Community mapping helps identify risks; digitization improves the process.
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Maps, models and data management

Geospatial analysis in shelter response

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> Information is key to a better disaster response.
>
> T Comes et al (2015) *Bringing Structure to the Disaster Data Typhoon*.[1]

Recent research suggests that the key information needs of humanitarian field workers responding to emergencies are:[2]

- situational (response) awareness – knowing which organizations are operating in specific areas, what their activities are, and how to contact them
- needs assessment – a single, integrated, localized overview of needs across all sectors[3]
- operational circumstances – knowing the available resources in the region, and logistical options to deliver aid and mobilize these resources (resource and logistics mapping).

As the built environment is so well suited to being mapped, and geographic information systems (GIS) enable the integration of varied layers of information at a range of different spatial and temporal resolutions,[4] GIS and remote sensing are ideally suited for supporting shelter programming for emergency response, as well as in conflict, displacement and refugee scenarios. In this chapter, we look initially at how GIS and remote sensing play a crucial role in meeting many of the information needs listed above. We then look at linking GIS with wider information management for shelter programming, followed by an analysis of some emerging trends, and then finish with some concluding remarks.

GIS, remote sensing and shelter programming

Creating situational (response) awareness

Maps of *Who is doing What, Where and When* (3/4W) are essential sources of information when coordinating humanitarian work. They can cover all sectors active in a response, and can also be sector specific. The most basic 3/4W maps show operational presence (Figure 8), but can also be paired with other types of information, such as damage,[5] humanitarian needs (for analyzing potential gaps in the response), resourcing (to show gaps in resource availability), and activities.[6]

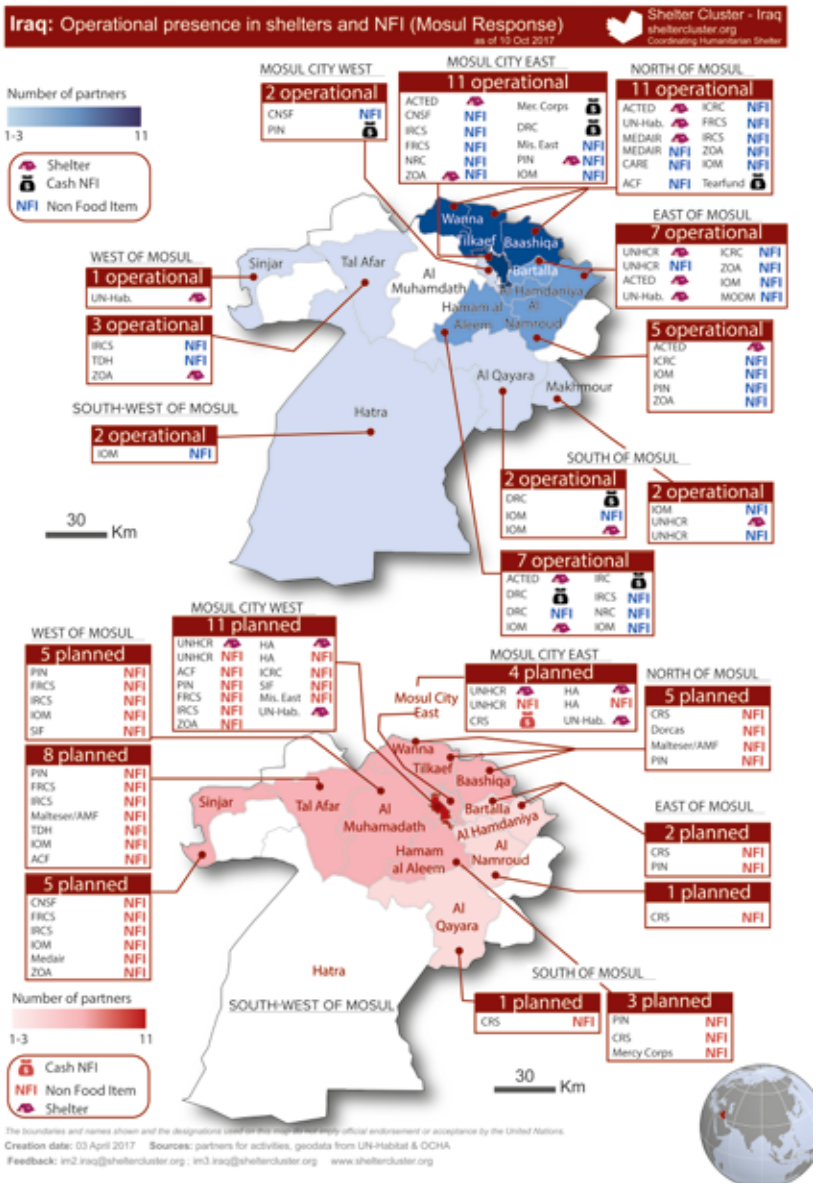

Figure 8 **Iraq: operational presence in shelter and non-food items.**[7]

Situational awareness also requires an understanding of what has been done, and where. Combining maps, data tables and brief text-based summaries of information,[8] gives decision makers spatial overviews and quantitative analysis in a very quick and easy-to-interpret format.

Assessing needs, risks and vulnerabilities

To understand humanitarian needs during an emergency, we need to know about any pre-existing vulnerabilities of the affected population, risks that the affected population might face, the extent of damage, and specific needs that have arisen from the disaster.

Although needs and damage extent are usually specific to a particular emergency, vulnerability data may be collected as a preparedness activity. A good example of this is the work of the Global Pulse Lab in Kampala, which is using remote sensing imagery to detect thatched versus metal roofs, and applying this as a proxy for measuring poverty or potential vulnerability: 'Without the biases that can be derived by the design or implementation of household surveys, the new data generated with the automated roof top counting can provide new insights on household economies'.[9]

Risk and vulnerability indices such as the Inform Index (of the UN Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness),[10] and the Community Risk Assessment Dashboard – Priority Index of the Netherlands Red Cross (NLRC)[11] are increasingly being used to provide preparedness information on risk and vulnerability in advance of disaster events.[12] For humanitarian shelter, these tools use information about building structures to identify specific risks and vulnerabilities relating to construction materials.

By combining information on risk and vulnerability with event data (such as wind speeds, distance to the typhoon, and accumulated rainfall), efforts are being made to develop reliable ways of remotely estimating the severity of damage and potential impact. During the response to Typhoon Haiyan, remotely compiled impact-estimate data were combined with operational-presence maps in the field to create 'impact estimate–operational presence' maps. These greatly helped responders to think more spatially about their response, to ask better-informed questions, and to give operational decision makers a clearer understanding of the situation.[13] This work was further developed for Cyclone Pam and Typhoon Maysak,[14] and now by NLRC, which is developing tools to remotely predict likely impact and damage within a very short time after landfall of a typhoon in the Philippines. NLRC is also looking into similar methods to support forecast-based financing, by trying to predict a few days in advance the likely impact of floods and typhoons.

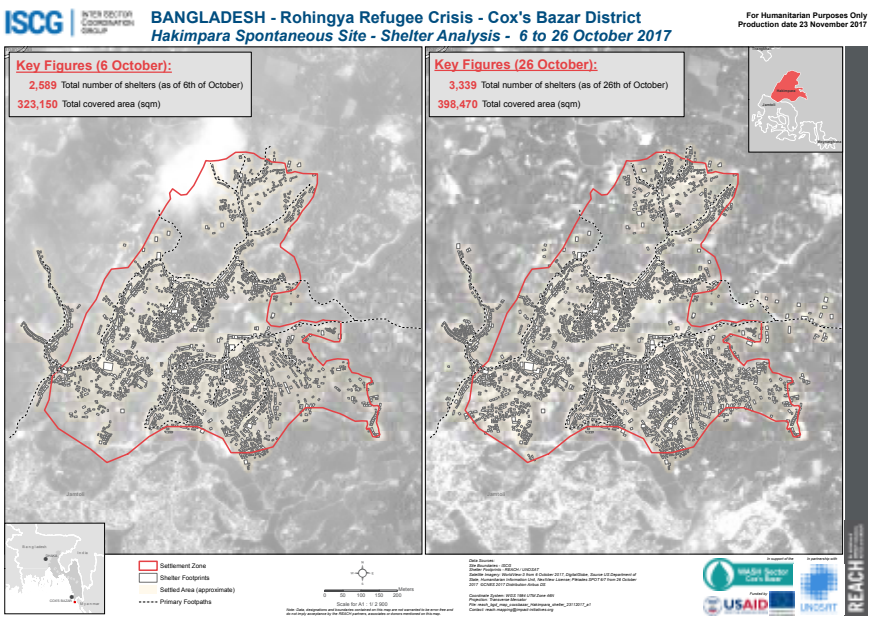

Figure 9 **Bangladesh: analysis of changes to camp extent over time.**[15]

Damage extent

Damage-extent data is the single most important indicator of vulnerability after a disaster such as a flood, earthquake or hurricane.[16] After hurricane Irma in 2017, the NLRC used drones to collect post-disaster imagery in St Maarten,[17] then compared it with imagery from before the hurricane, to assess damage. They found that the higher resolution of the drone imagery resulted in more accurate assessments of damage than satellite-based sources. The data were successfully used in programming the response.[18]

In Iraq in 2015–16, the Shelter Cluster used a combination of focus group discussions and key informant interviews, along with participatory mapping and damage analysis using remote sensing and satellite imagery, to produce shelter assessments of eight hard-to-reach areas.[19]

For humanitarian operations that continue over a lengthy period of time, analyses of temporal change can be useful for understanding evolving vulnerabilities and needs. In the Rohingya refugee crisis in Bangladesh, satellite imagery is being used to analyze changes to shelter extents over time (Figure 9). Satellite imagery analysis was also used to study urban expansion in an area of Somalia.[20]

Needs

GIS can be used to infer needs by, for example, overlaying information about extent of housing damage with poverty indices,[21] or damage extent with known locations of displaced people.[22] Once primary data on the needs of the affected population has been collected, GIS may be used to map activities against needs (Figure 10). This is often referred to as a gap analysis, as it can show where there may be gaps between what is needed, and actual humanitarian activity.

Shelter and household-level mapping are also essential for assessing and meeting other sectoral needs. For example, they can be a vital first step for WASH activities (placing latrines and water-points – see Figure 11) or health (such as vaccination campaigns).

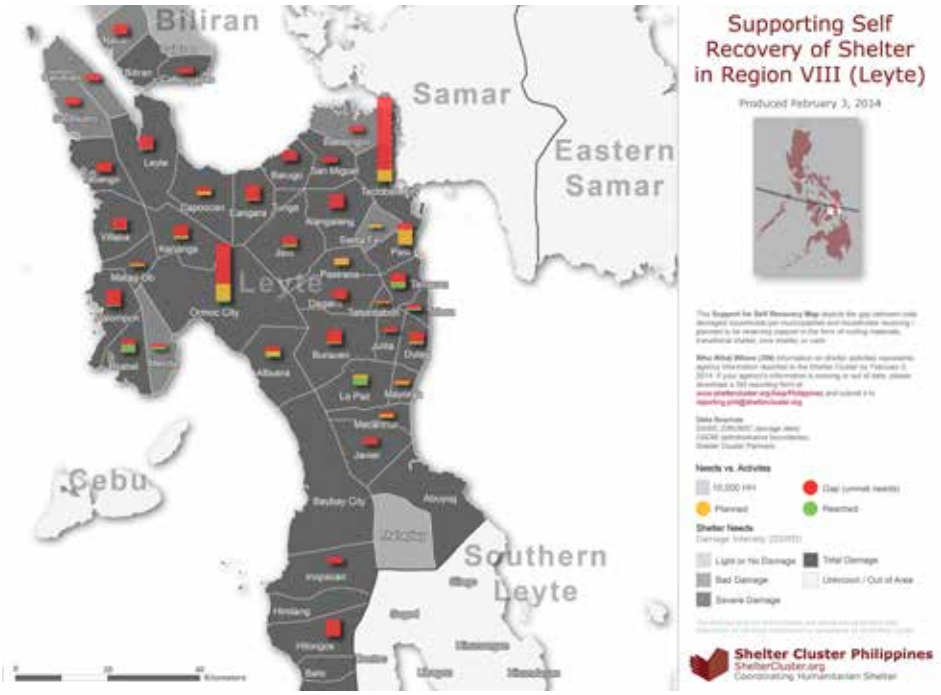

Figure 10 **Philippines: shelter self-recovery – activities mapped against needs.**[23]

Understanding operational circumstances

During a humanitarian operation, it is essential to know which resources are available in the surrounding region, and the logistical options for mobilizing these resources and delivering aid. There are many recent examples of efforts to map infrastructure in camps occupied by refugees and displaced people (see Figure 11). These maps show individual shelters, roads, and services available to the affected communities. They can be used to plan aid deliveries, as well as assess which areas might be over- or under-served, and which services may be missing.

The importance to the Shelter Cluster of infrastructure mapping led to the development of an inter-sector tool (the infrastructure mapping exercise in Somalia) to provide a reliable, useful and timely overview of the living conditions of internally displaced persons, and their access to basic services.[24] GIS can also be used to map and visualize shelter sites by, for example, combining pictures with underlying map data to show logistical information and convey living conditions at shelters,[25] or by overlaying differentiated point sizes representing locations of camps and camp populations onto map data, to convey logistical and needs-based information.[26]

GIS tools are also ideal when assessing the suitability of a site for shelters and settlements. Graded suitability maps for shelter locations are based on a series of weighted parameters (such as proximity to infrastructure, land slope, distance from fault lines, risk of landslides, geology and flood risk).[27] Elevation models are often created to help assess potential flood risks to shelters and settlements.[28]

Other uses

In Uganda, community mapping by refugees and local Ugandan nationals using OpenStreetMap is enabling communities to share information with each other and with the outside world.[29] These people are surveying lighting, education, movement, safety, water and hygiene, to prove that outbreaks of disease and aggression could

Figure 11 **Jordan: Al Za'atari refugee camp – camp infrastructure.**[30]

be eased by proper representation of community needs. Similarly, the Map Kibera project[31] in Kenya has resulted in vast improvements and greater government assistance to this slum area.[32]

Linking GIS to wider information management

Recent developments in other areas of information management, such as user-friendly tools for creating interactive dashboards, and the collection and analysis of primary and secondary data (including mobile data collection), are increasing the benefits that GIS and remote sensing bring to shelter programming.

User-friendly tools for creating interactive data visualizations and dashboards without the need for specific technical or programming skills (such as PowerBI and Tableau) are now being used with notable successes.[33] Mapping in PowerBI and Tableau has become more powerful over time due to the integration with ArcGIS for the former, and MapBox for the latter, allowing humanitarian practitioners to map their data more easily without needing specialist GIS skills, and without the need for data to always have coordinates attached to it. These dashboards can, for example, be used to:

- help demonstrate progress against a defined strategy – see the Shelter Cluster dashboard for the Sri Lanka floods in 2017,[34] or the interactive sector response dashboard produced for the Whole of Syria operation[35]
- communicate spatial relationships between datasets – see dashboard for shelter damage and winterization coverage in Nepal (December 2015)[36]
- demonstrate Shelter Cluster activities – see dashboard for winterization coverage in government-controlled areas of Ukraine.[37]

Use of mobile data collection tools (such as KoBo and ODK)[38] to rapidly collect data using mobile phones and tablets is becoming a standard part of humanitarian response. For the Shelter Cluster, these tools hold great promise for improving the identification and mapping of building damage. For example, in the Philippines in 2014 REACH compared a crowd-sourced remote damage assessment with data collected in the field using mobile tools.[39]

Emerging trends

Emerging sources of geospatial data (such as volunteer geographic information, data collected through the use of drones, and geosensor networks), when used alongside traditional sources of information, provide exciting opportunities for detecting and mapping shelters and settlements.[40]

Unmanned aerial systems (also known as unmanned aerial vehicles, remote-piloted aircraft systems, or drones) are increasingly being used to collect spatial data, with the benefits of being quickly deployable and providing data at fine spatial and temporal resolutions. Also, a multitude of low-cost sensors can be fitted to them (such as hyperspectral and LiDAR),[41] to supplement and improve the data that can be collected.[42] Imagery collected by the International Organization for Migration for the response to the Rohingya population movements in Bangladesh is truly impressive in scale (covering most of the 800,000+ camp populations) and resolution.[43] Field responders report that it has been very useful for planning and delivering humanitarian assistance, particularly for sanitation work.[44]

Volunteered geographic information, such as Google Map Maker and OpenStreetMap, are becoming prominent sources of spatial and socio-cultural data (Map Kibera is a good example).[45] As mapping can help communities better articulate their needs, one author suggests that we need novel methodologies that enable bottom-up processes, such as slum dwellers mapping their own local environments. Such methods may also be useful during humanitarian emergencies in urban areas.[46]

The opportunities provided by crowd-harvesting of social media information via platforms such as Twitter and Flickr are becoming apparent.[47] For instance, in the initial hours after landfall of Typhoon Haiyan, the UN Office for the Coordination of Humanitarian Affairs processed more than 3000 geo-coded expressions of need. When combined with satellite images and reports from the field, this told responders much about the impact.[48]

Smart devices, when combined with the Internet of Things[49] or geosensor networks,[50] create opportunities for collecting large amounts of information on humanitarian settlements, including air temperature and quality, the location and price of water at different access points, the movement patterns of dwellers in the settlements, and activities of humanitarian responders. Such data will better equip responders to meet the specific and evolving needs of inhabitants of humanitarian shelters and settlements,[51] and could also help to communicate the activities of humanitarian organizations in near-real time – something that is always difficult in the early days of a response.[52]

Mapillary combines street-level imagery to generate map data. While travelling around Dominica assessing and providing support during the response to Hurricane Irma, American Red Cross gathered Mapillary imagery to help document the hurricane's impact. They found that the images provided a powerful glimpse into the difficulties being faced by communities, increased situational awareness for responders, and created a baseline against which to measure change during the recovery process. The American Red Cross also used Mapillary and aerial imagery in the Philippines after Typhoon Haiyan, to help communities build a more complete picture of their towns.[53] From this, they were able to derive up-to-date OpenStreetMap data to create accurate maps, which are valuable both for planning and when responding to future disasters.[54]

Conclusion

Spatial analysis using GIS and remote sensing data is perhaps more important to shelter than to any other humanitarian sector. New sources of information (such as data from smart devices and the Internet of Things) could provide new insights into socio-cultural aspects of populations in humanitarian shelters and settlements. Remote sensing can measure only the radiometric properties of a settlement, but these new sources will allow us to delve deeper into living conditions, helping responders meet the specific and evolving needs of the inhabitants. Similarly, the emergence of tools that involve affected communities in collecting data, and that enable inhabitants of humanitarian settlements to improve their own visibility,[55] will make a big difference to the information available to shelter practitioners. However, dealing with the vast amounts of data from these newly mobile-enabled populations, who can communicate directly with responders, will be an increasing challenge for information management officers.[56]

These are exciting times for improving shelter programming through better use of data and information. Opportunities for evidence-based decision making by governments, the United Nations, non-government organizations and affected communities are greater than ever, as are the opportunities for affected individuals and communities to contribute to – and perhaps even lead – these improvements.

1 T Comes et al (2015) 'Bringing structure to the disaster data typhoon: An analysis of decision-makers' information needs in the response to Haiyan'. In *Structured Data for Humanitarian Technologies: Perfect Fit or Overkill? Papers from the 2015 AAAI Spring Symposium*. Association for the Advancement of Artificial Intelligence, California, pp. 7–11. www.aaai.org/ocs/index.php/SSS/SSS15/paper/viewFile/10288/10060.

2 D Paulus et al (2018) 'Turning data into action: Supporting humanitarian field workers with open data'. In *Proceedings of the 15th ISCRAM Conference*. Information Systems for Crisis Response and Management, Rochester, New York. www.researchgate.net/publication/324171780_Turning_data_into_action_supporting_humanitarian_field_workers_with_open_data.

3 This is only the case where multi-sectoral assessments are needed.

4 R Mahabir et al (2018) 'A critical review of high and very high-resolution remote sensing approaches for detecting and mapping slums: Trends, challenges and emerging opportunities'. *Urban Science* 2(1); A Stoddard et al (2015) *The State of the Humanitarian System* (2015 edition). London, ALNAP Overseas Development Institute.

5 For example, Shelter Cluster Philippines (2014) *Supporting Self Recovery of Shelter Activities by Municipality (Leyte): 3W Map Summary*. http://americanredcross.github.io/haiyan_mapfolio/img/maps/2014-02-03_3W_SSRS_Leyte.jpg.

6 Humanitarian Response (2018) *3W – Who Does What, Where?* United Nations Office for the Coordination of Humanitarian Affairs. www.humanitarianresponse.info/en/applications/tools/category/3w-who-does-what-where.

7 Shelter Cluster (2017) *Iraq: Operational Presence in Shelters and NFI (Mosul Response) as of 10 October 2017*. www.sheltercluster.org/iraq/documents/operational-presence-shelters-and-nfi-mosul-response.

8 For example, Shelter Cluster (2018) *Housing Damage and Rehabilitation Database*. www.sheltercluster.org/iraq/documents/housing-damage-and-rehabilitation-database-april-2018.

9 United Nations Global Pulse (2018) *Projects: Measuring Poverty with Machine Roof Counting.* www.unglobalpulse.org/projects/measuring-poverty-machine-roof-counting.

10 Inter-Agency Standing Committee, and European Commission (2018) *InfoRM*. www.inform-index.org.

11 Netherlands Red Cross (2018) *510+ Community Risk Impact Database*. https://dashboard.510.global/#!/community_risk.

12 J Visser (2018) personal communication.

13 A Verity (2014) 'Estimating disaster impact with contextual pre and post disaster datasets'. *Verity.Think: My Thoughts Shared*. https://blog.veritythink.com/post/104948097769/estimating-disaster-impact-with-contextual-pre-and.

14 SB Johnson (2015) 'Disaster impact before ground assessments'. *Medium*. https://medium.com/@Simon_B_Johnson/disaster-impact-before-ground-assessments-f0e128f1af19.

15 REACH (2017) *Bangladesh - Rohingya Refugee Crisis - Cox's Bazar District*. www.reachresourcecentre.info/system/files/resource-documents/reach_bgd_map_coxsbazar_hakimpara_shelter_23112017_a1.pdf

16 C Schweier and M Markus (2006) 'Classification of collapsed buildings for fast damage and loss assessment'. *Bulletin of Earthquake Engineering* 4(2), pp. 177–192; Al Achkar et al (2016) *Imagery Interpretation Guide: Assessing Wind Disaster Damage to Structures*. Harvard Humanitarian Initiative. https://hhi.harvard.edu/publications/satellite-imagery-interpretation-guide-assessing-wind-disaster-damage-structures.

17 For example: 510 (2017) *Before Irma* […] *After Irma*. Netherlands Red Cross. www.510.global/before-after-irma.

18 D Kersbergen (2018) personal communication; A Teklseidk (2018) personal communication.

19 For example, REACH (2016) *Assessment of Eight Hard-to-Reach Areas in Iraq, 2015–2016*. www.sheltercluster.org/documents/reach-irq-report-assessment-eight-hard-reach-areas-iraq-july-2016.

20 For example, Shelter Cluster Somalia (2016) *Comparison of Satelite* [sic] *Imagery Kismaayo 12/2012 – 10/2016*. www.sheltercluster.org/pilots-sustainable-shelter-solutions/documents/kismaayo-satellite-analysis-2012-2016.

21 For example, International Federation of Red Cross and Red Crescent Societies (2014) *Totally Damaged Houses and Poverty by Municipality: Typhoon Hagupit / Ruby*. www.sheltercluster.org/typhoon-hagupitruby-2014/documents/totally-damaged-houses-and-poverty-municipality.

22 For example, REACH (2011) *Misrata Inter-Agency Relief Operation: Damaged Areas and Current IDP Situation: Third Assessment, 2nd Version*. www.sheltercluster.org/libya-civil-unrest-2011/documents/damaged-areas-and-current-idp-situationmisrata.

23 Shelter Cluster Philippines (2014) *Supporting Self Recovery of Shelter in Region VIII (Leyte)*. http://americanredcross.github.io/haiyan_mapfolio/img/maps/2014-02-03_Gaps_SSRS_Leyte.jpg.

24 Global Shelter Cluster (2018) *Somalia: Mapping Exercise*. www.sheltercluster.org/somalia/library/mapping-exercise.

25 For example, Shelter Cluster Central African Republic, Camp Coordination and Camp Management, and Protection Cluster Central African Republic (2016) *Sites des personnes deplacées internes (PDIs) à Bangui et Bimbo*. www.sheltercluster.org/central-african-republic/documents/sites-des-pdi-bangui-juillet-2016.

26 MapAction (2017) *Sierra Leone Landslide & Floods: Shelter Sites as of 23 August 2017*. https://reliefweb.int/sites/reliefweb.int/files/resources/ma011shelterlocationsv2-300dpi.pdf.

27 B Kar and ME Hodgson (2008) 'A GIS-based model to determine site suitability of emergency evacuation shelters'. *Transactions in GIS* 12(2), pp. 227–248; E Şentürk (2017) 'Determination of temporary shelter areas in natural disasters by GIS: A case study for Gölcük/Turkey'. *International Journal of Engineering and Geosciences* 2(3), pp. 84–90; F Verjee and A Gachet (2006) 'Mapping water potential: The use of WATEX to support UNHCR refugee camp operations in eastern Chad'. *GIS Development* 10(4), pp. 36–40.

28 For example, UNOSAT (2015) *Elevation Map of Kalobeyei, Turkana County, Kenya*. www.unitar.org/unosat/map/2232.

29 Humanitarian Open Street Map Team (2018) *Community Mapping in North Uganda – Intrepid Refugees and Host Community Compare Needs*. www.hotosm.org/updates/2018-01-24_community_mapping_in_north_uganda_-_intrepid_refugees_and_host_community_compare.

30 REACH and United Nations High Commissioner for Refugees (2017) Jordan – Al Za'atari Refugee Camp, General Infrastructure Map. https://data2.unhcr.org/en/documents/download/44561.

31 Map Kibera (2018) http://mapkibera.org.

32 R Mahabir et al (2018) 'A critical review of high and very high-resolution remote sensing approaches for detecting and mapping slums: Trends, challenges and emerging opportunities'. *Urban Science* 2(1).

33 Microsoft (2018) *Power BI: Business intelligence like never before*. https://powerbi.microsoft.com/en-us; Tableau (2018) *Tableau*. www.tableau.com.

34 Global Shelter Cluster (2017) *Sri Lanka Floods 2017: Dashboard*. www.sheltercluster.org/response/sri-lanka-floods-2017.

35 Shelter Cluster (2018) *Syria Arab Republic: Whole of Syria Shelter / NFI Sector Response 2018*. https://app.powerbi.com/yJrIjoiMjIwN2JlN2QtNjk0Zi00ZGIzLWFmYjctNTk0MWRkMTYwMzk2IiwidCI6ImU1YzM3OTgxLTY2NjQtNDEzNC04YTBjLTY1NDNkMmFmODBiZSIsImMiOjh9.

36 Shelter Cluster (2015) *Shelter Damage and Winterization Coverage in Nepal*. https://public.tableau.com/profile/brad.kenny#!/vizhome/NepalWinterization_GSC_2015_12_08/CoverageType.

37 On winterization coverage in government-controlled areas of Ukraine, see Global Shelter Cluster (nd) *Northern Donbas*. www.sheltercluster.org/northern-donbas/page/winterization-coverage-government-controlled-areas-ukraine.

38 KoBoToolbox (2018) www.kobotoolbox.org; Open Data Kit (2018) https://opendatakit.org.

39 REACH (2014) *Philippines: Groundtruthing Open Street Map Building Damage Assessment: Haiyan Typhoon – The Philippines: Final Assessment Report*. www.reach-initiative.org/philippines-groundtruthing-openstreetmap-building-damage-assessment. American Red Cross, USAID and REACH.

40 Mahabir et al (2018).

41 LiDAR is light detection and ranging.

42 Mahabir et al (2018).

43 International Organization for Migration (2018) *Bangladesh: IOM Drone Image Overview with New Camp Boundary*. www.humanitarianresponse.info/en/operations/bangladesh/infographic/bangladesh-iom-drone-image-overview-new-camp-bouondary.

44 K Ahmed (2018) personal communication.

45 Map Kibera (2018).

46 Mahabir et al (2018).

47 Ibid.

48 Comes et al (2015).

49 A network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these objects to connect and exchange data (*Wikipedia*).

50 A geosensor network is a system of interconnected sensors collecting different sets of information about the environment, to form a more complete understanding of the area. Mahabir et al (2018).

51 Ibid.

52 S Johnson (2018) 'Internet of Things buttons for humanitarian response'. *Medium*. https://medium.com/@Simon_B_Johnson/internet-of-things-buttons-for-humanitarian-response-301dabb12cfe.

53 See American Red Cross (2018) *Imagery Viewer*. https://americanredcross.github.io/ttl-imagery.

54 D Joseph (2018) 'How Red Cross uses data during global disasters'. *Mapillary: The Mapillary Blog*. https://blog.mapillary.com/update/2018/03/21/how-red-cross-uses-data-during-global-disasters.html.

55 Mahabir et al (2018).

56 J Crowley and J Chan (2011) *Disaster Relief 2.0: The Future of Information Sharing in Humanitarian Emergencies*. Harvard Humanitarian Initiative. United Nations Foundation, Washington DC. www.unfoundation.org/assets/pdf/disaster-relief-20-report.pdf.

Box 17.1

Online housing platforms

Current tools and future opportunities

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Humanitarian agencies often lack the capacity and financial resources to directly help the majority of displaced persons find adequate housing for their period of displacement. As a result, most people are left to find their own shelter, often in unfamiliar locations and with no consistent and reliable mechanism for identifying the best solution for themselves. These populations increasingly seek housing in urban areas, where the most common type of accommodation is pre-existing housing stock. One current example is Jordan, though similar dynamics are in play across the Middle East and elsewhere.

In Jordan, two-thirds of refugees living outside camps have settled in densely populated urban areas. The increased demand, coupled with lack of knowledge of the Jordanian housing market, contributed to a 15 per cent increase in rental unit prices in 2014, affecting refugees and host communities. While current NGO rent-free programmes in Jordan have largely been successful, they are unable to operate at scale.[1]

Building on its experience, and seeking alternative approaches in urban contexts at scale, the Norwegian Refugee Council (NRC) is researching the feasibility of an online platform for use by people in need of housing. This tool would help people connect with property owners, while increasing NRC's reach to vulnerable individuals and host communities. Distinct from other digital initiatives, it would take a user-driven, self-service approach, in which affected populations could view and select options best suited to their particular needs and available resources, while giving both tenants and property owners tools to better manage risks and relationships – and improve security of tenure.

In today's internet-enabled economy, the growth and use of online platforms cannot be overestimated, yet these tools have not been fully embraced by humanitarian organizations. Online platforms can facilitate multi-party transactions, leverage 'network effects' and 'crowd-sourcing', and enable near-instantaneous user interactions, all of which widen consumer choice and increase access to information.[2] Like other sectors, the non-humanitarian housing market has become increasingly reliant on such platforms for buying, selling and renting properties. While levels of market penetration and user adoption vary greatly, there is a shift away from traditional ways of securing housing towards digital methods, particularly in urban areas.

NRC research into existing online housing tools revealed an absence of reliable, trustworthy and fully featured applications that serve the low-income, minimum-standard segment of the housing market, which is where displaced populations typically seek and find housing. Beyond this gap in serviced market segments, existing real-estate platforms focus on searching for and identifying possible housing, and on linking the housing seeker to the seller or leaser of the property. Other crucial elements of the process – negotiating a price, signing a tenancy agreement, registering complaints, making payments – are generally left to individuals, businesses or real estate agents to complete offline.

Given its unique role and relationships, the humanitarian shelter sector has an opportunity to contribute to the development of robust online platforms tailored to meet the specific housing needs of displaced persons. This will entail going beyond what most private sector housing platforms include, to supporting the entire housing process.

The potential benefits of digital platforms for helping displaced populations to secure housing have already been demonstrated in places such as Jordan. Six years into the Syria crisis, refugees' better knowledge of the Jordanian housing market has enabled them to make more informed choices on the quality and price of rental housing.[3] This increased knowledge has been partially facilitated by social media such as Facebook and WhatsApp groups, where peer-to-peer exchanges of information on prices and 'decency' of landlords have contributed to informed decision-making.[4]

Going beyond refugees using digital technologies, the shelter working group in Jordan is developing a publicly accessible information-sharing portal, which compiles data (collected by NGOs during home visits) into meaningful information for refugees seeking housing in the open market. Through innovative use of data and technology, this tool seeks to complement the refugees' own mechanisms for gathering housing market information, enabling self-service access to a wider target population than was previously possible.

To better understand the potential for online housing platforms in situations of displacement, NRC has held focus group discussions with affected populations in Lebanon, Greece and Jordan. These discussions have generated insights into possible features, as well as identifying benefits, concerns and limitations. For tenants, the platform would need to include mechanisms for verifying property condition, enable reputational dynamics to vouch for themselves and property owners, allow for search and comparison of housing and neighbourhoods, map public services, provide tools for managing relationships and rental agreements, and identify opportunities for financial support. For property owners, a platform could offer risk management and insurance

mechanisms, ways to verify reputations and tenant recommendations, financial instruments to enable upgrading to minimum standards, and payment-management systems.[5]

The creation of online platforms that build upon the practices of affected populations for identifying and selecting housing is an opportunity that should not be overlooked by the sector. Self-service digital tools that support households through contract negotiation and relationship management could enable humanitarian organizations to provide assistance on a larger scale than is currently achievable. Furthermore, a digital approach could more easily accommodate tiered assistance structures, allow a smoother exit from rental assistance programs, complement multi-purpose cash assistance, and empower beneficiaries to make more informed decisions on housing. Contextual dynamics mean that this type of tool will not be viable in all country responses, at all times. Nevertheless, in many locations, having such platforms in place at the early stages of displacement could be a powerful new tool for the humanitarian shelter sector, and could significantly improve displaced populations' access to shelter throughout the phases of displacement.

1 Over a four-year period, agencies were able to find rent-free accommodation for 90,000 individuals out of an estimated 520,000 in need. This translates to 17 per cent in total, or 4.3 per cent each year.

2 European Commission (2016) *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Online Platforms and the Digital Single Market: Opportunities and Challenges for Europe*. European Commission, Brussels. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016DC0288&from=EN.

3 Norwegian Refugee Council, and United Nations High Commissioner for Refugees (2018) *Assessment of the Jordanian Marketplace, 2018*. https://reliefweb.int/report/jordan/assessment-jordanian-marketplace-2018.

4 Ibid.

5 These feature sets draw upon focus group discussions on digital housing platforms held by the Norwegian Refugee Council in late 2017 with refugee tenants and property owners in Lebanon, Jordan and Greece.