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The design of a standardised mobile application for fieldwork management and monitoring in cross-national surveys

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1. Executive Summary

This report describes the design of a portable, standardised fieldwork management system (FMS) for the ESS and SHARE based on SHARE's existing system. In the next section (Section 2), we introduce the two surveys (ESS and SHARE), the goals of DASISH and outline the need for a standardised, transportable fieldwork management system. In Section 3 we describe the current procedures used for ESS fieldwork and highlight how a centralised fieldwork monitoring system would be beneficial. In Section 4, we describe the substantive features and practical aspects of a FMS from the perspectives of both directing and monitoring fieldwork. We also give consideration to the sample management system (SMS) utilised by SHARE and the key features that could be retained or removed and the additional features required. Section 5 includes a breakdown of the technical requirements for the FMS in both hardware and software by describing the system in development deliverables. Finally, section 6 includes a short discussion and summary.

2. Introduction

2.1 *The European Social Survey and the Survey for Health Ageing and Retirement in Europe*

The European Social Survey (ESS) is an academically driven cross-sectional, cross-national survey that has been conducted every two years across Europe since 2001. The survey includes questions on topics such as politics, religion, crime, health, well-being, experiences of discrimination and attitude questions e.g. towards ageism, welfare and understanding and evaluations of democracy. The data are collected via face-to-face interviews administered using either CAPI (computer assisted personal interviewing) or PAPI (pencil and paper interviewing). In the most recent round (round 6, 2012), 30 countries participated in the survey. The target population consists of individuals aged 15 and over (no upper age limit) who live in private households. Individuals are selected via random probability sampling.

The Survey of Health, Ageing and Retirement in Europe (SHARE) is a multidisciplinary and cross-national panel, conducted using computer assisted personal interviews (CAPI) in up to 19 European countries (and Israel) on health, socio-economic status, social and family networks. The study focuses on individuals aged 50 or over (Börsch-Supan et al. 2013).

The ESS and SHARE differ in the topics covered, the nature of the data (ESS cross-sectional, new respondents each time; SHARE longitudinal panel) and the organisation of the coordination teams. In addition, whilst SHARE adopts a centralised approach (meaning that the same survey instruments are provided for all countries and a train-the-trainer program[1] is in place), the ESS has adopted a decentralised model whereby National Coordination teams (NCs) in each participating country are ultimately responsible for the translation, CAPI/PAPI fieldwork materials and monitoring fieldwork progress.

Both the ESS and SHARE have a cross-national focus, need their survey instruments to be translated and fielded in many different languages and require standardised, rigorous fieldwork procedures and monitoring activities. Both SHARE and the ESS are recognised as a European Research Infrastructure Consortium (ERIC). Countries participating in either survey are responsible for funding their own fieldwork.

2.2 Goals specified in DASISH Description of Work

The goal of DASISH task 3.3 is to produce a transportable, standardised system of employing and monitoring harmonised metadata[2] files which can aid central fieldwork control, supervision and monitoring. The new system will draw on SHARE's existing sample management system (SMS) and enable crucial elements of the fieldwork progress to be fed into a central database accessible both to members of the ESS Core Scientific Team (CST) as well as to the NCs in their respective country[3]. We refer to this new system hereafter as the 'Fieldwork Management System' or 'FMS' and will on occasion refer to a 'mobile application' and/or 'central database'. Both of these components make up the 'Fieldwork Management System'.

2.3 Why a standardised transportable system is needed

The FMS is a necessary and useful addition to the ESS (and other cross-national surveys) as it will enhance the fieldwork monitoring process enormously. It will do this by enabling information about fieldwork to be recorded in a standardised way by all fieldwork organisations regardless of whether the interview data are collected using computer assisted personal interviewing (CAPI) or pencil and paper interviewing (PAPI).

The FMS will enable interviewers to record information on the door-step of the target respondent more easily than is currently possible in either CAPI or PAPI administration. This will be achieved by installing the FMS as an application instantly accessible from mobile telephones ('smart phones') or small tablet computers. Having an easy to use and portable system will ensure that all

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[1] The train-the-trainer (TTT) program is intended to train representatives from national fieldwork organisations by members of the central coordination team. They then train the interviewers in their respective countries in national training sessions.

[2] Both paradata (data about the process of collecting survey data e.g. case level files) and metadata (aggregated data about the data e.g. response rates) will be created by the system.

[3] To ensure confidentiality of data, each National team will only be able to access fieldwork data (case level files) pertaining to respondents in their country. Access to data from respondents in all countries will be restricted to those involved in central coordination.

contact attempts can be accurately recorded as soon as they take place, thereby improving the quality of this paradata.

The transfer of information from the FMS mobile application directly to a central database will facilitate comparable fieldwork monitoring in real-time (or as close to real-time as possible). This in turn will enhance the quality of data available during fieldwork. Since analysis of the information can also take place <u>during</u> fieldwork this could potentially feed into the development of responsive designs to increase response and minimise non-response bias.

The FMS will be based on SHARE's existing system whilst taking the demands of the ESS into consideration. It will focus on documenting contact attempts with target respondents and collecting essential information used for monitoring fieldwork (see section 3.2). The standardisation of the tool will ensure the quality of the system.

Before we provide more details about the new FMS, it is necessary to outline the current procedures used in SHARE and the ESS to manage and monitor fieldwork.

3. Cross-national fieldwork procedures in SHARE and the ESS

3.1 SHARE

SHARE has developed and used a computerised fieldwork management system from the first data collection onwards. The system is programmed and maintained by CentERdata at Tilburg University in the Netherlands and has undergone developments in each round of SHARE data collection. The system has to be used by all participating survey organisations and consists of a Sample Distributor (SD) and a Sample Management System (SMS). The SD is installed at the server of each survey organisation and contains the whole sample for each country. From there, households are assigned to interviewers and survey modes by a fieldwork manager (based at the fieldwork organisation). The SMS is installed on the interviewers' laptops and allows the interviewers to manage their own subsamples, to register contact attempts and appointments and to screen households. The system also assigns eligibility and respondent types and starts the correct version of the Blaise interview.

The main drawback of the current system is that the laptop used by interviewers is not suitable for use at the doorstep. This means that information about contact attempts are inserted later on and may not be completely accurate. From this point of view, a portable SMS seems to offer a promising alternative.

An ex-ante harmonised survey such as SHARE relies heavily on a standardised approach of data collection across all participating countries. Therefore, the SMS was developed with a common technical basis, ensuring that the same procedure of recording contact information and conducting interviews is used by all interviewers working for SHARE. The data transfers between the SMS and the SD are regular and occur through synchronisation. This enables survey managers

and the central coordination team ('SHARE Central') to analyse data during fieldwork creating a central, cross-national fieldwork monitoring procedure.

CentERdata processes the raw data transferred from all SD's centrally and provides data files[4] to both SHARE Central and the national country teams. Based on these data, SHARE Central produces monitoring reports, which compare fieldwork progress in all of the participating countries and which are delivered to all parties involved in SHARE on a fortnightly basis. Figure 1 provides a graphical overview of the flow of data from the fieldwork organisation to CentERdata and from CentERdata to SHARE Central.

Figure 1: Dataflow for fieldwork monitoring in SHARE Round 5 (2013)
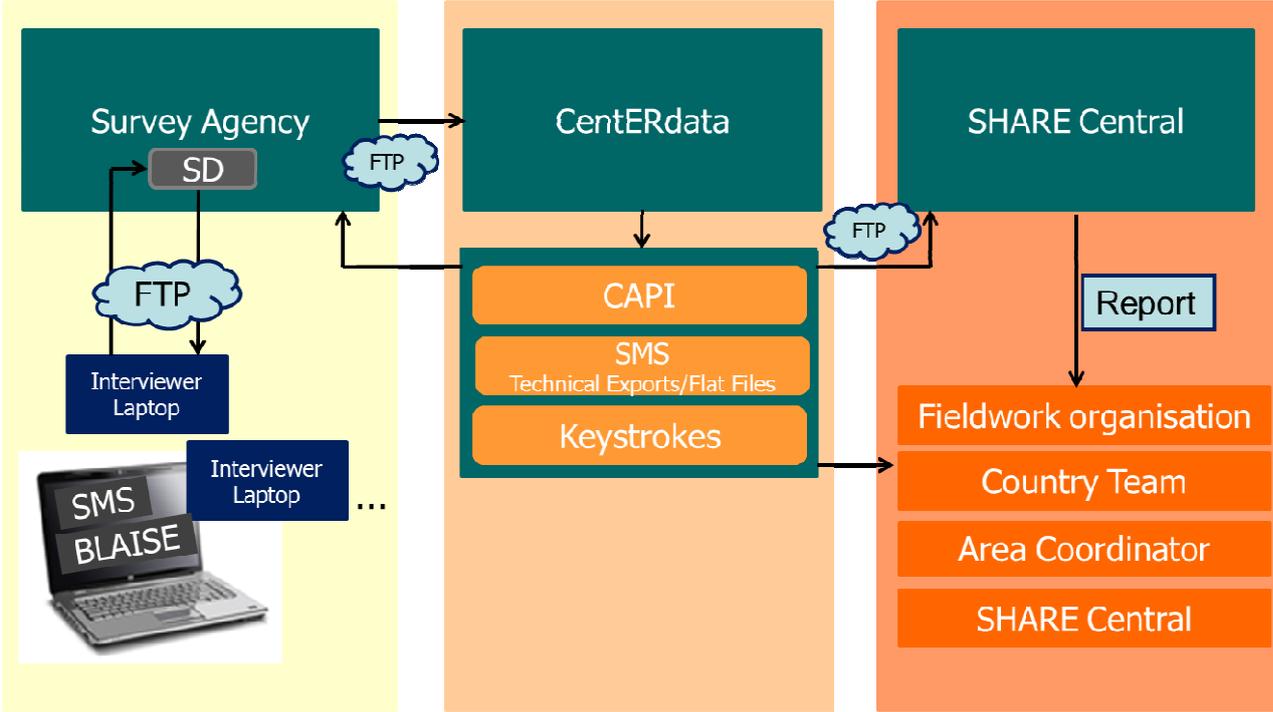
The monitoring reports in SHARE Round 5 document the progress of fieldwork for all countries in a comparative way. The fieldwork period lasted 10 months from January-November 2013. During this time 21 monitoring reports were produced and distributed to the fieldwork organisations, country teams, area coordinators and other members of the SHARE Central team (see dark orange box on the right hand side of Figure 1).

Since not all countries were in the field for the entire 10 month period, the reports always referred to countries 'currently' in the field. These reports offer a good and standardised overview of the fieldwork in all countries. SHARE monitoring is based strictly on ex-ante gross samples. All indicators reported in the monitoring reports (e.g. interim response rates, retention rates etc) are based on the internationally recognised standards set by the American Association of Public Opinion Research (AAPOR, 2011)[5].

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[4] Such as the substantive interview data, contact data from the SMS and item-level time stamp data.
[5] All rates calculated for SHARE use the formulas reported in the appendix of Kneip, 2013.

All reports consist of the following core indicators, which are analysed separately for the SHARE panel sample and the SHARE refreshment/baseline sample:
- Fraction of households with contact attempts by country
- Contact rate of households by country
- Cooperation rate of households by country
- Response rate of households by country
- Individual retention/response rates by country
- Absolute number of interviews by country over time

In addition, the following indicators were also occasionally used to enhance the core indicators:
- Number of active interviewers by country
- Extrapolation of panel fieldwork by country
- Extrapolation of refreshment/baseline fieldwork by country

The information provided is used <u>during</u> fieldwork to monitor progress in each country against projected targets. It also has the potential to be used to develop responsive designs during fieldwork although this possibility has not fully been explored yet.
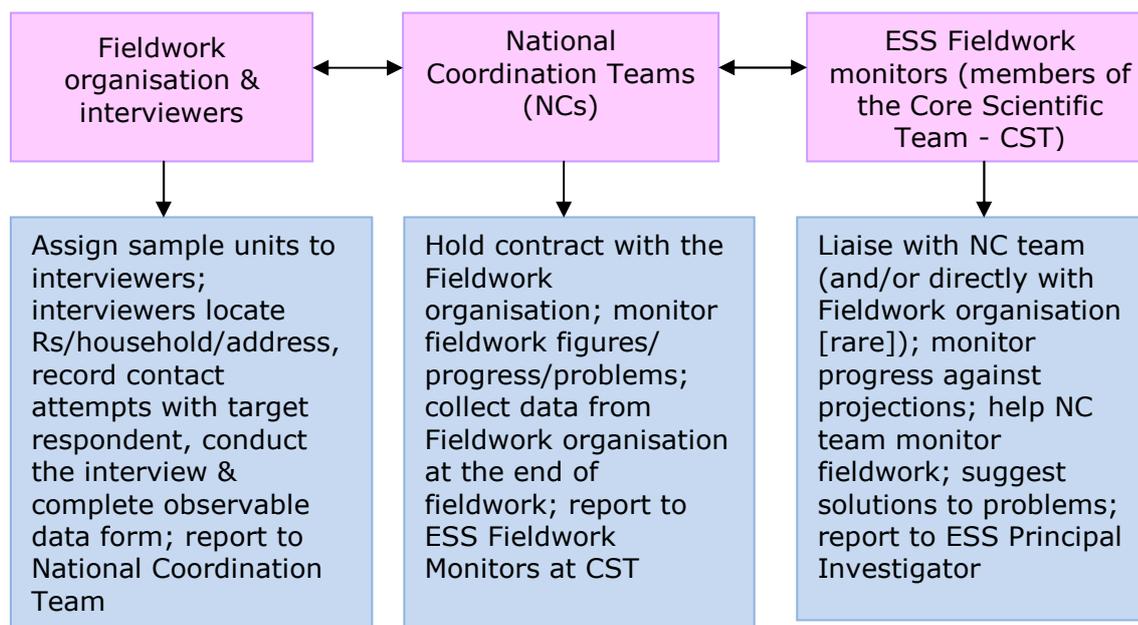
3.2 ESS

In each round of the ESS, there are usually around 25-30 participating countries. Fieldwork takes place between September and December and must last for at least one month (although it often lasts a lot longer than this). The organisations responsible for ESS fieldwork are selected by the NCs. In ESS Round 6, this consisted of 20 commercial survey agencies, six in-house teams (including within Universities); two national statistical institutes and two not-for-profit organisations. The ESS fieldwork process involves the Fieldwork organisation, NCs and members of the CST (see Figure 2).

Face-to-face interviews are conducted with target respondents in each country using CAPI or PAPI depending on the technical infrastructure available. In ESS Round 6, 18 countries used CAPI and 12 countries used PAPI. Unlike SHARE, the ESS does not have a central CAPI program instead the program used is chosen by the fieldwork organisation in each country. A fieldwork monitoring application, installed on a smart phone/tablet is appealing because it can be used by <u>all</u> interviewers regardless of whether CAPI or PAPI is used to collect the interview data.

The CST provides 'model' contact forms (CFs) that are tailored for household, address and individual sample frames. The CFs are intended to be used by interviewers to record outcomes of contact attempts throughout fieldwork and to record neighbourhood characteristics and observable data about the area where the target respondent resides. However, not all fieldwork organisations make use of the 'model' form (see section 4.2.1 for more details).

Figure 2: Dataflow for fieldwork monitoring in ESS round 6 (2012)

Fieldwork organisation & interviewers	National Coordination Teams (NCs)	ESS Fieldwork monitors (members of the Core Scientific Team - CST)
Assign sample units to interviewers; interviewers locate Rs/household/address, record contact attempts with target respondent, conduct the interview & complete observable data form; report to National Coordination Team	Hold contract with the Fieldwork organisation; monitor fieldwork figures/ progress/problems; collect data from Fieldwork organisation at the end of fieldwork; report to ESS Fieldwork Monitors at CST	Liaise with NC team (and/or directly with Fieldwork organisation [rare]); monitor progress against projections; help NC team monitor fieldwork; suggest solutions to problems; report to ESS Principal Investigator

The information collected in the CFs can be used by the fieldwork organisation, NCs and/or members of the CST either during or after fieldwork. It can be used to monitor the progress of interviewers; monitor contact attempts; produce summary reports (by interviewer and by area); check interviewer performance and compliance and contribute to non-response bias analysis[6].

The availability of information provided during fieldwork varies by country according to a number of factors e.g. CAPI/PAPI administration; length of time taken for information to be returned from the field to the fieldwork organisation; length of time taken to key data from the CF into the data file; whether the NCs request the information from the fieldwork organisation in the first place and whether the information is then made available by the fieldwork organisation.

All NC teams are required to submit written reports on fieldwork progress to their assigned fieldwork monitor in the CST. These utilise data provided by the fieldwork organisations and tend to be provided on a fortnightly basis.

The fieldwork reports should include:
- the number of achieved interviews (mandatory)
- the number of sample units where no contact has been attempted yet (mandatory)
- the number of non-contacts (with either the household or the respondent) (mandatory)
- the number of refusals (mandatory)
- the number of ineligibles (mandatory)
- a full breakdown of all available outcome codes (optional)
- a breakdown of outcome codes by region (optional)
- a breakdown of outcome codes by interviewer (optional)

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[6] See section 4.2.1 for details about how the ESS contact forms were used in ESS Round 6.

- a breakdown of outcome codes for demographic subgroups of target persons (optional)
- an interim dataset of achieved interviews (optional)
- an interim dataset of contact form data (optional)

It is rare that all reports (from all countries) include the required information.

The main limitation of the ESS model is that the frequency and content of information provided as well as the amount of detail varies greatly across the participating countries. This makes it difficult to deal effectively with problems as they arise during fieldwork and to create responsive designs. The ESS needs a system that will enable standardisation of the information recorded and will make data available quicker than is currently possible. The ESS would also benefit from a transportable, mobile application to make it easier for interviewers to record information on-the-spot in the field. The current system – where interviews either use paper forms or record the information in a laptop - is not optimal as the CFs are sometimes lost or the use of a laptop is impractical whilst on the doorstep.

4. The Fieldwork Management System (FMS)

In this section, we specifically describe the substantive features of the FMS that need to be included – both from the perspective of cross-national coordination and fieldwork monitoring and from the perspective of the fieldwork organisations who organise and manage the data collection.

4.1 *Substantive features – Cross national coordination and fieldwork monitoring perspective*

4.1.1 General comments

In general, from a central coordination point of view, both the FMS mobile application and central database <u>must</u>:
- enable fieldwork organisations to assign reference identifiers for cases (which are then used in the mobile application, the central database and any system already used by a fieldwork organisation)
- be compatible with the system fieldwork organisations currently use to assign cases to interviewers
- be compatible with samples of addresses, households and named individuals

In addition the mobile application <u>must</u>:
- be suitable for all interviewers – regardless of whether PAPI or CAPI administration will be used for the main survey interview
- be usable in all countries – regardless of which type of smart phone or tablet is used by interviewers
- be simple and easy to start and use – especially when navigating between cases (so that it could literally be used on the doorstep)
- not be an additional burden for either the Fieldwork directors or interviewers

Finally, the central database <u>must</u>:
- provide files in a standardised format
- be accessible to members of the CST and NCs[7]

4.1.2 Key features from the ESS Contact Forms (CFs)

The mobile application <u>must</u> be able to capture information that is currently recorded by interviewers completing the CFs. This includes details of respondent selection; logging visits and contact attempts; recording the outcome of contact attempts; reasons for refusal; likelihood of future cooperation; the status of invalid outcome addresses and neighbourhood characteristics.

<u>Respondent selection</u> – Respondent selection is completed using either a KISH grid or last/next/closest birthday method (depending on the sample being used). For countries/fieldwork organisations using address samples, the fieldwork application needs to facilitate household selection as well as respondent selection.

<u>Logging visits and contact attempts</u> – the mobile application should only be used to log personal visits and contact attempts made by the interviewer in the field. The visit number, date, day of the week, time of day and result of the visit[8] will need to be recorded. For ESS countries where first contact is made by telephone, the fieldwork organisation would feed the data into the central database and link it to a specific respondent using the respondent identifier. If a respondent opts out before an interviewer attempts to make contact[9], the fieldwork organisation should code this is as an 'office refusal' and should not assign the case to an interviewer. The fieldwork organisation would also feed this information into the central database and link it to the respondent using their respondent identifier.

<u>Recording the outcome of contact attempts</u> – this information is recorded for each contact attempt with a target respondent that does not result in an interview. There are 13 codes that an interviewer can use[10].

Cases could be assigned different colours depending on the outcome code assigned. Similarly, a summary overview could be made available allowing interviewers to quickly identify the status of a case without accessing the

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[7] To ensure confidentiality of data, each National team will only be able to access fieldwork data (case level files) pertaining to respondents in their own country. Access to data from respondents in <u>all</u> countries will be restricted to those involved in central coordination.

[8] In the ESS: 1=completed interview; 2=partial interview; 3=contact with someone, target R not yet selected; 4= Contact with target R but no interview; 5= contact with somebody other than target R; 6=no contact at all; 7= Address is not valid (unoccupied, demolished, institutional); 8= other information about the sampling unit. [same list for all samples]

[9] e.g. a respondent chooses to opt-out after they have received an advance letter

[10] In the ESS: 1=appointment; 2=refusal by R; 3=refusal by proxy; 4=household refusal (before selection); 5=R unavailable/not at home until…; 6=mentally/physical unable/ill/sick (short-term: could re-visit during fieldwork period); 7= mentally/physical unable/ill/sick (long-term: unable to complete interview during fieldwork period); 8=Respondent deceased; 9=Respondent moved out of country; 10=Respondent moved to unknown destination; 11=Respondent moved, still in country; 12=Language barrier; 13=Other.

detailed record. This could enable interviewers to manage their cases more effectively.

Similar colour codes could be assigned to problematic cases to alert the fieldwork organisation to difficulties the interviewer has experienced in contacting / locating a respondent. Another possibility would be to colour code cases that have not been contacted in the evening or at the weekend. However, the inclusion of colour coding for these scenarios (in addition to those proposed above to identify outcome codes) may create confusion. Therefore, we do not propose to include these additional colour codes in the FMS.

Recording reasons for refusal – the visit number that the refusal took place at would need to be recorded. In addition, there are 14 codes that an interviewer can use to categorise the reason for a refusal[11].

Recording likelihood of future cooperation – five codes are available to interviewers to record the likely co-operation of the selected respondent in the future 1) will definitely not participate; 2) will probably not participate; 3) may perhaps cooperate in future; 4) will cooperate in the future; 8) Don't know.

Recording status of invalid outcome address – if an address was not traceable; not residential or was unoccupied the status of the address is recorded. There are 7 codes that an interviewer can use[12].

Recording neighbourhood characteristics – this information is completed once for each address (regardless of the outcome of the contact attempt or the sample type being used). The questions focus on the target respondent's house, access to the property, physical condition of the property, presence of litter and vandalism and graffiti[13].

Recording a new address - if a respondent has moved, interviewers must record if the new address is in their area or not. If it is they have to try to reach the respondent at the new address. If it is not, the respondent is assigned to another interviewer.

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[11] In the ESS: 1=bad timing; 2=not interested; 3=don't know enough/too difficult for me; 4=waste of time; 5=waste of money; 6=interferes with my privacy/I give no personal information; 7=never do surveys; 8=co-operated too often; 9=do not trust surveys; 10=previous bad experience; 11=don't like subject; 12=R refuses because partner/family/HH do not give approval to co-operate; 13=do not let strangers in; 14=other.

[12] In the ESS: 1=Derelict or demolished house/address; 2=not yet built/not yet ready for occupation; 3=address not occupied (empty, second home, seasonal); 4=Address not residential: only business/industrial purposes; 5= A Address not residential: Institution (retirement home, hospital, military unit, monastery…); 6=Address not traceable, address insufficient; 7=Other

[13] In the ESS: **N1 What type of house does the (target) respondent live in?** (1=Farm, 2=Detached house; 3=Semi-detached house; 4= Terraced house; 5= only housing unit in a commercial property; 6=multi-unit house, flat; 7=student apartment/rooms; 8=retirement house; 9= house trailer/boat; 10= Other [specify]. **N2 Before reaching the (target) respondent's individual door, is there an entry phone system or locked gate/door?** 1=Yes – entry phone system; 2=Yes locked gate/door; 3=Yes – entry phone system AND locked gate/door; 4=No neither of these. **N3 What is your assessment of the overall physical condition of the building/house?** 1=Very good; 2=Good; 3=Satisfactory; 4=Bad; 5=Very bad. **N4 In the immediate vicinity, how much litter and rubbish is there?** 1=Very large amount; 2=Large amount; 3=Small amount; 4=None or almost none. **N5 In the immediate vicinity, how much vandalism and graffiti is there?** 1=Very large amount; 2=Large amount; 3=Small amount; 4=None or almost none.

An additional feature that is not currently collected on the ESS is a tool that could be embedded within the FMS mobile application itself. This tool would collect information about how and when the interviewers use the application. This form of paradata could be useful to facilitate future development or improvements for the mobile application and would generate files that could be useful to examine interviewer behavior during fieldwork.

Implications for development of the mobile application

- The FMS mobile application <u>must</u> enable interviewers to select individual cases and record its status throughout fieldwork
- A KISH grid and options for last last/next/closest birthday method of respondent selection needs to be installed
- Interviewers must be able to record multiple visits and contact attempts to a target respondent and the outcome of these
- Interviewers must be able to record the reasons for refusal, the likelihood of future cooperation, the status of invalid outcome addresses, neighbourhood characteristics and a new address (if applicable)
- Interviewers must be able to instantly identify the status of a respondent from a summary overview based on the last known contact attempt or visit outcome code assigned (e.g. via colour coding)
- Interviewers must be able to record a new address for a respondent (if applicable)
- Consideration about paradata to be collected should be carefully considered before development work on the mobile application begins
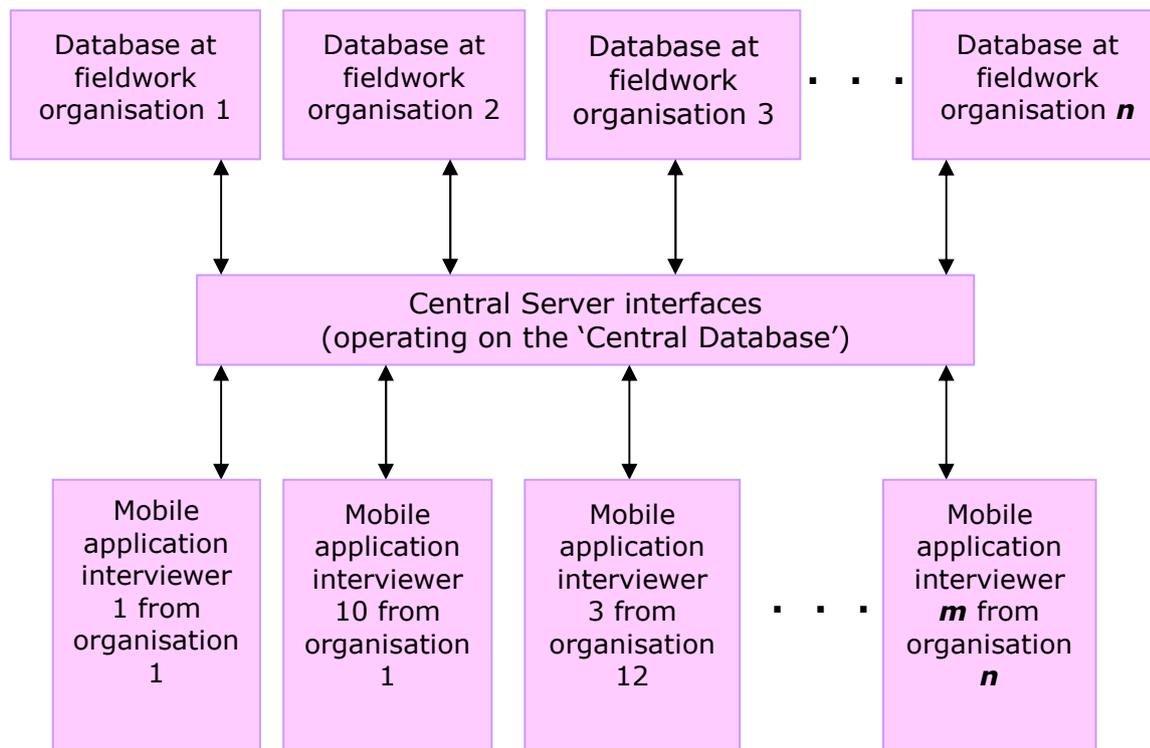

4.1.3 Central database

The central database will be accessible to members of the ESS CST as well as to National Teams. To ensure confidentiality of data, each National team will only be able to access fieldwork data (case level files) pertaining to respondents in their country. Access to data from respondents in all countries will be restricted to the ESS CST.

Information will be transferred from the fieldwork systems (at each fieldwork organisation) to the mobile devices (smart phones/tablets) of each interviewer via a Central server. Information transfer should be secure at every stage. Figure 3 shows the how information can be transferred via a central server. The double-headed arrows in Figure 3 indicate that data can flow in both directions.

The central server interface (which operates on the central database) communicates with <u>all</u> of the fieldwork database/fieldwork servers and with <u>all</u> of the smart phones/tablets used by interviewers.

The mobile application communicates through the Central database server to the fieldwork organisation. In this way, fieldwork organisations that do not already have a database to assign / manage cases can use the Central database application to assign cases to interviewers.

Figure 3: Transfer of information from/to fieldwork organisations and mobile applications via the central server

Database at fieldwork organisation 1	Database at fieldwork organisation 2	Database at fieldwork organisation 3 . . .	Database at fieldwork organisation *n*

Central Server interfaces
(operating on the 'Central Database')

Mobile application interviewer 1 from organisation 1	Mobile application interviewer 10 from organisation 1	Mobile application interviewer 3 from organisation 12 . . .	Mobile application interviewer *m* from organisation *n*

Updates from the mobile application will simultaneously update the central database and the database at the fieldwork organisation – this allows the fieldwork organisations to continue to use their own systems if they want to. Similarly, updates made at the fieldwork organisation can be relayed via the Central Server and onto the mobile applications. This information then updates or replaces the information previously stored in the mobile application. The information stored at each location (fieldwork organisation, central server, mobile application) would automatically update based on new information received at any of the three locations. The mobile applications or the fieldwork servers will need to check for or push updates to the central server and therefore update the central server and themselves on the basis of what is known from the central server.

The central database will keep <u>all</u> records generated by a mobile application. Items marked as deleted will not be pushed to the mobile applications, or will be detected by the mobile applications as 'not to be used anymore'. The mobile applications or the fieldwork servers will then remove local files of that kind, or will not show them anymore. This principle applies to other scenarios too. So for example, when there is a new round, new data will emerge. Data from the old round can be marked 'inactive' and therefore will not appear in the fieldwork servers, or appears in the fieldwork servers as inactive/previous data. The mobile application does not push or collect any of the information from the old round.

All variable choices (the visualisations on the mobile application or fieldwork database) can be catered for, by the principle of flagged data in the central server. A mobile application or fieldwork server will 'seek' the flag status on

known data and act accordingly - either removing the information locally or hiding/inactivating it.

The interfaces on either the central or the fieldwork servers should allow respondents to be reassigned according to their data/values. For example, a case may be assigned to another interviewer so that the new interviewer can attempt refusal conversion or reassignment might take place because a respondent has moved to an area covered by a different interviewer.

Implications for development of the central database

- The central database must be compatible with the range of different systems / databases already used by fieldwork organisations
- The transfer of information between the mobile application, central database and database at the fieldwork organisations must be secure
- The interfaces at either the central server or the fieldwork servers should allow respondents to be reassigned according to their data/values to new interviewers
- Security levels will differ to enable members of the ESS CST to access data from all countries but to restrict access to National Teams to the files from their own country.
- The interfaces on either the central or the fieldwork servers should allow for respondents to be reassigned according to their data/values.

Implications for development of the mobile application

- Transfers from the mobile application to the fieldwork organization and central database should be automated and simultaneous
- Any new data from the fieldwork organisation can be transferred via the central server to the mobile applications, updating or replacing the information previously stored in the mobile application
- As soon as an interviewer closes the application the data should automatically be stored and sent to the fieldwork organisation via the central database/server
- The application will be offline. Transfers will require an internet connection using Wi-Fi or a mobile phone network. If an interviewer does not have a signal on their mobile device or no/limited internet service is available, information should be transferred as soon as a signal is obtained /service resumes

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The central database should make it possible for output files to be generated for fieldwork monitoring purposes. These could be at the interviewer, area/region or full country level and should include the following information as summary statistics:
- the number of achieved interviews
- the number of sample units where no contact has been attempted yet
- the number of non-contacts (with either the household or the respondent)
- the number of refusals
- the number of ineligibles
- the number of contact attempts made to interim non-respondents (and when these attempts took place)
- the interim response rate within primary sampling units

- a full breakdown of all available outcome codes
- a full breakdown by gender or age of respondents (where possible)

From a coordination perspective, we need regular updates from the interviewers to be able to be kept informed about fieldwork progress. Whether the transfers take place on a daily basis, every two days or at end of a week should not matter so long as the central database can organise output files for each country and interviewer chronologically according to when the outcome code was recorded in the mobile application. We consider the frequency of transfers from the perspective of the fieldwork organisation in section 4.2.

Implications for development of the central database
- It should be possible to generate different output files depending on users needs
- Output files must be provided in a user-friendly, standardised format (e.g. Excel)
- Output files for each country and interviewer must be ordered chronologically according to when the outcome code was recorded in the mobile application

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4.1.4 Training

Training will need to be provided for users of the Fieldwork Management System. This will be required for use of the Central database and for the mobile application. The training requirements will differ depending on the user group – see Table 1 for details.

Training could be provided to the Core Scientific Team members by CentERdata in the first instance. Training materials could then be developed by the CST for the National teams and fieldwork organisations to use. Each fieldwork organisations would be responsible for training their own interviewers.

Table 1: User groups and training requirements

User group	Training / instruction required – central database	Training / instruction required – mobile application
Fieldwork Organisation Staff (supervisors/managers/ directors) – <u>with</u> existing database to allocate cases to interviewers	How to access and synchronise with the central server (from existing system) How to access data files from the central server (if required) (including exports and generating statistics)	Installation of the application onto mobile devices Use of the mobile application

User group	Training / instruction required – central database	Training / instruction required – mobile application
Fieldwork Organisation Staff (supervisors / managers/directors) – <u>without</u> existing database to allocate cases to interviewers	How to use the central server interface – including case allocation How to access data files from the central server (including exports and generating statistics)	Installation of the application onto mobile devices Use of the mobile application
Fieldwork Organisation Staff - Technical experts	How to access and synchronise with the central server (from existing system) How to access data files from the central server (if required) (including exports and generating statistics)	
Interviewers	Not applicable	Use of the mobile application – including navigation, inserting information and how to send information
National Coordinators	How to access data files from the central server - for own country (including exports and generating statistics)	Not applicable
Core Scientific Team (CST) members	How to access data files from the central server - for all countries (including exports and generating statistics)	Not applicable

4.2 Substantive features – Fieldwork Director's perspective

It is important that the FMS application and central database is compatible and 'fits' with current fieldwork practices and needs so that it is not seen by fieldwork organisations as an additional burden. To gain a better understanding of the varied fieldwork practices used in ESS Round 6 and to supplement what was known about SHARE Round 5, we conducted a Fieldwork Management Survey with ESS and SHARE Fieldwork Directors[14]. Respondents were also asked about

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[14] The survey was conducted with Fieldwork Directors from ESS Round 6 and SHARE Round 5 in June-September 2013. 22 responses out of 27 were collected for ESS Fieldwork Directors (15 agencies used CAPI;

their opinions of the development of the mobile application, with a view to incorporating the expertise of those who are familiar with the day to day implementation of ESS and SHARE fieldwork into the design of the FMS.

The following sections take each of the topic areas in turn highlighting the results from the survey and the implications for the development of the tool – including any key features which should be included in the design.

4.2.1 Use of ESS Contact Forms

If the information collected in the mobile application is to be based on the ESS contact forms our first step was to find out how many fieldwork organisations use the ESS 'model' contact form provided by the CST rather than a country specific form.

In ESS Round 6 25 countries used the ESS model contact form and five adapted it to a country specific contact form (source: ESS6 Pre-fieldwork questionnaire). A different picture was found in the data from the FMS[15]. Only six fieldwork organisations indicated that they used the 'model' contact form. Eleven stated that they adapted the model contact form for use in their own country (but ensured it included the same information as requested in the model contact form) and a further five used their organisation's own form.

Presently, just over half of the ESS fieldwork organisations surveyed indicated that they believed interviewers completed the ESS contact forms after a contact attempt had been made, but not on the doorstep of the target respondent. This adds weight to the argument that a transportable, mobile system could be convenient and beneficial to interviewers.

The main focus of the FMS mobile application will be to capture all contact attempts – in order to improve the completeness of data collected and enhance fieldwork monitoring efforts. For the ESS countries we wanted to know for what purpose the information in the contact forms were used. The Fieldwork Directors indicated that data from the contact forms was used to:
- monitor fieldwork progress (19 respondents)
- obtain information about interviewer performance (19 respondents)
- understand the number of contact attempts during fieldwork (17 respondents)

Twelve directors reported using the contact form information to inform future rounds of data collection. There was no real difference in use of the contact form data between CAPI and PAPI organisations.

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seven used PAPI). Four out of eight responses were collected from SHARE Round 5 Fieldwork Directors. See Annex 1 for more details.

[15] This could be attributed to differing interpretations of the phrase 'model contact form' and 'adapted for country', which were used in the survey question. Respondents might have been thinking about both the appearance of the form and the specific information collected or one or other of these. It might be the case that in some countries the categories and visual appearance is similar to the model contact form; in others it might be that the categories are the same but the visual appearance differs e.g. due to programming in CAPI.

Half of the Fieldwork Directors also reported that they paid interviewers to complete the contact forms in ESS Round 6. This suggests that there could be an issue with levels of compliance (or willingness) in terms of use of the mobile application by interviewers.

> **Implications for development of the mobile application**
> - Although a 'model' paper-based contact form exists, not all fieldwork organisations currently use it. Therefore, the application does not need to exactly replicate the format/structure of the current paper form – so long as all of the information can be collected
> - The use made of the information collected in the contact form during fieldwork by the fieldwork organisation means that information from the mobile application should be transferred to the fieldwork organisation and to a central database at the same time

4.2.2 Allocation of sample cases to interviewers

We wanted to find out how sample cases were allocated to interviewers and what type of information was transmitted. All 22 of the fieldwork directors who responded used information about the primary sampling units/sample point to allocate cases to interviewers in ESS Round 6. Compared to SHARE Round 5 Directors, ESS Round 6 Directors were far more likely to allocate sample cases to interviewers in one go rather than in batches as fieldwork progressed. Almost all of the ESS Fieldwork Directors reported that interviewers were given instructions on how to manage their cases (19 out of 22 respondents). A number of different methods were used to transfer details of cases to the interviewers. For organisations using CAPI this included: secure file transfer protocol (6 organisations), providing details via post or email (4 organisations), loading the names and addresses into the CAPI software on laptops (3 organisations) and an unsecure file transfer protocol (1 fieldwork organisation)[16]. None of the organisations said that they transferred information using either a USB device or a CD.

The ESS Round 6 Fieldwork Directors also cited different software programs that they use for transferring information about sample cases to interviewers electronically including five different software packages tailored to CAPI and programming languages such as Blaise, GnuPG, and SQL. Two Directors also reported that they used software tailored for CAPI that had been developed in-house.

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[16] Code all that apply question so answers do not equal the number of respondents. Fieldwork organisations using PAPI were not asked this question.

> **Implications for development of the mobile application**
> - The FMS central database should be able to handle multiple as well as single stages of case allocation to interviewers
> - The FMS central database will need to ensure that sample information, names and addresses can be securely transferred from the fieldwork organisation to the mobile application for each interviewer (via the database)
> - The variety of software packages used in ESS Round 6 might mean that the central servers need to compatible with a range of CAPI software programs (used by different fieldwork organisations)

4.2.3 Interviewer management of cases

Another aspect of the fieldwork management survey was to find out how interviewers manage the cases allocated to them in practice[17]. As Figure 4 shows, most of the Fieldwork Directors indicated that their interviewers managed their cases by the location of the respondent (20 ESS respondents and 3 SHARE respondents). However, there were also those that used the status of the case, weekly targets (set by the fieldwork organisation) and the target time for first contact attempts (also set by the fieldwork organisation).

Figure 4: Methods used by interviewers to manage their cases

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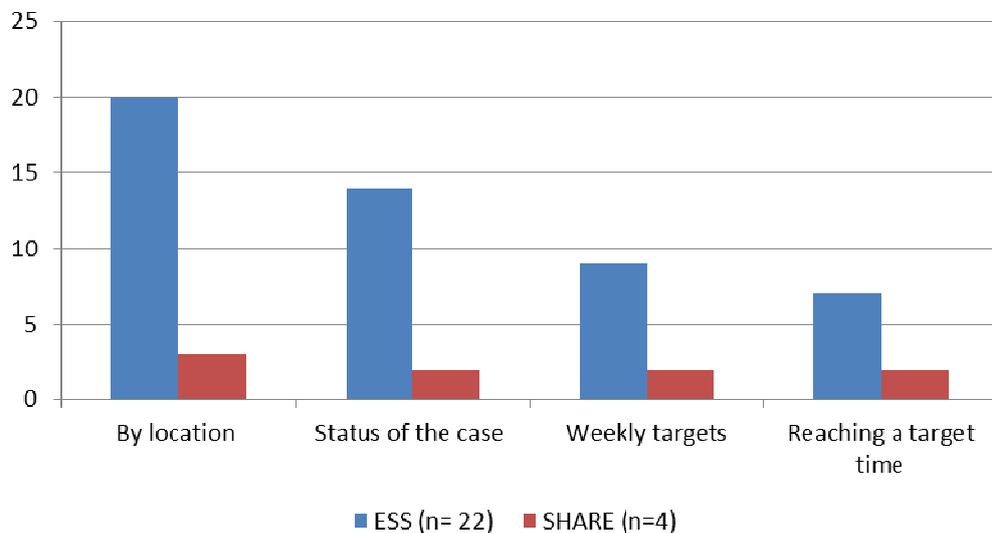
[17] Ideally we would have liked to have obtained this information directly from interviewers but this was not possible. The responses from the Fieldwork Directors might not give a complete picture of interviewer practices but it should be indicative.

> **Implications for development of the mobile application**
> - The mobile application should provide a number of filter options so that interviewers can manage their cases effectively from the overview summary lists. Colour coding might also be an efficient way to quickly check the status of a case (as mentioned in section 4.1.2)
> - A map or travel distance indication feature could be included in the mobile application to assist interviewers in managing their workload based on the location of the respondent
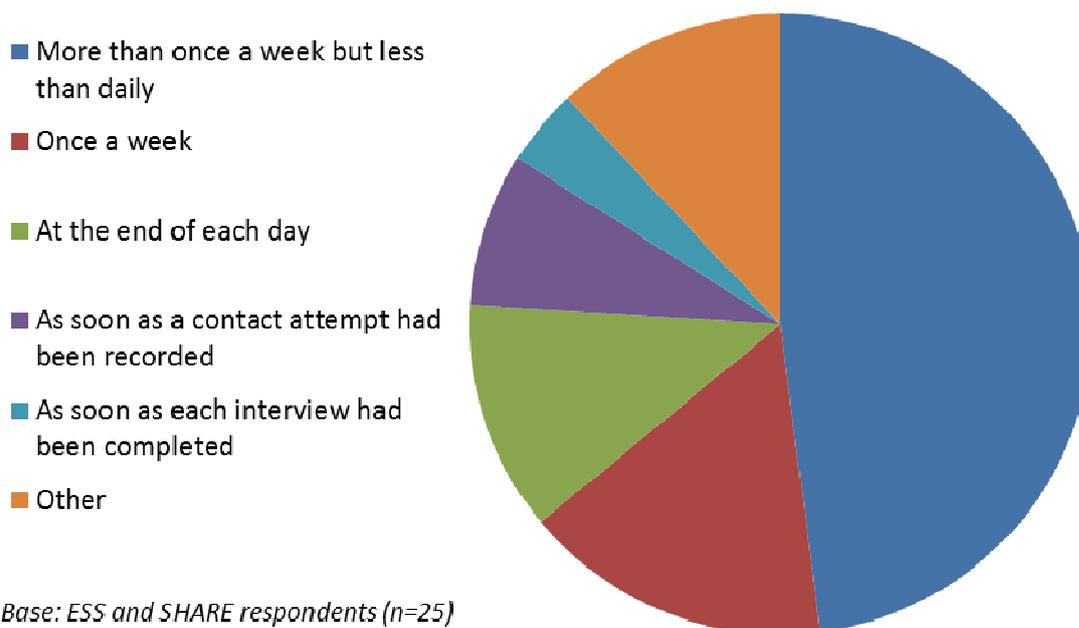
4.2.4 Communication – volume and type of information transferred

We also wanted to understand the volume and type of information that was communicated by interviewers to the fieldwork organisation as the FMS could facilitate all types of contact between the interviewer and the organisation.

The ESS Round 6 Fieldwork Directors reported that the methods most commonly used to keep track of interviewer progress were telephone (16 respondents) or email (15 respondents). However other methods, including software updates (16 respondents) and reports from area managers/coordinators (14 respondents) were also used. None of the respondents reported using the GPS of the interviewer.

Fieldwork progress updates were most commonly received more often than once a week, but less than daily. However there were some fieldwork organisations who reported that updates were received as soon as a contact attempt had been made or an interview had been completed. Figure 5 below provides detailed information.

Figure 5: Frequency of interviewer updates received by the fieldwork organisation

Legend:
- More than once a week but less than daily
- Once a week
- At the end of each day
- As soon as a contact attempt had been recorded
- As soon as each interview had been completed
- Other

Base: ESS and SHARE respondents (n=25)

ESS Fieldwork Directors also reported that different information was provided by interviewers in their progress updates. Most common was:
- information on the number of completed interviews (21 respondents)
- the problems experienced during fieldwork (21 respondents)
- the number of contact attempts (20 respondents)
- updates on contact attempts (15 respondents)

CAPI, telephone, email and paper-based contact forms were all used by interviewers to provide progress updates during ESS Round 6 and no clear method was favoured over the other alternatives.
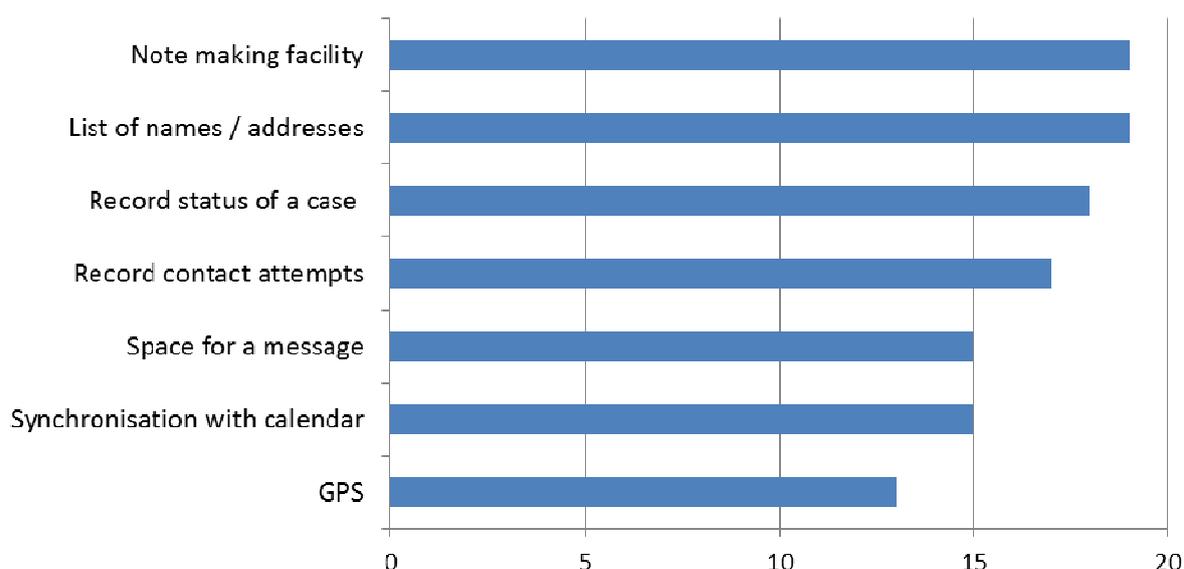

Implications for development of the mobile application

- The FMS mobile application and Central database should offer the possibility of transferring information on a frequent basis. This would ensure that duplication is reduced and greatly increase efficiency by streamlining and automating the reporting process (for example by freeing up fieldwork staff who would normally receive and handle the updates that are received via phone and email)
- Automated 'close and send' (from the mobile application) should increase the frequency of information received from interviewers
- Simultaneous updates from the mobile application to the central database and the database at the fieldwork organisation should also increase the frequency of information received from interviewers
- At the bare minimum, the mobile application should enable interviewers to record the number of completed interviews and contact attempts as well as updates on contact attempts
- Interviewers do convey information about problems experienced during fieldwork to the fieldwork directors. The mobile application could facilitate this e.g. via a messaging function
- The GPS of the interviewer was not reported to have been used. This may be because the opportunity to make use of it was not available. This could be considered for inclusion in the mobile application but is not essential

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4.2.5 Other useful features

A list of possible additional features was presented to Fieldwork Directors in the Fieldwork Management Survey, and they were asked to indicate which they thought would prove useful. Figure 6 highlights their responses. A note making facility, lists of names and addresses of respondents and the ability to record information (such as the status of the case and the number of contact attempts) were perceived as the most useful.

Figure 6: Useful features identified by fieldwork director
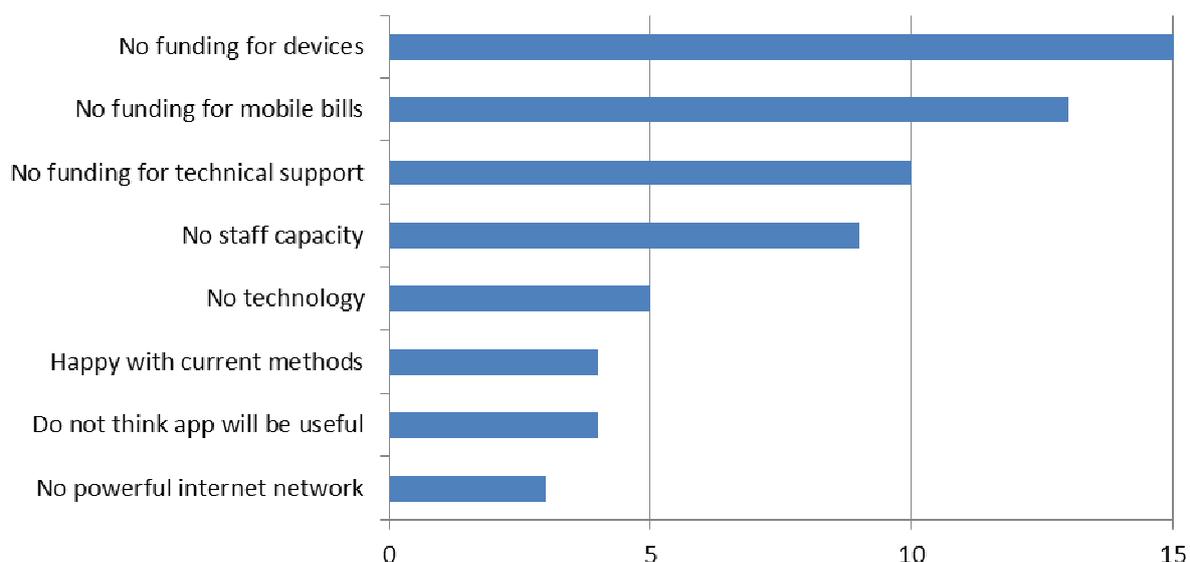

Base: ESS and SHARE respondents (n=26)

Implications for development of the FMS

- The mobile application could provide space for interviewers to record notes to themselves but this is not essential
- Due to confidentiality and concerns about data protection, personal information about the respondent (name, address) should not be transferred between the mobile application, central database and fieldwork organisation. All cases (an address, household or individual) would be assigned a reference identifier and these would be linked to names and/or addresses. The reference identifier would be transferred between all three tools (fieldwork organisation's database, central database and mobile application) but the name and address values would only be visible to the fieldwork organisation and the interviewer within each country
- We could include a calendar as part of the mobile application (that is separate to the calendar on the smart phone or tablet). This might help interviewers organise their workload but is not an essential feature from a monitoring perspective
- The GPS of the interviewer does not seem to be a popular feature and could be considered for inclusion in the mobile application but is not essential

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4.2.6 Potential Barriers to implementation

When contemplating the design of the FMS, it is also important to recognise and consider any potential barriers to implementation. The results from the fieldwork management survey provide insight into the main challenges facing the successful implementation of the FMS. The key concern by far was funding. As Figure 7 shows, lack of funding for devices and for mobile bills were named as a key reasons for Fieldwork Directors not implementing something similar to the FMS at their fieldwork organisation.

Figure 7: Reasons provided by fieldwork directors for not implementing something similar to the FMS

Base: ESS and SHARE respondents (n=24)

Lack of funding affected both the initial implementation costs, and also the on-going operational costs foreseen by the Fieldwork Directors. 15 Fieldwork Directors (out of 24) stated that there was currently no technical support available at their organisation. This response was most common amongst fieldwork organisations using PAPI. With a large number of Fieldwork Directors noting that there was no funding for technical support, this could be a key barrier to both implementation and on-going operationalisation of the FMS.

Other reasons for not implementing something similar to the FMS included being happy with the current methods (4 respondents) and believing that the FMS (or something like this) would not be useful for their organisation (4 respondents).[18]

There was also a concern about the ethical implications associated with the transfer of name and address information via the FMS and the ability of older interviewers to adapt to new technology and processes.

We also asked fieldwork directors about the technology currently used at their organisation. Whilst most of the ESS Fieldwork Directors using CAPI provided the majority (if not all) of their interviewers with laptops, there were very few organisations who reported that interviewers also used mobile devices[19] to manage their fieldwork. A similar pattern followed for those ESS Fieldwork Directors using PAPI. Five (out of six) reported that none of their interviewers used mobile devices to manage their fieldwork. In the one fieldwork organisation where interviewers did use mobile devices, these were personal devices that were not provided by the fieldwork organisation.

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[18] At a previous question, 10 of the 22 respondents indicated that they did not think that a computerised fieldwork management system could be useful to their organisation.

[19] By 'mobile device' we meant things like smart telephones, tablets and personal digital assistants (PDAs).

Implications for acceptability

- To ensure successful implementation and adoption of the mobile application, efforts will need to focus on capacity building – in terms of increasing the provision of smart phones / tablets made available to interviewers
- Promotional work will also be important in order to make the benefits and advantages of the fieldwork management system clear to the fieldwork organisations and interviewers
- The mobile application will be made available without charge, which might alleviate some of the concerns regarding cost and encourage usage of the tool

Implications for development

- To alleviate privacy/legal/ethical concerns regarding the installation of a respondent's personal details on either an interviewer's personal mobile device or a mobile device provided by the fieldwork organisation interviewers should be required to sign in to the application using a secure password. The mobile application should not have the capacity to 'remember' the password, meaning that the interviewer will need to enter it each time they open the application for the first time and if they are timed out of the application. This will enhance data security.
- As stated previously, all cases would also be assigned a reference identifier that would be linked to names and/or addresses. The reference identifier would be transferred between all tools but the name and address values would only be visible at the fieldwork organisation and for the interviewer within each country

4.3 Summary of key features for the new Fieldwork Management System

The features identified in sections 4.1 and 4.2 have been summarised into Tables 2a and b below – according to whether they relate to the mobile application or the central database. Each feature has been assessed to establish whether its inclusion is 'essential' for the new FMS or 'optional'.

Table 2a: Features for the FMS – mobile application

Feature for the FMS mobile application	Essential / optional
Simple and easy to start, use and navigate through	Essential
Suitable for all interviewers – regardless of whether using PAPI or CAPI administration for the main survey interview	Essential
Usable in all countries – regardless of which type of smart phone or tablet is used	Essential
Assign a unique reference identifier to each case	Essential
Compatible with system(s) currently used by fieldwork organisations	Essential

Feature for the FMS mobile application	Essential / optional
Compatible with samples of address, household and named individuals	Essential
Password protected secure log-in for interviewers; no capacity for the application to 'remember' a password	Essential
User timed-out of the application after a defined period of time	Essential
Allow for any new data from the fieldwork organisation to be transferred via the central server to the mobile applications, updating or replacing information previously stored in the mobile application	Essential
Secure transfer to/from central database and to/from fieldwork organisation	Essential
Automatic and simultaneous transfer to fieldwork organisation and to central database as soon as the application is closed by an interviewer	Essential
Offer the possibility of transferring information on a frequent basis	Essential
Transfers of information via internet connection using Wi-Fi and via mobile phone networks[20]	Essential
Installation of a KISH grid and last/next/closest birthday questions (to select respondents)	Essential
Name and address of target respondent only visible to the fieldwork organisation and interviewer within each country	Essential
Possibility to select individual cases and to record/track their status throughout fieldwork	Essential
Summary overview to instantly identify the status of a case	Essential
Filters to manage cases using the overview summary lists	Optional (if summary overview created, otherwise Essential)
Colour coding to determine the status of a case – based on the outcome code assigned	Essential
Log visit information and contact attempts	Essential
Record outcome codes for contact attempts	Essential
Log to record the reasons for a refusal	Essential
Log to record the status of an invalid outcome address	Essential
Log to record likelihood of cooperation in future	Essential
Space to record new address if respondent has moved (only visible to the fieldwork organisation and the interviewer within each country)	Essential
Log to record answers to neighbourhood questions	Essential
Exact replication of structure / format of ESS contact forms	Optional

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[20] Connectivity is key for the full functionality of the mobile application to be assured. The application may start and run on a device without internet access but it will stop working as soon as a login or synchronisation is required.

Feature for the FMS mobile application	Essential / optional
Note making facility (for interviewers to make notes for themselves)	Optional
Ability to send messages to fieldwork organisation	Optional
Include a calendar to help interviewers organise their workload	Optional
A map or travel distance indication feature to help interviewers manage cases e.g. by location of respondent	Optional (if maps are already installed on the device, otherwise Essential)
GPS of interviewer	Optional

Table 2b: Features for the FMS – central database

Feature for the FMS central database	Essential / optional
Provide secure access to members of the CST (to data from all countries) via password protected log-in	Essential
Provide secure access to the NCs (restricted to data from their own country) via password protected log-in	Essential
Assign a unique reference identifier to each case	Essential
Handle multiple as well as single stages of case allocation to interviewers	Essential
Compatible with system(s) currently used by fieldwork organisations	Essential
Compatible with samples of address, household and named individuals	Essential
Provide options for 'hiding' information from users based on 'flags' e.g. data from previous round / respondent details only visible to users within a country	Essential
Offer the possibility of transferring information to/from mobile application and to/from fieldwork organisation on a frequent basis	Essential
Facilitate secure transfer from/to mobile application and from/to database at fieldwork organisation	Essential
The interfaces at either the central or the fieldwork servers should allow respondents to be reassigned according to their data/values to new interviewers (e.g. if respondents move house)	Essential
Secure storage of anonymised data files	Essential
Create output files based on needs of the user	Essential
Provide output files in a user-friendly, standardised format (e.g. Excel and/or SPSS)	Essential
Order output files (for each country and interviewer) chronologically according to when the outcome code was recorded in the mobile application	Essential
Compatible with a range of CAPI programs	Optional[21]

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[21] Whilst the central server does not need to be compatible with a range of CAPI programs, the fieldwork servers will need to be to ensure that they can upload information to the central server. The fieldwork

4.4 Important points to remember during development

The development of the FMS by CentERdata will be based on knowledge they have acquired through the development of the Sample Management System for SHARE.
Several discrepancies between SHARE and the ESS have to be kept in mind for adapting the tool to the needs of the ESS. These are outlined below.

Firstly, the ESS is a cross-sectional survey, whereas SHARE is a longitudinal survey. SHARE's SMS has to be capable of tracking changes in addresses and household compositions across rounds, having split-households with eligible respondents to be followed, assigning interview roles (e.g. financial respondent, family respondent), or using preloaded information for sample-specific routing. This does not apply to the ESS where new respondents are selected for each round of the survey.

Secondly, since the ESS uses PAPI administration (as well as CAPI), routing within the questionnaire itself is less complex and is not based on either sampling or household information. Therefore the FMS mobile application does not need to communicate with the CAPI version of the questionnaire, which reduces its complexity.

Thirdly, SHARE is a household survey, while the ESS is a survey of individuals. Within SHARE, there is the possibility of having more than one eligible respondent per household and a distinction between household and respondent level information is crucial. For the ESS this distinction depends on the sampling frame. For example, for address and household samples, either a KISH grid or last/next/closest birthday method may be implemented in order to select a respondent. In the ESS it is also of interest if a contact was made with the target respondent or with another person in the same sampling point. Despite these differences, both surveys demand that all interviewers collect contact information on an individual and household level.

Finally, SHARE requires all fieldwork organisations to use the tools provided for fieldwork – including a central CAPI program. The ESS is more decentralised in this respect and allows for a variety of software tools. Therefore, the development of the FMS has to be more flexible than SHARE's SMS in terms of connectivity with other systems at the fieldwork organisation's server. Since communication between the CAPI system and the mobile application is not needed, the mobile application can be developed as a stand-alone tool that is completely separate from the CAPI system in use.

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organisation needs to be able to import/export data from their server in a computer readable format (for example via CSV, XML or JSON) before they can upload information to the central server. The central server can be expanded as required to include additional imports to match the exports of third parties.

5. Technical features for the new Fieldwork Management System (FMS)

This section describes the hardware and software system architecture and lists all functional requirements from a technical point of view, to be implemented by CentERdata and tested by users affiliated to ESS fieldwork monitoring at national and central level.

5.1 Overall hardware and system requirements

The FMS application will be an offline application for designated tablets and smartphones which can connect to the internet via Wi-Fi and preferably also via mobile phone networks. The communication between the server at the fieldwork organisation and the mobile application on each smart phone / tablet will utilise a HTTPS[22] connection. The operational prototype will be developed using HTML5 and JavaScript or native software for at least the following platforms:
- Android from Google (smartphones, phablets, and tablets using recent Android versions)
- iOS from Apple (iPhones and iPads)

The mobile applications will require interviewer login and server connection configuration in order to become operational. The application will be free to all Fieldwork Organisations (identified by the ESS and SHARE). Native applications for IOS need to be downloaded from the Apple Store or by an Organisation enterprise store facilitated by Apple. Android applications could be obtained via a regular download from the internet but this would require additional settings in the android phone. Therefore, the mobile application will be made available to fieldwork organisations from the online Apple store and from Google play as these offer the easiest methods for installation[23].

The central server needs to provide 24/7 uptime and secure socket connections, using HTTPS. Domains for connection protocols should be DNS registered. The server hardware and software should be under supervision, thus maintained to be up to date and secure.

The central server is the main hub, and communicates with the mobile application. The information systems based at the fieldwork organisation (the 'fieldwork servers') will communicate with the mobile application via the central server. Downtime or non-connectivity of mobile applications or local servers is therefore no issue for robustness of operations.

The fieldwork servers only require users to have access to a personal computer with internet and Windows XP or Win7 operating systems in order that they can be used.

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[22] HTTPS is a communication protocol for secure transfer of data layered on the standard Hypertext transfer protocol. It uses Secure Socket Layer (SSL) certificates to identify the server.

[23] Other distribution options are available but are impractical due to the labour required, the distribution costs and administrative regulations (e.g. Testflight or IDE based connections). Updates released in online stores may also require 'commercial' revision and could therefore take weeks to be released.

The FMS and the servers communicate a JSON[24] protocol over HTTPS. The mobile application needs to be able to adopt all JSON objects in its local models, updating and merging new information. The central server will hold a database from and to which JSON objects are abstracted using a scripting language or a webclient framework using PHP or Java. Exports from or on the database, and insertions or updates of its data are done via webforms or local software packages[25]. Users are assigned, and filters are provided on software level. Exports that do communicate via JSON via websockets are filebased downloadables in appropriate file formats, like SPSS, Excel, CSV, or XML.

Local fieldwork servers at the fieldwork organisation should implement a connection using the same internet protocol as the central server that trigger communication using JSON over HTTPS.

Mobile applications will be applications that need to be installed on the smartphone or tablet manually. The size of these applications will be rather small - a mere tens of MegaBytes at most. The additional data stored in the devices, built from what is received via JSON will be in terms of kilobytes (some MegaBytes at most). Most data is simple text, so the amount of storage required is rather minimal. If the applications were to be enriched with enhanced design features or lots of imagery, then additional storage would be required (in terms of additional Megabytes). We expect applications to end up using between 5 and 35 Megabytes of storage effectively, which is equivalent to a maximum of 0.1% of the available storage on a 32GB device. This is also the average storage space available on newer smartphones.

5.2 Data transfer & Data output

When developing a portable version of the SHARE SMS as a stand-alone tool it is crucial to ensure compatibility with central sample management systems which are already in place at the survey organisations. In general, it is preferable that data transfer takes place via a HTTPS using JSON protocols. This is a very easy and readable protocol and is easily scripted in many software languages. It ensures quick, lightweight and reliable data transactions in comparison to (S) FTP file transfers. HTTPS is easily ported to online and mobile applications or browsers and webserver frameworks.

Data output at the central server should be compatible with major statistical analysis software packages (e.g. Excel, SPSS).

Communication between the central server implies a two-way direction to and from the mobile application (held on each smartphone or tablet) and to and from the server at the fieldwork organisation. In the former case, communication is triggered by the mobile application. In the latter, communication is triggered by the servers at the fieldwork organisation. Authorisation headers are used to ensure eligible connectivity. SSL is used to ensure encryption over HTTP.

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[24] JSON stands for JavaScript object notation and is a standard format for exchanging data between information systems as an alternative for XML.
[25] We advise against importing or exporting data into a device other than over HTTPS using JSON; so no parallel data transfer methods such as memory cards, USB etc can be used.

Data communication from and to the central server from local servers (at the fieldwork organisation) are triggered by the local servers. They push and collect data by manually triggered actions, meaning the interviewers have to export the data from their mobile devices on a regular basis via implemented export/data transfer functionality. This setup does not require automated jobs for data transfer.

It is also possible to have 'push messages' to the mobile application triggered by the central server. This requires utilisation of the Google/Apple push services that will then activate the application in order to trigger the action.

The central server ensures the necessity for unique data identification at the respondent (case) level, since all data from all countries is combined and stored there. Uniqueness is derived from the sample design and unified via country parameters. For example, the case records for an individual respondent will have unique identifiers to ensure that it is bound to both the fieldwork organisation and the country where it originates. This means that if the mobile application requested new data for Round x and retrieved John Doe from Place A with Birth date z – it would not be mixed up with a similar John Doe from the same place with the same birth date (coincidentally) from another fieldwork agency in another country.

5.3 Data modelling

For securing the correct data linkage at all times all data instances carry unique identifiers. These are not the same as the reference identifiers mentioned earlier. These unique identifiers are useful when other information (like address information) is hidden from a case record. The presence of the unique identifier enables data linkage to be maintained.

The following list summarises all models for data instances that need to be used from the central server and in the FMS application.

- Users (central server users)
    - Id, Name, Email, Password, Affiliation_Id →
- Interviewers
    - Id, Password, Name, Internal_Code, Affiliation_Id →
- Affiliations
    - Id, Organisation, Address1, Address2, City, Postcode, Country, Email
- Respondents
    - Id, Lastname, Firstname, Infix, Gender, Respondent_number (non-unique reference), Household_Id →, Respondent_Status_Code_Id →
- Respondent_Status_Codes (fixed list of codes relevant to defining the status of a respondent – possibly a combination of the 'results of visit' codes and the 'outcome of contact attempt' codes)[26]
    - Id, Code, Colour, Description

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[26] In order to make it as simple as possible for the interviewer, the 'results of visit' codes (in footnote 8) and 'outcome of contact attempt' codes (in footnote 10) could be combined. The interviewer could be asked to select one outcome code from a list and then based on their selection, be asked for another code if necessary.

- Households
  - Id, Address_Id →, Phone1, Phone2, Affiliation_Id →, Household_Status_Code_Id →
- Household_Status_Codes
  - Id, Code, Colour, Description[27]
- Addresses
  - Id, Street/Address1, Address2, City, Postcode, Country, GPS_Coordinates[28]
- Neighbourhood_Questions
  - Id, Address_Id → Answer1, Answer2, Answer3, Answer4, Answer5 (see footnote 13 for full question wording)
- Notes
  - Id, Note/Description, Subject, →, Respondent_Id →, Contact_Attempt_Id →, Interviewer_Id →
- Contact_Attempts
  - Id, Datetime, Mode {inPerson, byTelephone}[29] →, Respondent_Id →, Contact_Attempt_Result_Code_Id →
- Contact_Attempt_Status_Codes (fixed list of codes relevant to defining the status of a contact attempt – possibly a combination of the 'refusal' codes and the 'invalid outcome address' codes)[30]
  - Id, Code, Description
- Respondent_Appointments
  - Id, Respondent_Id→, Datetime

'Resultcodes' from visits are simple respondent status codes. Once a visit was final the last known status codes indicates the result. Each mobile application always points to a last know status by reference and/or colour indication. In addition, all logged status codes can be viewed in order to see the progress overview and chronological timepath.

Addresses are a separate model, so in the case of a respondent moving house but still residing in a country[31], a new address can be inserted, keeping the old data separate and traceable. A household - as is - has its own model and identification in an abstract sense then.

Server users include individuals from the fieldwork organisation, NC team or Core Scientific Team. Server users and interviewers have a binding to an affiliation. This affiliation may also be country specific (to make it clear where the fieldwork organisation / interviewer is based). By referencing to a country, data integrity is assured on the central server. Similarly, respondents are bound to

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[27] Household information will only be applicable to countries where samples of addresses or samples of households are used.

[28] GPS is an optional feature of the mobile application and may not be included.

[29] Only to be used at the Central server rather than part of the mobile application since the mobile application only records the interviewers' attempts to contact the respondent.

[30] In order to make it as simple as possible for the interviewer, they will be asked to choose either one of the refusal codes (listed in footnote 11) or one of the 'invalid address' codes (listed in footnote 12). Then they will be asked to specify in more detail the outcome of that refusal or invalid address so that in the end only one code is recorded.

[31] This applies to samples of named individuals and household samples (but not samples of addresses).

households and households are in turn are bound to countries. This means that all respondents are traceable to the country of residence so that there is no risk of interference with the data from respondents in other countries.

Addresses may have <u>GPS</u> coordinates, to support map-finding or distance calculating functions. GPS is an optional feature of the mobile application and may not be included.

<u>Notes</u> have a set of possible reference identifiers, like household, respondent, interviewer, contact attempt. This allows multiple messages and or notes to be generated on each relational level. An interviewer can write a note to himself or alternatively, send a message to the fieldwork organisation. These are optional features that may not be included.

'<u>Contact attempts</u>' are either at the household or respondent level.

5.4 Communication services

The communication protocol requires certain functions between the fieldwork organisation servers and/or the mobile applications. These are triggered either from the local servers (at the fieldwork organisation) or from the mobile devices. Functions can be triggered manually from the local servers and either manually or automatically from the mobile applications.

The following is a list of all specific programmatic actions that initiate certain data transfers, over JSON protocol:

- GET
  - Households
  - Addresses
  - Respondents
  - Interviewer (for login)
  - Contactattempts
  - Notes
- PUT
  - Neighbourhoodquestions
  - Contactattempts
  - Notes
  - RespondentStatus
  - HouseholdStatus
  - HouseholdAppointments
  - Addresses (new address for household)

5.5 Server controllers and views

To access and interact with the data via the fieldwork servers, technical controlling functions need to be implemented that disclose and update the data. These controllers mostly output data into views for interactivity, or send the data to other controllers or send it out via services. The following clusters can be assigned:

- Login for users

- Exports on the data. Exact filters need to be determined later on but these could be at the interviewer, area/region or country level etc
- Administrative tooling or database administrative tooling

5.6 Mobile controllers and views

To access and interact with the data on mobile devices, technical controlling functions need to be implemented that disclose and update the data. These controllers mostly output data into views for interactivity, send the data to other controllers or send it out via services. The following clusters can be assigned:

- Setup connectivity with the/a central server
- Login by an interviewer
- Enlisting households, including filters for status, completion, refusals, colour-based
- Search within the household list for name and address information.
- Respondent selection using KISH grid or last/next/closest birthday question
- Displaying household details, including address information, respondents, contact attempt information, statuses, notes, neighbourhood questions, appointments
- Displaying notes on all levels
- Allowing for note/message generation (e.g. internal message, text message, or email)
- Displaying affiliation contact information, possibly triggering a phone call or text message

The visual flow for the FMS as a mobile application is as follows:

1. Server Connection Setup (once, URL setup)
2. 1. → Login (once, or timed out) for Interviewer
3. 2. → Overview of households (possibly filtered by parameters or search)
   - B) Including latest status indicator
   - C) Including latest visit date/time
   - D) Action for note generation (for interviewers own reference) (optional feature)
   - E) Action for message sending (to fieldwork organisation) (optional feature)
4. 3. → Details on household
   - B) Including address information
   - C) Including list of respondents
   - D) Actions for contact attempts/ status update / outcome on
     - i. Household
     - ii. Respondent
   - E) Action for note generation (optional feature)
   - F) Action for message sending (optional feature)
   - G) Action for Address Update (form)
   - H) Action for Neighbourhood question (form)
   - I) Action for Appointment creation (form)
5. 4. → Detailed enlisting on contact attempts
6. 4. → Entering/reviewing neighbourhood questions form (popup, form)

7. 4. → Note generation form (popup, relational)
8. 4. → Message sending screen (popup)
9. 4. → Contact attempt form (popup, relational)
10.4. → Future cooperation form (popup, relational)
11.4. → Address update form (popup)
12.4. → Appointment creation form (popup)

Visualisations have not yet been specified, but any cell-based interface can be used as a basis. These are usually applied to mobile applications and each cell has the possibility to trigger an action to 'the next view', which then enlists new cells.

Syncing to and from the central server (central database) can be triggered automatically by closing the application or by (re)launching it. The application will not be 'available' for navigation / data entry during the synchronisation process so as to ensure data integrity. Server connection errors or data connectivity errors are caught and reported to the user during syncing.

6. Discussion and Summary

This report has aimed to provide a detailed design for a new fieldwork management system (FMS) to be developed in the remaining 12 months of the DASISH project. The FMS will consist of a central database and an application for smart phones and small tablet computers. The development of the FMS is part of the collaboration between ESS and SHARE to enhance survey instruments for cross-national fieldwork in Europe, to combine acquired knowledge for developments which have relevance beyond their own survey work, and in the end to increase survey quality by having more standardised approaches, based on mutual efforts.

SHARE's existing computer assisted sample management tool enables interviewers to record contact and household information at the doorstep and in real-time during their daily fieldwork activities. This tool will form the basis for the development of the new FMS, which will be more mobile and less complex. CentERdata will adapt the current system used by SHARE for the demands of the ESS. The new FMS also has the potential to be utilised by other national and cross-national surveys.

In developing the FMS mobile application and central database, we have become aware of innovative use of new tools / technology to enhance contact procedures and fieldwork management elsewhere in Europe. In the UK, a leading social and market research organisation has developed a Windows 8 program for the management of wave 6 fieldwork for the Millennium Cohort Study. The system enables interviewers to log contact attempts in different modes, to manage appointments and to record outcomes across all the study elements (interviews, diary placement and biomarker collection). In ESS Round 6, the Spanish fieldwork organisation programmed both the contact questions and the neighbourhood characteristics questions into a PDA for interviewers to use. This enabled interviewers to complete the neighbourhood characteristic information at the first visit, before attempting to make contact with the respondent. In Albania, ESS Round 6 interviews were completed using tablet computers and

data was transmitted in real time to the fieldwork organisation using 3G technology. Interviewers at the Central Statistical Office of Poland (CSO) working on the Census were equipped with an enumerator terminal with GPS function (Kurkowski, 2013). The device enabled them to plan their visits to households using a map function, record appointments, communicate with team leaders at CSO and receive news/updates. Interviewers were also able to collect reasons for refusal as well as respondent demographics. There is bi-directional data exchange between the device and a central coordination system. There has already been a switch in hardware for the CAPI programme, from notebooks to hand held computers, and there are also plans to use 10" tablets in 2014.

The new FMS to be developed in this DASISH workpackage could be used for many different purposes. It will be possible for the new FMS to distribute data from the fieldwork organisation to the interviewer and back from the interviewer to the fieldwork organisation. The information provided to National Teams and the CST via the data files will be accurate, up-to-date and available earlier than is currently possible on the ESS.

The FMS can be used before, during and after fieldwork making it a flexible and useful tool. Before fieldwork starts, it will allow samples to be distributed to interviewers in a convenient and simple way. During fieldwork, it will allow communication to/from interviewers and the fieldwork organisations; facilitate the redistribution of cases; provide overviews of fieldwork for monitoring purposes and a record of all contact attempts to monitor the contact history of a case. This will create opportunities to derive and analyse contact information during fieldwork on a regular basis. The major advantage of the FMS's mobile application is its ability to produce up- to-date information <u>during</u> fieldwork. This will enable ESS researchers from the CST as well as the NCs and Fieldwork Directors to have a much better overview of the status of cases in the field. Depending on how frequent data uploads and data processing takes place, this information could also be used for designing and implementing responsive designs within specific countries in order to try and achieve more balanced response rates. After fieldwork has been completed, the data files will be stored in the FMS's central database indefinitely. This will allow the possibility of the data being used after fieldwork e.g. for nonresponse bias analysis, for quality assurance as well as checks of interviewer compliance and work-flow.

7. References

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8. Annex 1 Fieldwork Management Survey – Methodological summary

The aim of the fieldwork management survey was to incorporate the expertise of those who were familiar with the day to day implementation of ESS and SHARE fieldwork into the design of a slimmed down version of SHARE's SMS – the FMS.

We hoped that this approach would lead to a greater understanding of the varied current fieldwork practices used in ESS Round 6 and supplement what was known about SHARE Round 5, which should ensure that we developed a tool that was compatible and 'fits' with current practices and needs, rather than one which is seen as an additional burden.

The main research questions we hoped to answer were:
- How are sample allocations currently managed?
- How are organisations kept informed of interviewer progress?
- What are the main barriers to implementation?

To answer these questions, the following topics were addressed:
- the number of interviewers working for each survey organisation – so we can assess if this impacts fieldwork practices, technical capabilities, or perceptions of the usefulness of the application
- the sample allocation process and how data is transferred
- the type and frequency of communication between the fieldwork organisation and the interviewers
- current capacity and the availability of resources including use of laptops and portable devices for fieldwork, and technical support available in-house
- experience of using similar devices for fieldwork management
- barriers to using a mobile application during fieldwork

The survey was conducted between June and August 2013 using paper self-completion methods. Three different versions of the FMS were issued depending on whether CAPI or PAPI methods were used on the ESS. A SHARE supplement was sent out separately to eight organisations who had conducted fieldwork in round 5 (see Appendices 2-4 for question wording).

An invitation letter and the relevant survey were sent to the ESS /SHARE National Coordinator, who was asked to pass both documents on to the fieldwork director responsible for ESS Round 6 or SHARE Round 5 fieldwork. The invitation letter explain the purpose of the survey and was signed by the Principal Investigators of the both the ESS and SHARE. We think this added weight to our request and ensured that we got a high number of responses (see Appendix 1 for the invitation letter).

Reminder emails were also sent (via ESS NCs) to try to increase response. In the end we received 22 responses from ESS countries (out of 27) (of these 15 were CAPI and 7 were PAPI). We also received 4 SHARE completions (out of 8).

9. Appendices 1-4

The documents listed below were used for the Fieldwork Management Survey. Each is a PDF and is included in the zipped file that accompanies this report:

1. Appendix 1 – Invitation letter to participate in the Fieldwork Management Survey
2. Appendix 2 – Fieldwork Management Survey (ESS-CAPI)
3. Appendix 3 - Fieldwork Management Survey (ESS-PAPI)
4. Appendix 4 - Fieldwork Management Survey (SHARE supplement)