (2012a). *Gender in water, sanitation and hygiene promotion*. Geneva: IFRC.  
[http://watsanmissionassistant.wikispaces.com/file/view/Guidance+note-Gender+in+water+and+sanitation-EN\\_LR.pdf](http://watsanmissionassistant.wikispaces.com/file/view/Guidance+note-Gender+in+water+and+sanitation-EN_LR.pdf)

IFRC (2012b). *Getting the balance right: A Red Cross Red Crescent call to address the imbalance between sanitation and water*. Geneva: IFRC. <https://www.ifrc.org/PageFiles/99218/1228400-Sanitation%20Advocacy%20paper-EN-LR%5b1%5d.pdf>

IFRC (2013) *World Disasters Report: Focus on Technology and the Future of Humanitarian Action*. Geneva: IFRC. [www.ifrc.org/PageFiles/134658/WDR%202013%20complete.pdf](http://www.ifrc.org/PageFiles/134658/WDR%202013%20complete.pdf)

Innovation Exchange (2014). *Humanitarian Innovation Funds Seeks WASH Solutions*, <http://blogs.washplus.org/innovation/2014/01/>

Innovasjon Norge, About Innovation Norway, <http://www.visitnorway.com/uk/about-visitnorwaycouk/innovation-norway/>

INTER-AGENCY Water, Sanitation and Hygiene (WASH) Working Group-London, *WASH Strategy for 2014*, February. [file:///Users/hjr21/Downloads/WASHStrategyFebruary2014%20\(1\).pdf](file:///Users/hjr21/Downloads/WASHStrategyFebruary2014%20(1).pdf)

International Committee of the Red Cross  
<https://www.icrc.org/en>

International Federation of Red Cross and Red Crescent Societies  
<http://www.ifrc.org/>

[Interview with Anders Wilhelson, founder of Peepoole, Oct. 2009](https://www.youtube.com/watch?v=gIImpZxmYio)  
<https://www.youtube.com/watch?v=gIImpZxmYio>

Johannessen, A. (2011). *Identifying gaps in emergency sanitation: Design of new kits to increase effectiveness in emergencies*. Presented at the Oxfam/WASTE Workshop, Stoutenburg, The Netherlands, 22-23 February 2011, [www.wsscc.org/sites/.../susana8\\_stoutenbergworkshopreport\\_2011.pdf](http://www.wsscc.org/sites/.../susana8_stoutenbergworkshopreport_2011.pdf)

Keehn, J., (2014). The Toilet Papers: can a high-tech sanitation appliance save lives in poor countries, *International Affairs*, May

Mara, D. (1996). *Low-Cost Urban Sanitation*, Wiley

[Médecins Sans Frontières \(MSF\) International](http://www.msf.org/)  
<http://www.msf.org/>

Meet the smart eSOS toilet on World Toilet Day | UNESCO-IHE [WWW Document],(n.d)  
<http://www.unesco-ihe.org/news/meet-smart-esos-toilet-world-toilet-day>

Office of US Foreign Disaster Assistance  
<http://www.usaid.gov/who-we-are/organization/bureaus/bureau-democracy-conflict-and-humanitarian-assistance/office-us>,

Oxfam (n.d.). *Sharing Oxfam's Policy, Practice & Research*,  
<http://policy-practice.oxfam.org.uk/>

Oxfam (n.d.). *Research, Development and Innovation Fund For Water, Sanitation and Public Health Promotion*  
<http://mariposafoundation.org/docs/MariposaOxfamInnovation.pdf>

Oxfam (n.d.). *Oxfam GB's Research, Development and Innovation Fund for Water, Sanitation and Public Health Promotion*. Oxford: Oxfam.  
<http://mariposafoundation.org/docs/MariposaOxfamInnovation.pdf>

Oxfam (2006). *Guidelines for Public Health Promotion in Emergencies*. Oxford: Oxfam.  
<http://oxfamlibrary.openrepository.com/oxfam/bitstream/10546/126738/1/guidelines-public-health-promotion-emergencies-250406-en.pdf>

Oxfam (2006). *Water quality analysis in emergency situations*. Oxfam, Oxford.  
<http://oxfamlibrary.openrepository.com/oxfam/bitstream/10546/126714/1/tbn3-water-quality-analysis-emergency-situations-030608-en.pdf>

Oxfam (2008). *Domestic and Refugee Camp Waste Management Collection & Disposal*. Oxford: Oxfam. <http://oxfamlibrary.openrepository.com/oxfam/bitstream/10546/126686/5/tbn15-domestic-refugee-camp-waste-management-collection-disposal-210508-en.pdf>

Oxfam (2009). *UD Toilets and Composting Toilets in Emergency Settings*. Oxford: Oxfam.  
<http://oxfamlibrary.openrepository.com/oxfam/bitstream/10546/126692/5/tbn7-UD-toilets-and-composting-toilets-emergency-settings-110509-en.pdf>

Oxfam (2010). *The Use of Poo Bags for Safe Excreta Disposal in Emergency Settings*. Oxford: Oxfam. <http://oxfamlibrary.openrepository.com/oxfam/bitstream/10546/136535/5/tbn19-poo-bag-emergency-excreta-disposal-16092010-en.pdf>

Oxfam (2011). *Urban WASH Lessons Learned from Post-Earthquake Response in Haiti*. Oxford: Oxfam. <http://oxfamlibrary.openrepository.com/oxfam/bitstream/10546/136538/8/tbn20-wash-urban-lessons-learnt-haiti-06052011-en.pdf>  
Peepoople, <http://www.peepoople.com/>

Poke, T., P. (2013). *Development and Application of a Product Development Framework for Emergency Excreta disposal*, Laporan Progres II, Program Pasca Sarjana Teknik Lingkungan, Fakultas Teknik Sipil Dan Lingkungan, Institut Tecknologi Bandung.

Purchas, H, (2014). *Urban Emergency Sanitation*, redr uk  
[www.communityledtotalsanitation.org/](http://www.communityledtotalsanitation.org/)

Randall, J.J., Navaratne, A., Rand, E.C. and Hagos, Y. (2008). *Integrating environmental sustainability into the water and sanitation sector: Lessons from tsunami response*. Presented at the 33rd WEDC Interational Conference, Accra, Ghana.  
[http://wedc.lboro.ac.uk/resources/conference/33/Randall\\_J.pdf](http://wedc.lboro.ac.uk/resources/conference/33/Randall_J.pdf)

Red R India, Facilitating Humanitarianism,  
<http://www.redr.org.in/>

Safe water - saving lives: the DeIAgua Story - Full Case Study | SETSquared Partnership [WWW Document], (n.d.). <http://www.setsquared.co.uk/impact/environment-case-studies/safe-water/safe-water-saving-lives-delagua-story-full-case-study>

SanCoP (2014). 14 Synopsis:: *Sanitation in Emergencies*, 10th April 2014,  
<https://groups.google.com/forum/#!topic/ewbukwatsan/4Hlztm2zYsQ>

Sanergy, *The Sanergy Model, Building an Integrated Sanitation Value Chain*,

<http://saner.gy/our-work/the-sanergy-model>

Sanitation crisis: It's time to talk about the solutions - IFRC [WWW Document], (n.d.).

<https://www.ifrc.org/en/news-and-media/opinions-and-positions/opinion-pieces/2013/sanitation-crisis-its-time-to-talk-about-the-solutions--61094/>

Sitali, M. (2010) *Life and dignity at risk: The water, sanitation and hygiene sector in Liberia*.  
Monrovia: Liberia WASH Consortium.

<http://oxfamlibrary.openrepository.com/oxfam/bitstream/10546/114956/1/bp-life-and-dignity-at-risk-liberia-170610-en.pdf>

S(P)EEDKITS, <http://www.speedkits.eu/>

The Sphere Project (2011). *Humanitarian Charter and Minimum Standards in Disaster Response*,  
Oxfam Publishing

SuSanA forum [WWW Document], (n.d.)<http://forum.susana.org/forum/categories/170-public-toilets-community-toilets-toilets-at-festivals-and-events/8635-consumer-insights-on-sanitation--upping-the-usage-of-fresh-life-toilets-update-by-sanergy-in-nairobi-kenya#8635>

The Sphere Project (2013). *The Sphere Project strategy for working with regional partners, country focal points and resources persons, January*, [SphereProject.org/focal-points](http://SphereProject.org/focal-points)

The Sphere Project (2012), *Strategy 2015: Right to Life with Dignity*, Geneva, April,  
<http://www.sphereproject.org/silo/files/the-sphere-project-strategy-2015.pdf>

TU-Delft,

<http://www.io.tudelft.nl/reinventthetoilet>

UNESCO-IHE,

<http://www.unesco-ihe.org/>

UNESCO-IHE Wins Africa Leadership Award for eSOS Smart Toilet - Water Policy & Practice  
(n.d). <http://water-l.iisd.org/news/unesco-ihe-wins-africa-leadership-award-for-esos-smart-toilet/>

USAID, (2014). *Testing the :Tiger Toilet*, Dec.,

<http://www.usaid.gov/div/portfolio/bvv-tiger>

UNICEF (n.d.). *Water Sanitation and Hygiene, emergency co-ordination and the WASH Cluster Initiative*,

[http://www.unicef.org/wash/index\\_43104.html](http://www.unicef.org/wash/index_43104.html)

UNICEF WASH Strategies | Water, Sanitation and Hygiene | UNICEF (n.d.).

[http://www.unicef.org/wash/index\\_43084.html](http://www.unicef.org/wash/index_43084.html)

WASTE | *Towards sustainable improvement of the urban poor's living conditions and the urban environment in general*. [WWW Document],(n.d.) <http://www.waste.nl/>

WASH Cluster (2011). *Global WASH Cluster Strategic Plan 2011-2015*,

<http://washcluster.net/wp-content/uploads/sites/5/2014/05/Global-WASH-Cluster-Strategic-Plan-2011-2015-Vs3.pdf>

Waste Water Treatment, (n.d.). *Proctor and Gamble's PUR Packets Clean Drinking Water*  
<https://wastewatertreatment1.wordpress.com/2009/12/14/hello-world/>

Water and habitat: An ICRC priority for 30 years - ICRC [WWW Document], (n.d.)  
<https://www.icrc.org/eng/resources/documents/interview/2013/09-19-water-habitat-interview-dross.htm>

*What innovation does the WASH sector need: shiny new toys or system reboot?* | Tremolet Consulting [WWW Document], (n.d). <http://tremolet.com/news/what-innovation-does-wash-sector-need-shiny-new-toys-or-system-reboot>

WHO (2014) *UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) 2014 Report: Investing in Water and Sanitation - Increasing Access, Reducing Inequalities*. Geneva: World Health Organisation.  
<http://www.unwater.org/publications/publications-detail/en/c/269604/>