amp | The Alliance for Malaria Prevention

EXPANDING THE OWNERSHIP AND USE OF MOSQUITO NETS

The use of digital tools to improve the operational efficiency of ITN campaigns

May 2021

1   Background

Insecticide-treated nets (ITNs) remain the primary prevention tool for malaria control and over two billion ITNs have been distributed around the globe since 2000. The primary mode of distribution is through mass distribution campaigns which normally take place every three years and aim to provide one ITN for every two people in households at risk for malaria. National malaria programmes have integrated digital tools into mass distributions, initially for recording and aggregating registration and distribution data, but many countries are now transitioning from paper-based systems to fully digitized approaches.

This landscaping report briefly summarizes the components of mass ITN campaigns and the areas where digital solutions are currently being used or might have important potential for use. It summarizes the current tools in use across malaria-endemic countries and presents a feature list comparing tools against each other. An illustrative "wish list" of features and functions is also presented.

2   Components of mass ITN campaigns and the need for digital solutions

2.1   Macroplanning

Summary: At the macroplanning stage, large-scale population estimates are used along with a quantification algorithm to generate the number of ITNs for procurement.

Current challenges: Generating/obtaining accurate population estimates due to population movement, outdated and incomplete censuses. Use of previous household registration by national malaria programmes does not account for quality of the previous registration and might include presence of ghost households and undocumented inflation that may unnecessarily increase the number of ITNs procured.

Potential digital solutions: Improved population modelling based on satellite imagery and/or triangulated from previous health campaigns.

Potential obstacles: Population estimates based on e.g. building footprints such as MAXAR[1] are still in the process of being validated against on-the-ground population estimates. Modelled population from building footprints is currently still linked to census data, which may have inaccuracies. Building footprint data may not be generated on an annual basis and thus may not capture housing construction and population movements (including abandonment of housing) with sufficient granularity and accuracy. GRID3[2] maps are not generated in a way that easily relates to health facility catchment areas.

---

[1] Maxar owns and operates imaging satellites. More than three million square kilometres of imagery are collected each day to provide customers with a current view of the changing planet. https://www.maxar.com/about

[2] GRID3 (Geo-Referenced Infrastructure and Demographic Data for Development) works with countries to generate, validate and use geospatial data on population, settlements, infrastructure and boundaries. https://grid3.org/about-us

2.2   Microplanning

Summary: At the microplanning stage, district and sub-district details on population, transport infrastructure, geographic accessibility and social and behaviour change resources, opportunities and barriers, as well as security, are integrated to update population estimates and distribution locations. Updates are also made to associated human resources requirements for different activities, as well as transport plans, to inform budgets and ensure that they are tailored to local conditions and resources.

Current challenges: Timely submission of complete, accurate data. Excel-based templates require extensive review and validation. Templates need to be adjustable to specific contexts but also standardized to allow data aggregation. Means for verification and validation of population estimates largely rely on comparative data from other programmes, such as Expanded Programme on Immunization (EPI) or Neglected Tropical Diseases (NTDs) which may have similar problems in terms of accuracy.

Potential digital solutions: Online microplanning templates could accelerate data review and submission. Integrated geospatial analysis could account for obstacles (e.g. drive/travel time given roads and terrain), help delineate intervention zones to avoid missed areas, generate microplans that incorporate local points of interest (POI) and estimate time and resources needed for campaign activities based on planning parameters, geography and catchment population.

Potential obstacles: Network, internet availability and computer access are typically challenging at the lowest microplanning levels. Online templates require additional training and would need to be flexible in order to work for many different planning and implementation contexts.

2.3   Supply chain

Summary: ITNs are transported from warehouses at point of delivery to final distribution points, often with temporary warehousing at different levels, such as region or district. ITNs left over from distribution are integrated back into the Ministry of Health (MoH) system by a process called "reverse logistics".

Current challenges: Poor visibility on real-time locations of ITNs and ITN quantities. Lack of integration of inventory management systems into larger monitoring systems. Lack of visibility and accountability when leftover ITNs are moved from campaigns back into the MoH system.

Potential digital solutions: Commodity-tracking software exists; RFID[3] tags for commodities or geolocation-enabled vehicles are in use throughout sub-Saharan Africa in the commercial and humanitarian sectors.

Potential obstacles: Set-up cost for dedicated commodity tracking systems is high particularly for campaigns, which occur every three years. Logistics management information systems (LMIS) are built to focus on routine commodities and are difficult to adapt for short-term, large volume processes.

2.4   Training

Summary: Campaign staff are trained to conduct their roles and responsibilities for registration, distribution, supervision, transport, etc.

Current challenges: Mismatch of recruited staff vs. skills needed. Training fraud[4]. Incomplete or insufficient training, especially with cascade training. Turnover of trained campaign staff.

Potential digital solutions: Biometric attendance-taking at trainings. Videos or other training content delivered virtually or supported with digital job aids. Digital skills pre- and post-tests could be used to

---

[3] RFID = radio frequency identification. It uses electromagnetic fields to automatically identify, and track tags attached to objects.

[4] Training fraud refers to situations where training is reported but does not take place, or where participants are substituted by others not eligible or taking the place of another trainee.

confirm suitability of candidates for roles as registration/distribution agents, supervisors, etc. Digital evaluations of trainees' understanding of their tasks using quizzes, games, etc.

Potential obstacles: Cost of biometric equipment; privacy concerns. Training content must be designed for lower and higher digital literacy. Digital training content can consume significant network bandwidth and/or phone storage capacity. Linking identities with bank accounts for payment continues to pose challenges due to shared mobile phones and thus mismatched mobile phone registration, incomplete penetration of mobile banking services across settings or mobile network providers. Possible exclusion of suitable people without necessary documentation (especially women, internally displaced persons, etc.).

2.5   Communication/demand creation

Summary: Targeted households are informed of campaign registration and distribution activities and understand the process of registration, the purpose of the voucher (if part of strategy) and the process for redeeming coupons for nets or receiving ITNs where no coupons are used. Targeted households are motivated to obtain their nets and use them for sleeping under. Rumours are managed.

Current challenges: Insufficient reach of communication activities leading to recipients missing out on registration and/or distribution. Insufficient motivation to obtain nets, leading to low net redemption rates in certain areas. Refusal to pick up or use ITNs due to concerns/fears/rumours.

Potential digital solutions: Text messages (SMS) to inform targeted households in specific geographic locations of dates and locations for household registration and ITN distribution. Take advantage of social media to inform about campaign dates/locations and to proactively address rumours or clarify misunderstandings. Direct follow-up with registered households who have not yet picked up their nets. WhatsApp hotline numbers, social media platforms for people to message or call to voice complaints or ask questions.

Potential obstacles: Households without mobile phones and areas with no mobile network coverage would be missed during SMS outreach. Inequitable reach of social media; households without access to (or low use of) social media would need other communication channels. Care needed to ensure social media outreach does not result in or contribute mis- or disinformation. Relatively high cost for developing and managing social media strategies, given incomplete access to the population.

2.6   Household registration

Summary: All households in targeted areas are visited by a registration team and correctly registered and provided with coupons to use when picking up their ITNs (if part of strategy).

Current challenges: Insufficient reach of registration teams due to under-resourcing (often a result of budgets being fixed, and microplanning being "adjusted" to fit to budget), transport challenges, hard-to-reach areas, and insufficient delineation of teams' daily work areas. Errors in data entry or calculation of nets to be given due to low literacy, poor training or poorly designed coupons/forms. Inflation of number of household members or creation of fictitious households so as to receive additional nets, either by registration agent or the household. Slow aggregation of data impedes programme's ability to identify problems in real time.

Potential digital solutions: Geospatial-supported planning of work zones to eliminate missed areas. Tablet/phone-based registration forms to minimize data entry and calculation errors, and metadata (location, timestamps) to assist in monitoring performance of registration teams. Analytics and dashboards to focus on key performance indicators, progress towards targets and to identify challenges where additional supervision/support is needed. Real-time feedback to supervisors and teams to identify areas where corrective action is needed.

Potential obstacles: Households without mobile phones are not able to receive SMS coupons to redeem for nets; paper back-up or other solution is needed. Errors in geospatial maps can contribute to missed areas. Over-reliance on satellite maps can lead to false assumptions about travel distances and infrastructure status. Inflation of household members can occur whether or not digital/paper tools are used. Digital tools must be effective offline for areas of no/low network connectivity.

2.7   ITN distribution to targeted households

Summary: All households in targeted areas receive the ITNs allocated to them either through redemption of coupons or use of household registration forms often at fixed distribution points. In door-to-door campaigns ITNs are provided on the spot based on the number of household members which may be determined prior to the ITN distribution where registration takes place as a separate phase or at the same time as the ITN distribution where registration takes place simultaneously.

Current challenges: Confusion about location of distribution points. Stock-outs of ITNs. Receiving an incorrect number of ITNs, through error or due to stock-outs and rationing. Coupons being brought for redemption by another household member or other representatives of a household. Inability to find names in an efficient manner when using registration forms and no vouchers. Managing requests from households missed during registration who want to receive ITNs at the distribution point. Slow aggregation of data impedes programmes' ability to identify problems in real time.

Potential digital solutions: Distribution linked to coupons generated at the time of registration, allowing for reminders to be sent to those who have not yet picked up their nets. Inventory management software to inform plans for shifting of ITNs from oversupplied distribution points to undersupplied.

Potential obstacles: Digital tools may not solve the challenge of unregistered households requesting ITNs at the distribution point. Digital tools must be effective offline for areas of no/low network connectivity.

2.8   Monitoring and evaluation

Summary: Campaign activities are supervised, monitored and evaluated in ways that support successful completion of the campaign and reaching performance targets.

Current challenges: Supervision checklists not always aggregated to report to higher levels on observations and performance. Data from monitoring activities not used to manage the campaign. Campaign data not automatically linked into national malaria dashboards. Daily review meetings focused on qualitative observations and anecdotal reports rather than using data for programmatic decision-making.

Potential digital solutions: Digital supervision, monitoring and evaluation tools aggregated in real-time in ways that facilitate decision-making for campaign planners.

Potential obstacles: Digital tools must be effective offline for areas of no/low network connectivity.

3   Digital tools for mass ITN campaigns

Six digital platforms are described below and in the accompanying Feature Table (Annex 1). Criteria for inclusion were:
1. Used in multiple campaigns or at national scale within a given country.
2. Focus on managing data aspects related to multiple campaign components – primarily household registration and ITN distribution.

3.1   Red Rose/CAT

Primary use: verify and track training and campaign workforce attendance, register targeted households and issue coupons, redeem coupons for nets, pay workforce.
Primary benefit: reduce fraud, reduce ITN allocation errors; streamline ITN redemption process; rapid data aggregation for decision-making and reporting.

First piloted in Nigeria in 2017, Cash and Asset Transfer (CAT) is now used in multiple states in Nigeria and Benin and may soon be implemented in additional ITN campaigns. CAT is used to register targeted households, track training attendance, manage ITN distribution and monitor intervention coverage. Campaign workforce clock in and out daily using barcodes and/or biometric information to reduce corruption and security risks. Payment is issued dependent on the days worked. Financial transaction verification processes are included within the platform. Household registration and distribution data are aggregated in a decision-making portal.

In Benin, 3,700 devices were used in a phased ITN campaign to register targeted households and record distribution. In Nigeria, 6,100 devices were used for an ITN campaign to register households, record ITN distribution and financial transaction verification processes. In both countries, the number of devices has been the rate-limiting factor for the speed of distribution activities.

Previously used in: Nigeria, Benin
Planning for use in: Benin, Burkina Faso, Niger, Nigeria, Guinea, Republic of Congo[5]

3.2   CommCare

Primary use: provide e-coupon at registration; register targeted households and issue codes for ITN redemption.
Primary benefit: reduce ITN allocation errors; streamline ITN redemption process; rapid data aggregation for decision-making and reporting.

The Gambia used CommCare to record information at household level and for issuing barcoded coupons, which were then redeemed for nets at distribution points. The platform had 300 users during the 2019 ITN campaign and 500 users during the 2020 seasonal malaria chemoprevention (SMC) campaign.

Previously used in: The Gambia
Planning for use in: The Gambia

3.3   NetApp

Primary use: provide e-coupon at registration; register targeted households and issue codes for ITN redemption.
Primary benefit: reduce ITN allocation errors; streamline ITN redemption process; rapid data aggregation for decision-making and reporting.

NetApp, an Android-based application, was designed and developed by information technology (IT) professionals within the Ghana Health Service to provide real-time monitoring of campaign registration and distribution and to reduce mathematical and data entry errors in calculating the number of ITNs

---

[5] As of March 2021 AMP survey.

needed by households. The application was developed in 2016–2017 and was first used during the 2017–2018 campaign. A similar app (SiCApp) was developed and used for the 2019 and 2020 SMC campaigns and will be used for the 2021 ITN and SMC campaigns. A third app, Nets4Schools, is used for school distribution in Ghana.

NetApp works offline and can issue an SMS code to targeted households who own a mobile phone; the code is then used to redeem ITNs at the distribution point. Paper coupons are provided for households without mobile phones.

Previously used in: Ghana
Planning for use in: Ghana

3.4   ODK Collect and KoboCollect

Primary use: register targeted households and record ITN distribution; compile data for household registration and ITN distribution.
Primary benefit: open source; rapid data aggregation for decision-making and reporting.

Open Data Kit (ODK) is an open-source software used to build data entry forms and is used across many e-Health platforms such as KoboToolbox, CommCare, RedRose's RRCollect, SurveyCTO, Ona and more. It has offline and online capabilities.

The Democratic Republic of Congo (DRC) is using ODKCollect and KoboCollect in its 2020 single-phase campaigns to record household information and ITN distribution. Data were aggregated to facilitate real-time decision-making. Android phones were purchased and will be reused across several provincial campaigns.

Togo used KoboCollect for its 2020 single-phase campaign to record household information and ITN distribution. In contrast to DRC, the MoH recruited individuals who used their own Android phone and installed the KoboCollect app to collect and submit data, resulting in significant cost savings. In some cases, phones were rented from community members for the period of the campaign. Over 21,000 users were involved and the use of local phones also allowed the campaign to take place in a single phase.

Liberia used KoboCollect to enter data at county level for all 15 counties in its 2018 campaign.

Yemen also used KoboCollect for its 2020 ITN campaign, with over 1,100 users, to report distribution data and disaggregate by age, sex and pregnancy status. A web dashboard allowed charting and mapping of results accessible by all stakeholders and facilitated follow-up. Devices were personal mobile phones of the campaign staff.

Previously used in: DRC, Liberia, Togo, Yemen, Liberia
Planning for use in: DRC, Djibouti, Togo, Yemen, Liberia

3.5   EDMIS

Primary use: compile data for household registration and ITN distribution to households.
Primary benefit: rapid data aggregation for decision-making and reporting.

Uganda MoH used their Electronic Data Management Information System (EDMIS) as a data collection app and is implementing their current campaign by having data entry clerks use their own smartphones

to record the ITN distribution activities. Data entry clerks were part of every door-to-door team to facilitate data collection at household level and onward transmission to the campaign database.

Previously used in: Uganda
Planning for use in: Uganda

3.6   DHIS2
Primary use: compile data for household registration and ITN distribution to households.
Primary benefit: rapid data aggregation for decision-making and reporting.

Population Services International (PSI) developed electronic data collection forms in their in-house version of DHIS2 to collect data on household registration and ITN distribution in DRC and in Mali. The DHIS2 Data Capture Android app is used by regional M&E officers to enter data during the registration and distribution phases of the campaign. To support prompt repositioning of nets and management of stock balances, interactive dashboards track the performance of key indicators related to net distribution. The national malaria programme of Mali has also used DHIS2 Data Capture Android to track the completed household registration and distribution. In Republic of Congo, DHIS2 was used by around 50 district-level officers to enter aggregated data and map completed household registration. The system took nine months to be developed, but the key benefit was its integration into the national Health Management Information System (HMIS).

Previously used in: DRC, Mali, Guinea, Republic of Congo, Cameroon, Guinea-Bissau
Planning for use in: Cameroon, Guinea-Bissau, Mali, Zambia

4   Summary of recent and upcoming campaigns use of digital tools

Table 1 lists the type of data collection method (paper or digital) used during the most recent mass campaign for each country where data are available and provides information on whether digital or paper data collection is planned in the upcoming campaign. This information was collected via a short online survey circulated to national malaria programmes and their ITN campaign implementing partners in December 2020 and January 2021.

Table 1: Use of and plans for digital data collection during mass ITN campaigns, as of March 2021.

| Country	Most recent campaign	Upcoming campaign	Year of upcoming campaign	Funding secured for digital in upcoming campaign?
Afghanistan	Paper	Yes TBD	2022	No
Angola				
Bangladesh	Paper	Paper	Rolling	-
Benin	RedRose	RedRose	2023	Yes
Botswana	Paper	Paper		-
Burkina Faso		Yes TBD (RedRose)	2022	
Burundi	Paper	Kobo	2022	Yes
Cambodia	Paper	Paper		-

Country	Most recent campaign	Upcoming campaign	Year of upcoming campaign	Funding secured for digital in upcoming campaign?
Cameroon	DHIS2	Yes (DHIS2)	2022-2023	Yes
Central African Republic	Paper	Paper	Rolling	-
Chad	Paper	Paper	2023	-
Congo-B	DHIS2	RedRose	2022	Yes
Côte d'Ivoire	Paper	DHIS2	2021	No
Djibouti	Paper	Kobo	Rolling	No
DRC	Kobo	Kobo	Rolling by province	Yes
Ethiopia	SMS/IVR	IVR	2021-2022	No
Gabon				
Gambia	CommCare	CommCare	2022	Yes
Ghana	NetApp	NetApp	2021	No
Guinea	Paper	Yes TBD	2022	No
Guinea-Bissau	DHIS2	DHIS2 Capture	2022	No
Haiti				
India			Rolling	
Kenya	Paper	Paper	2021	-
Liberia	Kobo (county)	TBD	2021	No
Madagascar	CAMPMID	Yes TBD	2021	Yes
Malawi	Paper		2021	
Mali	DHIS2	DHIS2	2023	Yes
Mauritania	Paper	CDM		No
Mozambique	Paper	Yes TBD	2023	No
Myanmar	Paper	Paper		
Niger	Paper	Yes TBD (RedRose)	2021	Yes
Nigeria	Paper, RedRose	Paper, RedRose	Rolling by State	Yes
Pakistan	Paper	Yes (RedRose)	2021	Yes
Papua New Guinea	Paper	Paper	Rolling	-
Rwanda			2023	
Senegal	DHIS2	TBD	2022	No
Sierra Leone	Paper	Yes TBD	2022	No
Singapore	n/a	n/a		n/a
South Sudan	Paper	Yes TBD	2021	No
Tanzania	MRC-MIS	Yes TBD	2023	No
Thailand	Paper			-

Country	Most recent campaign	Upcoming campaign	Year of upcoming campaign	Funding secured for digital in upcoming campaign?
Togo	Kobo	Kobo	2023	Yes
Uganda	ED-MIS & CCMIS	Yes (same)	2023	Yes
Yemen	Kobo	Kobo	2023	No
Zambia	DHIS2 (to aggregate paper)	Yes DHIS2	2023	No
Zanzibar	Paper	Yes TBD		No
Zimbabwe			Rolling	

5 "Wish list" feature list/requirements for ITN campaign use case

From a campaign implementation perspective there are a number of key features and functions that, if digitized in a collaborative platform, would greatly facilitate campaign planning, implementation and accountability.

Figure 1: "Wish list" of digital functions for ITN campaign process
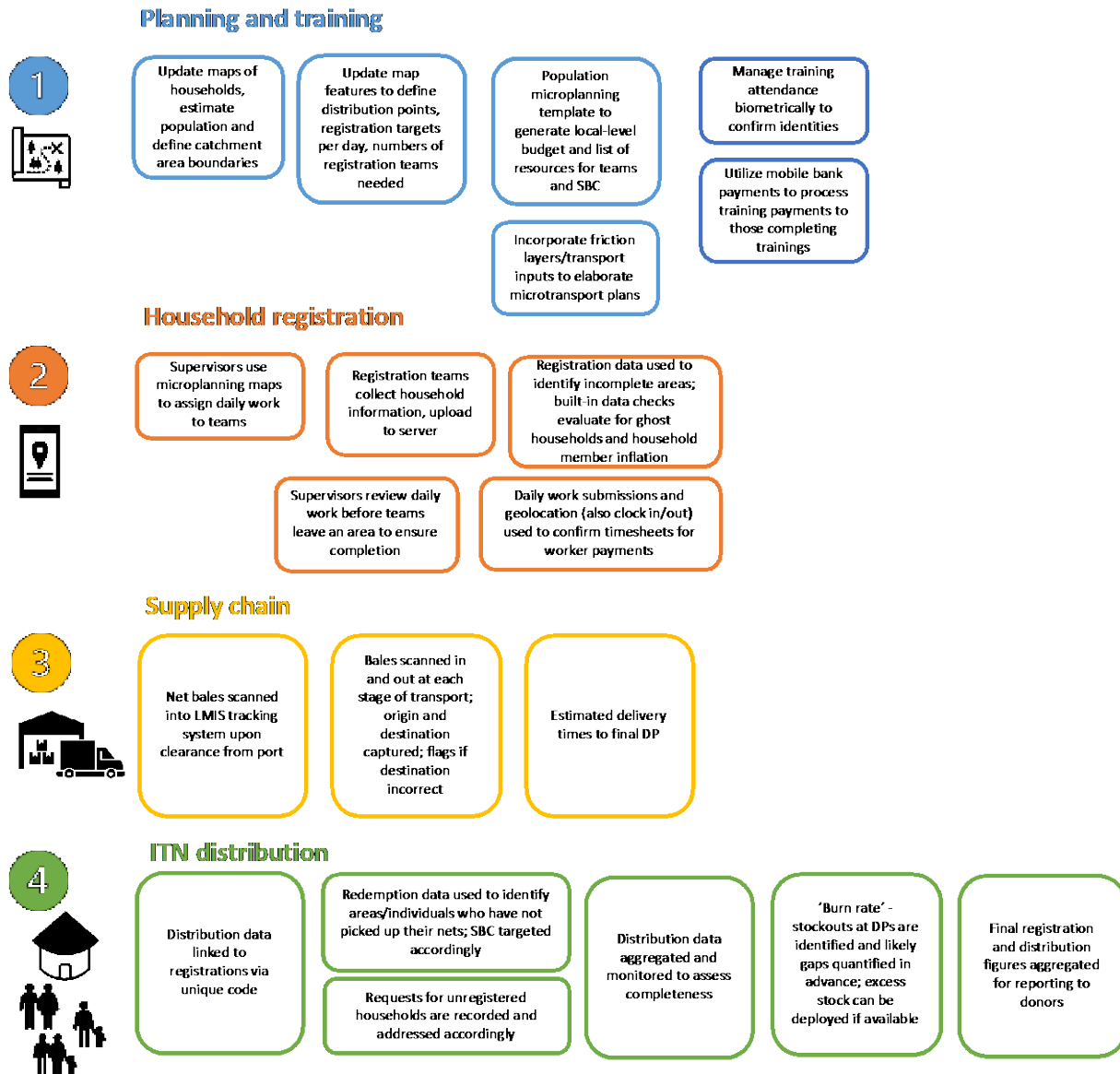
6 Feature list matrix (Excel)

See Annex 1.

7 Conclusion

Based on the breadth of currently available features and functions, RedRose/CAT is the digital platform that provides a nearly complete set of management and data features to plan and implement mass ITN campaigns. It is the only platform that provides functionality for training and workforce management, payment of the campaign workforce, household registration and ITN distribution. It also has promising functionality for supply chain management once ITNs arrive in-country. However, the cost of deploying this application could be a limitation as it is one of the most expensive applications used to implement ITN campaigns.

The remaining digital apps and platforms are more limited in their functionality, primarily capturing and aggregating data from household registration and ITN distribution, and with varying levels of data visualization. Some, like CommCare, can be set up to integrate with mobile payment systems, but for the most part these are data collection and visualization platforms only. Where campaign budgets are limited, these are highly useful options, with KoboToolbox standing out as an ideal open-source option. The apps developed by Ministries of Health in Ghana and Uganda are strong examples of locally led solutions.

8   Other tools reviewed but not included in use cases

Planfeld – used for SMC in [Borno State](#), Nigeria, in 2020. Settlement and feature maps from Nigeria's eHealth data portal were used to generate microplans that automatically estimate the appropriate number of teams needed for SMC activities within the specified timeframe. Planners input the duration of the activity (days) and the estimated population that can be served per day. Mobile, outreach and fixed post strategies and their buffer ranges can be selected, along with age ranges within the targeted population. Points of interest such as schools, churches, mosques can be specified as the fixed posts. Finally, driving, bicycle or walking catchment areas are set. From these parameters, the planner created daily schedules for the teams and identified additional resources required to complete activities within the timeframe. Geographic information system (GIS) devices were used to track progress of teams and to estimate SMC coverage, using automated dashboards. Templates exist for Routine Immunization and Micronutrient Surveys. It is not clear how accurate the automatically generated microplans are once implemented in the field.

Reveal – geospatial intelligence tool integrated with GRID3 building footprints to guide teams to locations (targeted households) and check off tasks. Primarily used in Zambia. Used for indoor residual spraying (IRS) to guide teams to households and mark them as sprayed; for mass drug administration (MDA) to create base maps, navigate to households and record MDA. Was planned for pilot in Nigeria for SMC (May 2020) to create base maps and guide community distributors to households. Unclear if used for immunization campaigns, although use case is described on [website](#). Used for foci investigation in Siavonga District (Zambia) to define boundaries, population at risk, track case data, map larval habitats and record activities. Ongoing discussions about the possibility of using Reveal for ITN distribution, but thus far only mapping/area delineation function seems to have been used in the 2020 Zambia ITN campaign, to clearly delineate IRS and ITN areas. Purports to handle microplanning but more work needed to understand these features other than the maps themselves. Unclear if functionality of the platform or cost is the prohibiting factor.

RITA – logistics/supply chain system used by the World Food Programme (WFP) for ITN campaigns as well as food/aid delivery. Does not, to our knowledge, have household registration or ITN distribution functionality.

SMS systems – While Ethiopia has implemented campaigns and relied on SMS submission of key data (daily distribution point reports, etc.), the platform is not formalized and does not represent a viable "tool", as such. However, a number of SMS-based platforms exist, including TeleRivet, which provides short survey functionality. TeleRivet has been used in the context of IRS campaigns but may not be scalable to the ITN campaign context.

Annex 1: Excel feature list