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Guidelines to conduct RANAS based socio-hydrological (SH) surveys to understand behaviour

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Disclaimer

Abstract

This is a protocol to quantify the determinants of behavioral change (such as technology adoption) in a generic socio-hydrological context, using the RANAS approach to systematic behavior change. This protocol combines survey design, sampling, and data collection with model conceptualization and development.

Troubleshooting

Before start

Obtain the necessary ethics permissions from your institutions regarding the collection, processing and storage of Personally Identifiable Information (PII) and/or Personally Identifiable Research Data (PIRD).

- PII includes directly identifiable information (e.g., name or email address).
- PIRD includes directly or indirectly identifiable data (e.g., videos, pictures, IP address, gender, age, etc.).

Undertaking any exercise with human participants (like a survey) entails risks that arise to the participants. Such permissions ensure that these risks (both actual and potential) are accounted for and mitigation measures are in place for each of these risks. An example of these principles and some guidelines are given here (as a reference): https://www.tudelft.nl/over-tu-delft/strategie/integriteitsbeleid/human-research-ethics/hrec-approval-1-application

Identify the research question

1 **Identify an appropriate socio-hydrological (SH) research question**
Try to answer the following questions, to identify the appropriate research question. Each question is given with an appropriate SH example with underlying human-water interactions.

- Do you want to study behaviour within the framework of exploratory research? *E.g.: Which are the socio-psychological factors influencing behaviour to improve water savings in agriculture?*
- Do you want to make a predictive model? *E.g.: The objective is to develop a data-based SH model to predict the adoption of water-saving behaviour in agriculture by a farmer or farming communities.*
- Do you want to intervene using some understanding of behaviour? *E.g.: How can you design an intervention based on socio-psychological factors to promote water-saving behaviour in agriculture?*
- Do you want to assess the impact of an intervention? *E.g.: What is the impact of a behavioural intervention aimed at promoting water-saving behaviour in agriculture?*

2 Eligibility check 1:

- Is the research question based on underlying human-water interactions? This protocol deals with SH questions.
- Is collecting data from a survey suitable to answer your SH question, as opposed to other approaches (e.g., interviews, focused group discussions, secondary data, web scraping)? You may inform yourself using available resources (**Javaid, 2023**; **Bhat, n.d.**).
- Can you collect observed and/or self-reported data from the participants? (**Abrahamse et al., 2016**)

If answers to the above questions are yes, then proceed.

Draw a conceptual model which connects the behavioural and/or psychological variables, water system to result in a particular human behaviour

3 **Decide on conceptual modelling approach ➔**
Identify the conceptual pathways of human-water interaction, clearly highlighting target behaviour.

4 Review the literature (see recommended reading below) and identify:

- the appropriate environmental **Behavioural** (or intention)** theories and
- a corresponding model (which are derived from these theories).

that is appropriate to answer your research question.

Example of a theory: Theory of Planned Behaviour (**Ajzen, 1991**)

Example of model within the theory: RANAS (**Mosler, 2012**)
For a comprehensive discussion, please refer to the recommended reading, particularly **Stern (2000)**.

5 **Eligibility check 2:** This protocol only describes the RANAS model. Please proceed only if you have chosen the RANAS model.

RANAS is an acronym for Risk- Attitude- Norms - Ability- Self regulation, which is a systematic approach to behavior change interventions (**Mosler, 2012**). More recently, Trust and Psychological ownership (e.g., of the technology adoption which exemplifies the behavioural change) have also been discussed as important factors to drive behavioural change (**Contzen et al., 2023**). You are encouraged to have a look at the literature to better inform yourself.

6 Decide the scales and corresponding levels of modelling in terms of spatial, temporal and human organizational scales (**Yu et al., 2022**).

For an example, if you want to do exploratory research (e.g., *Which are the socio-psychological factors influencing behaviour to improve water savings in agriculture?* from point 1), the:

- **Spatial** scale can be a **plot (patch)** - to determine the behaviour that is adopted to save water at the scale of a single plot/farm (e.g., target behaviour of farm **land levelling**)
- **Temporal** scale can be a **cropping season** - in case the target behaviour is based on demand side interventions such as adoption of micro-irrigation technology, such as sprinkler irrigation.
- **Human organizational** scale can be that of a **community (neighbourhood)** - in case the target behaviour is about **small scale managed aquifer recharge** which requires cooperation and collective action within a community.

7 (Recommended) Using the RANAS framework (detailed in **Mosler, 2012** and **Contzen et al., 2023**), identify factors (from risk, attitude, norms, abilities, self-regulation, trust and psychological ownership) and sub-factors (e.g., descriptive, injunctive and personal norms are sub-factors of the norm factor) which are relevant to your research question. In the conceptual model, there are the driving behavioural factors (factors which can influence behaviour), and the behaviour itself. Decide and list the relevant behavioural factors and behaviour within the RANAS template.

8 If you did not use the RANAS framework initially, categorize each of the driving behavioural factors (such as risk, future profit, capacity, etc.) into the RANAS factor and sub-factors (**Mosler, 2012**).

Design a survey questionnaire

9 Don't build the survey from scratch! Use templates of pre-existing survey questionnaires to start designing your survey.

They are usually available in the Appendix section of the concerned publication case, or within the text of the authoritative literature about the respective model, or open-source websites which document typical surveys within their scope (e.g.: **SIASAR** for rural water supply studies in the global south). This helps also in verifiability and standardization for comparative studies.

10 Make a list of survey questions with their appropriate responses.

E.g., Question on personal norms: *What is your perception about the importance of saving water in your agricultural farm?*
Answers (Likert scale): *Highly unimportant, Unimportant, Neither unimportant nor important, Important, Highly important.*

10.1 Make a list on a text editor which contains explicit questions and corresponding answers to address your research question.

- Questions can be about perceptions related to the RANAS factors and sub-factors (step 7).
- Questions can relate to the target behaviour being investigated (step 3).
- Questions can also be about additional variables that are relevant to answer the research question (such as socio-demographic variables, Personally Identifiable Research Data (PIRD). Ask Personally Identifiable Information (PII) only if extremely necessary because this requires stringent ethical clearances. The definitions of these data are explained further in the "Guidelines and Warnings".

Answers can include different types of data (with examples):

- Text: Question - "*What is your name?*"; Answer - "*Jane Doe*".
- Numeric: Question - "*What is the size of your farm (in hectares)*"?; Answer - "*4 hectares*".
- Single choice: Question - "*What is your perception about the importance of saving water in your agricultural farm?* "; Answer - "*Not important*".
- Multiple-choice: Question - "*How do you irrigate your farm?*", Answer: "*Sprinkler irrigation, Flood Irrigation*".

10.2 Label the questions into different themes, such as demographic, socio-economic, RANAS based perceptions

10.3 Code the answers according to the type of variable (e.g., categorical, see **Fink, 2003**) and indicate the levels for each categorical answer. RANAS based perceptions can be coded into the potential responses using the Likert scale (**Jamieson, 2004**). One example of a 5-point likert scale which indicates the perceived change in some variable,

is 1 = Decreased significantly, 2= Decreased slightly, 3 = No change, 4 = Increased slightly, 5 = Increased significantly.

10.4 (Recommended) For a quantitative analysis, it's better to have more close-ended questions (rather than more open-ended).

According to **SurveyMonkey**, close-ended questions are those where the respondent chooses from a list of pre-selected options which can help to generate statistical models, as compared open-ended questions which are more exploratory and can provide richer qualitative insight but may be difficult to incorporate into models.

E.g., to ask about personal norms, it is better to ask a close-ended question with Likert scale responses such as in point 10 ("*What is your perception about the importance of saving water in your agricultural farm?* "), rather than asking the open-ended question of "*What do you feel about saving water in agriculture?*"

11 Decide how you will conduct the survey - with printed paper or digitally.

11.1 (Recommended) If you choose digital survey, identify and use a tool to design it. Digital surveys can be implemented using tablets, mobile phones, etc.

There are different software, which may either be

- Free: **Kobo Toolbox**, Census and Survey Processing System (**CSPro**), Google Forms
- Licensed: **Qualtrics**, **ArcGIS Survey123**, **SurveyCTO**, **Open Data Kit (ODK)**, **Survey Monkey**

11.2 If a digital survey is not feasible or preferable, then use paper based surveys. Don't forget to weather-proof the sheets of paper, and write legibly, and carry stationery (board, extra pens, etc.)

12 If necessary, translate the questionnaire to capture the language and local contexts of the target population.

12.1 Ensure that the local nomenclature (about your topic) is incorporated into the survey.

13 Conduct Trial 1 of the survey questionnaire with non-respondents. This trial is for the purpose given in step 13.1.

13.1

- Practise trials (around 10-20) of the survey questionnaire with colleagues and non-colleagues (and not respondents) to balance your study requirements with logistical constraints, such as clear semantic communication of the questions (whether the participant understands your query clearly), survey duration (keep as short as

possible), and survey fatigue (the "lack of motivation to participate in assessments"). (DiLeonardo et al., 2021; Clark, 2008)

13.2 Conduct a pilot study of the survey with a small representative group, to identify whether the questions are being interpreted reasonably, and to modify/remove questions which may be sensitive (e.g., age, gender, income, personal preferences)

13.3 Verify the data collection during the pilot (online in case of a digital survey) to check for
1. completeness (i.e., if the information is complete, and all answers have been included
2. accuracy (i.e., all data is being correctly collected)
3. consistency (i.e., data collected is consistent across respondents)

14 Pre-survey introduction:
1. Design a transcript to introduce the survey.
2. Design the text for obtaining informed consent.

Get the necessary ethical clearances

15
- Obtain the necessary ethical clearances and data management strategy (e.g., storage and backup) corresponding to the questionnaire. You can inform yourself using university guidelines such as TU Delft (2016).

15.1 While designing the questionnaire, think carefully about the PII and PIRD which will be collected, and obtain the corresponding ethical clearances or alternatively, modify the questionnaire based on the limits of the clearances you obtain.

15.2 Different storage sources include: iCloud, Google Drive, Dropbox, your organization's storage, etc.

Determine the sampling strategy

16 Determine the representative sample size of the target population. Considerations could be statistical power (Duflo et al., 2006; Krejcie and Morgan, 1970), logistical constraints, etc. There are some online resources to compute sample size (e.g., Raosoft, 2004).

17 Identify the sampling design which is statistically acceptable as well as logistically realistic to capture a representative sample.

Collect data using the survey questionnaire

18 Before conducting the survey, do the following.

18.1 Give a brief introduction statement to describe the survey.

18.2 Obtain a physically signed or vocal recording of voluntary **informed consent**.

19 Conduct Trial 2 with key informants (such as an staff from an NGO working with the intended informants) using the current survey, get feedback and revise the survey questionnaire. Trial 2 is more geared towards situating the survey in the local context (e.g., using relevant local terminology, identifying and modifying questions which might be mis-interpreted, identifying and removing sensitive questions)

20 After testing, modify and finalize one version of the survey and do not change it anymore during the survey. This will help in maintaining internal consistency in the collected data.

21 Conduct the actual survey with the identified survey respondents.

Analysing the collected data: conduct statistical analysis

22 Data preparation: make or import (from the software) a table for questions with responses, including demographic, socio economic, and RANAS factors, and output behaviour.

23 Data cleaning: clean the data based on guidelines from **Fink (2003)**. Aspects of data cleaning include miscoding, missing responses, data entered incorrectly, etc. (**Fink, 2003**). This step is time consuming and requires patience and caution.

24 Based on your research question, decide the type and number of dependent variables (DV) and independent variables (IV) for your statistical analysis.

This information is useful to create a codebook for your report (**Fink, 2003**).

25 Conduct Descriptive statistical analysis based on your reading of the literature.

25.1 Explore the data, e.g.: trends, outliers you can start with the descriptive statistics. Further statistical analysis depends of the research question you need to answer.

Visualization can be done using bar plots, histograms, or tables, etc.

26 Conduct additional inferential statistical analysis to establish relationships between your IVs and your target behaviour (DV).

26.1 Choose the method that suits the number and type of the IVs and DVs. Guidelines from **Fink (2003)** can be useful (Table 4.1) or other literature.

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Recommended Reading

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