Session 3:
Survey Design

February 2019
Outline — Survey Design

01 - Sampling Method

- Data Collection Approach
- Sampling Frame
- Sampling Design
- Probability Proportional to Size (PPS)
- Applying Weight to BE Data

02 - Data Collection Method

- Data Collection Method
- R&D Survey Financial Year
- Data collection methods used in R&D Survey

03 - Questionnaire Design

- What is Questionnaire?
- Advantages and Disadvantages of Questionnaires
- Questionnaire Design Process
- Guidelines for Survey Questionnaire

04 - Survey Process

- Survey Methodology
- Phase 1: Front-end call
- Phase 2: Canvassing Survey — Emailing Process
- Phase 2: Canvassing Survey — Follow up with respondents

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SAMPLING METHOD

1. Data Collection Approach
2. Sampling Frame
3. Sampling Design
4. Probability Proportional to Size (PPS)
5. Applying Weight to BE Data
A census approach for data collection of the units for GRIs, HLIs and NGOs was adopted while the BE sector comprising of private companies that was surveyed on a sample basis.
01 SAMPLING METHOD

1. Data Collection Approach
2. Sampling Frame
3. Sampling Design
4. Probability Proportional to Size (PPS)
5. Applying Weight to BE Data
**Establishment and Enterprise (EE) frame belongs to the DOSM and it is the most updated and comprehensive list of establishments in Malaysia**

**Establishments with R&D expenditure above RM1,000**
1. Data Collection Approach
2. Sampling Frame
3. **Sampling Design**
4. Probability Proportional to Size (PPS)
5. Applying Weight to BE Data
Sampling design for BE sector

- A one-stage stratified sampling design
- The sampling units are establishments that have at least RM1,000 of R&D expenditure.
- It is designed to produce estimates of R&D expenditure, with an overall precision of 5% RSE at Malaysia level
- Stratification:

<table>
<thead>
<tr>
<th>R&amp;D Expenditure (RM)</th>
<th>Number of establishments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,001</td>
<td>7,134 establishments</td>
</tr>
<tr>
<td>104,200</td>
<td>1,921 establishments</td>
</tr>
<tr>
<td>903,400</td>
<td>1,225 establishments</td>
</tr>
<tr>
<td>1,047,937,321</td>
<td></td>
</tr>
</tbody>
</table>

A random sample is selected (PPS) for Strata 2 and Strata 3. All the establishments are completely enumerated for Strata 1.
01

SAMPLING METHOD

1. Data Collection Approach
2. Sampling Frame
3. Sampling Design
4. Probability Proportional to Size (PPS)
5. Applying Weight to BE Data
Why PPS?

- Probability proportional to size (PPS) is used as the R&D expenditure of sampling units vary in size.

- If the sampling units are selected with equal probability, then the likelihood of a sampling unit with a large R&D expenditure being selected for the survey is less than the likelihood of a sampling unit with a small R&D expenditure being selected.

- PPS reduces standard error and bias by increasing the likelihood that a sampling unit from a larger R&D expenditure will be chosen over a sampling unit from a smaller R&D expenditure.
The formula for sample size for combined Strata 2 and 3

\[ n = \frac{N^2 S^2}{c^2 Y^2 + NS^2} \]

Where,
- \( n \) = sample size for strata 2 and 3 combined
- \( N \) = population size for strata 2 and 3 combined
- \( c \) = desired coefficient of variation (RSE = 5%)
- \( Y \) = Total R&D expenditure for strata 2 and 3 combined in 2015
- \( S^2 \) = variance in strata 2 and 3 combined
Sample size and Selection (cont’)

- Apply Neyman’s allocation to obtain sample size for Strata 2 and Strata 3

\[ n_h = \frac{N_h S_h}{\sum_{h=2,3} N_h S_h} \times n \]

Where
- \( h \) = take-some stratum (2 or 3)
- \( n_h \) = sample size in stratum (2 or 3)
- \( S_h \) = Standard deviation of population in stratum \( h \)
- \( n = 1,190 \) establishments for strata 2 and 3 combined

- Further adjustment for expected 40% non-response (NR) applied to obtain final sample size (\( n_1 \)) of **2,891 establishments**.

- Technique of Probability Proportionate to Size (PPS) is applied for the selection of establishments in Strata 2 and Strata 3
01 SAMPLING METHOD

1. Data Collection Approach
2. Sampling Frame
3. Sampling Design
4. Probability Proportional to Size (PPS)
5. Applying Weight to BE Data
Weight is applied to BE data to obtain estimates of the total R&D expenditure and other related variables that reflect the entire BE sector.

The total estimates for the four sectors are then summed to obtain the overall figure for Malaysia, that is:

\[
\hat{Y}_{BE} = \sum_{h} \sum_{i} w'_{ih} y_{ih}
\]

Where,
- \(i\) = establishment
- \(h\) = stratum, \(h = 1,2,3\)
- \(w'\) = final sampling weight
- \(y\) = survey data
- \(\hat{Y}_{BE}\) = estimate for BE Sector

\[\text{Total} = Y_{GRI} + Y_{HLI} + Y_{NGO} + \hat{Y}_{BE}\]
DATA COLLECTION METHOD

1. Data Collection Method
2. R&D Survey Financial Year
3. Data collection methods used in R&D Survey
Basic Data Collection Modes

1. **Person-administered surveys**
   - An interviewer reads questions, either **face-to-face** or **over the telephone**, to the respondent and records his or her answers.

2. **Computer-assisted surveys**
   - Computer technology plays an essential role in the interview work:
     - self-enumeration (Computer-Assisted Self-Interviewing, CASI);
     - by telephone (Computer-Assisted Telephone Interviewing, CATI);
     - in person (Computer-Assisted Personal Interviewing, CAPI).

3. **Self-administered surveys**
   - The respondent **completes the survey on his or her own**.

4. **Mixed-mode (hybrid) surveys**
   - A **combination** of two or more methods.
DATA COLLECTION METHOD

1. Data Collection Method
2. R&D Survey Financial Year
3. Data collection methods used in R&D Survey
R&D data for the 2016 portion of the project(s), although project(s) may have begun even before 2016.
DATA COLLECTION METHOD

1. Data Collection Method
2. R&D Survey Financial Year
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Data collection methods used in R&D Survey

ONLINE
- Respondents fill e-form
- Link sent via email with guidelines on how to fill up the survey
- Each firms are provided with unique Username and Password for login

TELEPHONE INTERVIEW
- Enumerators conduct phone interview with respondents
- Respondents are informed to prepare related documents prior to phone interview

FACE-TO-FACE INTERVIEW
- Enumerators conduct FTF interview with respondents
- Respondents are informed to prepare related documents prior to face-to-face
QUESTIONNAIRE DESIGN

1. What is Questionnaire?
2. Advantages and Disadvantages of Questionnaires
3. Questionnaire Design Process
4. Guidelines for Survey Questionnaire
What Is A Questionnaire?

▪ A questionnaire (or form) is a group or sequence of questions designed to obtain information on a subject from a respondent.

Why use a questionnaire?

A well designed questionnaire:

▪ Collect data efficiently with a minimum number of errors and inconsistencies

▪ Be respondent friendly and interviewer friendly (if interviewer-assisted);

▪ Lead to an overall reduction in the cost and time associated with data collection
QUESTIONNAIRE DESIGN

1. What is Questionnaire?
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Advantages and Disadvantages of questionnaires

**Advantages**

1. Can reach a large number of people relatively easily and economically
2. Provide quantifiable answers
3. Relatively easy to analyse

**Disadvantages**

1. Provides only limited insight into problem
   - Limited response allowed by questions
   - Maybe not the right questions are asked
2. Varying response
   - Misunderstanding/ misinterpretation
3. Need to get it right first time
   - Hard to chase after missing data
03

QUESTIONNAIRE DESIGN

1. What is Questionnaire?
2. Advantages and Disadvantages of Questionnaires
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4. Guidelines for Survey Questionnaire
Questionnaire Design Process

1. Consult with data users and respondents
2. Review previous questionnaires
3. Draft the questionnaire
4. Review and revise questionnaire
5. Test and revise questionnaire
6. Finalise questionnaire

Formulation of survey objectives & information requirements
1. Consult with data users and respondents

- The process of **consulting with data users** continues from the **planning – design – development phase** of the questionnaire.

- By understanding how the data are to be used - **able to develop a well-designed questionnaire** that meets the users’ needs.

- **Consultation with the experts** in the field of study & those who have conducted similar surveys in the past before the questionnaire is drafted.

- It can also be **helpful in identifying the wording and language** that respondents use to describe the survey concepts.
2. Review previous questionnaires

**Good source of information** when developing a survey.

Examining questions that were used by other surveys can be a **useful starting point** when drafting questions.

**Same questions should be used when comparing results from different surveys.**

**Documentation on the data quality** from such surveys should be examined to assess the effectiveness of the questionnaire (e.g., problems with question wording, response burden, refusal rates, etc.).
3. Draft the questionnaire

Method of data collection

The length of the questionnaire depends on the data collection methodology.

Self-enumeration surveys - questionnaires should be less complex & shorter than for interviewer-assisted methods and preferably be stand-alone*

*all relevant information (e.g., instructions, contact information, examples) is included on the questionnaire.

Interviewer assisted methods - the wording of a question is different than for self-enumeration questionnaires

Characteristics of respondents

Survey questions intended for general public should be easily understandable by all respondents.

Survey aimed at professionals may use technical or professional language related to the work of the respondents.

Response burden

The time & effort required to provide answers & whether other individuals or records have to be consulted.

The number of questions should be kept to a minimum.

Each question must have a reason for being on the questionnaire.
3. Draft the questionnaire

Complexity of the data to be collected

Careful wording of the questions is necessary when collecting complex data.

Instructions should be included in questions covering complex topics. This will help the interviewer to explain questions and the respondent to accurately answer them.

Confidentiality & sensitivity of the information

The questionnaire instrument should include introductory statements regarding how the confidentiality of respondent data is to be protected.

It should also explain how the data are to be used, who has access to the data, how long the data will be kept, etc.

When asking questions about sensitive issues (a question that respondents may not feel comfortable answering), it may be necessary to use techniques that soften the impact of asking the question. This increases the likelihood of a response.
3. Draft the questionnaire

**Translation**

- The questionnaire should be translated into all languages that are commonly spoken by the target population.
- Care must be taken when translating questions from another language to take account of not only the language, but also different customs and culture.

**Comparability of results with other surveys**

- When survey results are to be compared with other surveys, the questions must be drafted in the same manner.
- Each version of the question must cover the issue in the same way and have the same meaning in the context of the question.
- To ensure the comparability of the results with other surveys, the same question wording should be used after the quality of the earlier results is confirmed.

**Consistency**

- The wording of the question must have the same meaning for all respondents as that intended by the statistical agency.
- If the questionnaire is to be translated into different languages it is particularly important to test all language versions.
3. Draft the questionnaire

Other factors to consider when drafting questions:

- The availability of the data being sought
- The respondent's willingness to provide the data
- The likelihood of nonresponse
- Administrative requirements
- The type of questions
- The wording of each question
- The layout of the questionnaire
- Sources of measurement or response error
- Processing of the questionnaire
4. Review and revise questionnaire

- Questionnaire be reviewed internally before it is tested- should identify any obvious problems with the questionnaire such as mistakes in spelling or grammar or awkward wording.

- Have the questionnaire reviewed by people who are not directly involved with the project.

- Reviewers could include experts in the field of study, people who have experience designing questionnaires, interviewers or members of the population to be surveyed.
5. Pilot test and revise questionnaire

- It is important to test all versions (i.e., all language versions) of the questionnaire on ‘typical’ respondents long before data collection begins (i.e., typical for the target population, which may mean respondents of a certain age, sex and level of education).

- Testing methods are intended to identify difficulties and errors with the questions.

- Testing can also identify whether the question order affects the interpretation of questions, whether instructions are clear and how respondents feel about the appearance of the questionnaire.

- The benefit of questionnaire testing includes the production of a respondent and interviewer friendly questionnaire which permits the collection of accurate data, with a format that facilitates data capture and coding thereby minimising errors and reducing the cost and time of data collection, capture and processing.

- Methods used to test questionnaires (their content, layout, etc.) are typically based on small, subjective non-probability samples of respondents from the target population.
Pilot test of R&D Survey 2016 questionnaire revealed several common issues

<table>
<thead>
<tr>
<th>Issues</th>
<th>Recommendations to improve the questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of questionnaire - very long and too complex</td>
<td>Questions to be simplified</td>
</tr>
<tr>
<td>General understanding of Research &amp; Development (R&amp;D) – misconception of what is R&amp;D</td>
<td>Include Standard definitions of R&amp;D based on the Frascati Manual</td>
</tr>
<tr>
<td>Definition of R&amp;D personnel - uncertainty about what to be ‘included’ and ‘excluded’ for their employees to be counted in the headcount</td>
<td>Interviewers will assist/guide the respondent as they go through the questionnaire</td>
</tr>
<tr>
<td>FOR and SEO terminology used - jargon to respondent</td>
<td>R&amp;D activities based on the FOR are listed in nine (9) divisions with sub-categories so it is easier to understand</td>
</tr>
</tbody>
</table>
### Pilot test of R&D Survey 2016 questionnaire revealed several common issues (cont.)

<table>
<thead>
<tr>
<th>Issues</th>
<th>Recommendations to improve the questionnaire</th>
</tr>
</thead>
</table>
| **5** | One respondent, a project leader in a public university, could not answer questions on *emoluments*. This information was not shared with the project leader.  
Respondents advised to obtain emoluments information for R&D personnel from the office of Vice Chancellor (Research & Innovation) as they have more input on the money spent on R&D as well as Output (publications, pattern etc) for the university. |
| **6** | One respondent from a private hospital raised the concern about whether the R&D expenditure is able to capture information on ‘sponsored’ items such as equipment or raw materials received from donors or R&D funders (underestimate of R&D expenditures).  
As stated in Frascati Manual 2015 (Section 4.112, Page 134), a common example might involve a government or private non-profit institution providing such R&D equipment in the context of international aid efforts. Such “in-kind” transfers do not entail monetary flows & should not be included in intramural R&D expenditure totals or in totals on extramural R&D |
Types of questions

Open-ended questions
- Response categories are not provided to the respondent
- Allow respondents to express their own ideas and opinions
- E.g., In order to enhance the effectiveness of R&D activities in Malaysia, particularly in your sector, what measures should the government take?

Closed-ended questions
- List answers & respondents select either one or multiple responses
- Answered by checking a box or circling the proper response from those provided
- E.g., Please tick (√) the problems faced by your company when applying for R&D incentives.
  - The application procedures are not clear
  - Decision by the Interview Panel is slow
  - Information on R&D incentives is not easily available
  - The definition of R&D incentives is not clear
The most frequently used of closed questions are single choice, multiple choices and checklist, ranking and rating questions.

**Single-Choice Questions**

- Often it is a yes/no question and is used to split the respondents into two distinct groups.
- Used as screening questions to prevent respondents from being asked a series of questions that do not apply to them.
- The direction ‘Go to question X’ then appears directly after one of the response categories so that the respondents can skip some questions.

For example:

*Did your company engage in any R&D activity in 2016?*

- [ ] No, (end of survey, thank you)
- [ ] Yes, conducted and funded R&D activities (please complete the entire survey, thank you)
- [ ] Yes, only funded R&D activity (please complete the survey but skip Section 3, thank you)
The most frequently used of closed questions are single choice, multiple choices and checklist, ranking and rating questions.

Multiple Choice and Checklist Questions

- Multiple choice question asks the respondent to select one response from a list of choices.
- Checklist question asks the respondent to pick one or more responses from the list.
- An ‘Other (specify)’ category is normally provided to ensure that the list is exhaustive.

Example of a Multiple Choice Question

22. Please tick (✓) the benefits your company has obtained from carrying out R&D activities.
   Tick all that apply.

- [ ] Improved company’s sales revenue
- [ ] Acquisition of new market(s) for goods and services
- [ ] Reduced cost/energy consumption
- [ ] Increased technology transfer
- [ ] Procurement of external funding
- [ ] Improved quality of goods and services
- [ ] Other benefits (please specify):
The most frequently used of closed questions are single choice, multiple choices and checklist, ranking and rating questions.

Example of a checklist question:

Example of a checklist question: Please state type of organisation (Check one only)

- □ 1 Independent entity
- □ 2 Headquarters
- □ 3 Branch / Operations Office
- □ 4 Franchise
The most frequently used of closed questions are single choice, multiple choices and checklist, ranking and rating questions.

**Rating Questions**
- With rating questions, respondents are asked to rate their answer.
- E.g., How satisfied are you with our customer service?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very satisfied</td>
<td>Satisfied</td>
<td>Dissatisfied</td>
<td>Very dissatisfied</td>
</tr>
</tbody>
</table>

**Ranking Questions**
- The respondent is asked to order the response categories.
- E.g., Please rank the top 5 factors for your firm’s investment in Malaysia.
  (1 = Most Important factor, 2 = Second Important factor, ... 5 = Fifth Important factor)

- Availability of Workers
- Skilled and Trainable Workers
- Cost of Workers
- Multilingual Workers
- ICT Infrastructure
- Availability and Affordability of Offices to rent
- Developed Banking and Financial Systems
- Political Stability
- Tax Incentives
- Others, please specify: ____________
QUESTIONNAIRE DESIGN

1. What is Questionnaire?
2. Advantages and Disadvantages of Questionnaires
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4. Guidelines for Survey Questionnaire
Guidelines for Survey Questionnaire

Questions asked in a questionnaire can distort survey results and provide inaccurate data if respondents:

▪ Do not understand what the words in a question mean;
▪ Interpret the questions differently than intended;
▪ Are unfamiliar with the concept(s) conveyed by the question.

Keep it Simple
Define Acronyms and Abbreviation
Ensure that Questions are Applicable
Be Specific
Avoid Double-Barrelled Questions

Ensure that Questions Read Well
Be Specific
Avoid using Double Negatives
Avoid Leading Questions

Soften the Impact of Sensitive Questions
Questionnaire Layout

Sequencing of Questions
- Introduction
- Opening questions
- Placement of sensitive questions
- Placement of demographic and classification questions

Instructions
- Clear, short & easy-to-find instructions
- Instructions may be placed directly above the questions concerned, at the beginning of the questionnaire

Transitional Statements
- Used in questionnaires to introduce sections of related questions
- E.g. Part A - We first would like to collect some background information about your organisation.

Format Considerations
- Consistency of typeface & font should be maintained for questions, instructions, headings & transitional statements.
- Titles & section headings are usually in a larger font than the questions and response categories.
- Number the questions consecutively
Processing Considerations in Questionnaire Design

- Processing transforms survey responses obtained during collection into a form that is suitable for tabulation and data analysis.

- In order to streamline processing, some activities – namely, data capture, editing and coding – can be done during data collection with a computer-assisted application.

- Processing tasks should be considered during the design and development of the questionnaire.

- The coding scheme should be developed at the same time as the questions are drafted.

- Each questionnaire should include a unique identification number, this facilitates the verification of data capture.
1. Narrow down what you want to know to the key questions that get to the root of the issue – **Keep your survey focused**

2. A survey should be **short** in order to get the **best response rate**. Avoid questions with more than 10 answer options.

3. Ask **closed-ended questions** that generate results that are easy to analyse, spot trends, and set base lines.

5. Use a scale that ranges from “not very” to “extremely” with a few options in between. **Avoid using “Always” or “Never” extremes as they can bias responses in the opposite direction.**

6. Too many required questions in a survey can ruin the flow and likely decrease your response rate.
Top 12 Survey Best Practices

7. Question order matters
   - The first question or two should be easy & interesting to engage the respondent and get them into the flow of the survey

8. Create a logical flow
   - Group questions that cover similar topics together & use text boxes to introduce each section of the survey

9. Test the survey
   - Time how long it takes to complete & provide feedback on the overall flow of the survey

10. Avoid biasing the response
    - When using an email survey invitation or a survey greeting page, tell the audience why you’re asking these questions, provide an estimated completion time, & explain what you will be doing with the data collected

11. Get it in front of the right people
    - To get the most out of your survey efforts, you have to get the right people to take it.

12. Share the results & actions with respondents
    - Once the survey is complete and the data is collected and analysed, let the respondents know what you’ve learned & what actions you’ll be taking as a result.
SURVEY PROCESS

1. **Survey Methodology**
2. Phase 1: Front-end call
3. Phase 2: Canvassing Survey – Emailing Process
4. Phase 2: Canvassing Survey – Follow up with respondents
**Phase 1: Front end call**

- List of firms received from MASTIC/DOSM (BE, GRI, HLI)
- Front End Call
- Verify Address & Contact Person details (name, designation)
- Get Correct Address
- Speak to PIC:
  - To explain about R&D survey
  - Get Firm Info (Business activity / Industry / PIC contact details)
  - Check whether firm involved/conducted any R&D
- Correct details
- Incorrect details
- End of Front end call

**Phase 2: Canvassing survey**

- Reminder send to non-respond firm / institution
- Follow up via calls/email
- Email send out to firms / institutions
- Request for Face-to-face (FTF) appointment
- Fix date for FTF interview with respondent
- Conduct Fieldwork
- Fill-in an e-form
- Phone interview
- Partially complete
- Partially complete
- Complete
- Data Processing
- Checking, Coding, Editing, Data Capture, Tabulation

**Survey methodology**
SURVEY PROCESS

1. Survey Methodology
2. Phase 1: Front-end call
3. Phase 2: Canvassing Survey – Emailing Process
4. Phase 2: Canvassing Survey – Follow up with respondents
Phase 1: Front-end call

Purpose of front-end calls

- Introduce the purpose of the study to the firm
- Update/Verify firm's information
- Get the right PIC to send survey invitation
- Know the R&D status of the firm (e.g. conduct R&D or not, R&D activities conducted). Further investigation is made if no R&D is conducted for the fiscal year to get clarification of the firm's R&D activity.
SURVEY PROCESS

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Phase 2: Canvassing Survey – Emailing Process

What is emailing process?

- Emailing is an essential process in survey canvassing. It is a process where information about the survey is delivered to the respondents.
- E-form is distributed to firms via email with guidelines on how to fill up the survey.
- Sending out email to the respondents will prepare them for the survey.
SURVEY PROCESS

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Phase 2: Canvassing Survey — Follow up with respondents

**Survey methodology**

**Phase 2: Canvassing survey**

- Reminder send to non-respond firm / institution
- Follow up via calls/email
- Email send out to firms / institutions

- Follow up
- Fill-in an e-form
- Phone interview

- Partially complete
- Partially complete
- Complete

- Data Processing
- Checking, Coding, Editing, Data Capture, Tabulation

- Request for Face-to-face (FTF) appointment
- Fix date for FTF interview with respondent
- Conduct Fieldwork

Follow up

Complete
Phase 2: Canvassing Survey — Follow up with respondents

Purpose of follow-up calls

- Ensure PIC received the survey form
- Ensure PIC understands how to fill in the questionnaire
- Attend any questions or inquiries with regards to the survey
- Inform PIC of the submission date
- To check their survey progress
- Schedule for phone/FTF interview
End of Session 3