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Theme: Mixed Mode Data Collection

Contents

- General section 3
 - 1. Summary 3
 - 2. General description..... 3
 - 2.1 Uni-mode and mixed-mode designs 3
 - 2.2 Modes of data collection 3
 - 2.3 Mode quality, cost, and response burden considerations 5
 - 2.4 Multi-source/Mixed-mode design drivers 6
 - 3. Design issues 6
 - 3.1 Parallel and sequential mixed-mode designs..... 6
 - 3.2 The most appropriate modes during the business survey data collection process..... 7
 - 3.3 Increasing web take-up rates 8
 - 3.4 Improving the respondent experience..... 10
 - 3.5 Planning for data quality and its assessment 12
 - 3.6 Tailoring the mixed-mode design to business size 13
 - 3.7 Implementation of mixed-mode design for business surveys..... 14
 - 4. Available software tools 15
 - 5. Decision tree of methods 15
 - 6. Glossary..... 15
 - 7. References 15
- Interconnections with other modules..... 18
- Administrative section..... 19

General section

1. Summary

In this theme module we will discuss mixed-mode data collection designs in business surveys, with the term ‘survey’ in the limited sense of ‘data collection’ from businesses. This topic is of great relevance, since at present many NSIs around the world are moving from uni-mode to mixed-mode designs. When talking about modes in surveys we can distinguish between modes (or channels) of communication as used in a contact or survey communication strategy (like advance and reminder letters, telephone follow-up, etc.), and data collection modes, i.e., the mode used for the questionnaire or the delivery of the data. In this module we focus on data collection modes.

First we will give a general introduction to uni-mode and mixed-mode designs, discussing the characteristics of the various data collection modes. From there we will move on to discussing mixing modes in business surveys, with a focus on the web as a primary mode. This includes a brief discussion on a design for large and multi-surveyed businesses. We conclude with an overview of implementation steps.

2. General description

2.1 *Uni-mode and mixed-mode designs*

In general, we can identify two kinds of survey designs with regard to data collection modes: uni-mode designs and mixed-mode designs. In a uni-mode design, only one mode is used for data collection for all sampled units in the fieldwork period. For business surveys this used to be paper: sampled businesses received a paper questionnaire, sent, e.g., by mail or fax. In a mixed-mode design we use multiple modes to collect data from the sampled units in the data collection period of one survey. Apart from paper, the design can include a self-administered electronic questionnaire to be accessed on the internet, an interviewer-administered telephone interview (based on a paper or electronic questionnaire), or other types of data entry modes like TDE (Telephone/Touchtone Data Entry).

2.2 *Modes of data collection*

An overview of modes used most frequently in business surveys is presented in Table 1. This table also indicates whether a mode is self or interviewer administered, as well as an average indication of effects on data quality and costs. (For a detailed discussion on modes, we refer to: the theme module “Data Collection – Design of Data Collection Part 1: Choosing the Appropriate Data Collection Method”; De Leeuw, 2008; Dillman et al., 2009: Chapter 12, on Surveying Businesses and Other Establishments; Groves et al., 2004: Chapter 5: Methods of Data Collection.)

The modes listed in this table mostly are traditional ones, like paper questionnaires (either sent out and returned by mail, or by fax). CATI (Computer-assisted Telephone Interviewing) is a very common mode in social surveys since the 1970s; in mixed-mode business surveys it can be used as an additional mode to increase response rates (as we will see in Section 3.2). CAPI (Computer-assisted Personal Interviewing) refers to an interviewer visiting a respondent; in business surveys this could be the case when a field agent visits a business to complete or help completing a questionnaire.

Table 1. Data collection modes used in business surveys *)

Mode of data collection	Self/interviewer administered	Effects on data quality: risks of non-response and measurement errors	Costs
Paper: - mail-out/mail-back, - fax	Self-administered	High	Low
Electronic questionnaires in CAWI: - on-line - off-line	Self-administered	High	Low
Smart phone web questionnaires	Self-administered	High	Low
Smart phone, using Apps	Automatic registration	Low	Low
TDE	Self-administered	High	Low
CATI	Interviewer-administered	Low (depends on the topic: higher for sensitive topics)	Moderate
CAPI	Interviewer-administered	Low (depends on the topic: higher for sensitive topics)	High

*) For definitions, see Glossary. See also Table 1 in the theme module "Data Collection – Design of Data Collection Part 1: Choosing the Appropriate Data Collection Method".

As for electronic questionnaires, those can be run on an ordinary PC, laptop, notebook, or tablet (we do not consider a tablet to be a separate mode). An electronic questionnaire can be completed on-line, or downloaded from the internet (or installed from a CD) and completed off-line. In that case, the data can be sent back by e-mail (as a scrambled attachment), or via a secured internet connection (after logging-in on a secured web portal). Strictly speaking electronic questionnaires are used in all CAI modes, including interviewer-administered CAI modes like CATI and CAPI; in business surveys, however, the term electronic questionnaires often refers to the electronic equivalent of a self-administered paper questionnaire. When the internet is used for accessing the questionnaire, either for on-line or off-line completion, we speak of CAWI (Computer-Assisted Web Interviewing) or Web surveys. In general, when an electronic questionnaire is used for self-completion, the acronym CASI (Computer-Assisted Self-Interviewing) is used. This includes all kinds of electronic formats, like Excel-files that may be sent by e-mail. We could say that CAWI can be considered as a special form of CASI. Design issues that need to be considered with web questionnaires are trusted web portals, firewalls, and visual design and usability issues for various screen settings and web browsers.

The table also includes the use of Smart phones. This is a relatively new device that is just recently being explored for its use in survey data collection in general. Smart phones can be used in two ways. The first way is to use the device for the completion of web questionnaires (like on PCs and tablets), e.g., to be used as a small diary that can be completed every time a specific situation occurs. We consider this to be a separate mode since it involves the development of a separate questionnaire, tailored to the completion process and usability issues when using a small screen. The other one

involves the use of all kinds of Apps that register all kinds of variables, e.g., the route a lorry has taken during a day in a transportation survey. This research is still in its infancy, and will not be discussed further in this module; however, we foresee a lot of opportunities for this device in future survey designs.

2.3 *Mode quality, cost, and response burden considerations*

In general, the effects on data quality and costs are in the opposite direction: expensive modes result in the best data quality. With data quality we refer to non-sampling errors like non-response and measurement errors (see the theme module “Data Collection – Design of Data Collection Part 1: Choosing the Appropriate Data Collection Method” and Snijkers et al. (2013, pp. 83-125) for a detailed discussion on quality issues in business surveys). These errors are affected by a large number of survey design considerations like the choice of the mode, the design of the questionnaire, and the survey communication strategy.

The mode choice depends, e.g., on characteristics of the sampled population: if businesses cannot access the internet, CAWI is not a good choice; this will result in high non-response rates. Self-completion modes in general have a high risk of high non-response rates, since the persuasion power of these modes is low: a paper questionnaire (or an advance letter introducing a web questionnaire) can be left on a desk, forgotten about or left since it has no priority; they therefore require a very well designed contact and reminding strategy. On the other hand these modes are cheap in comparison to interviewer-administered modes, which require a well-trained and managed interviewer unit.

The mode impacts the questionnaire design: the questionnaire needs to be tailored to the mode, in such a way that usability of the questionnaire is high and response burden to complete it is low. The questionnaire should also be adapted to the response process within businesses. If this is not the case, this may result in measurement errors, item non-response, and maybe even unit non-response: respondents may skim the questionnaire and apply a satisficing response behaviour. When they get stuck they may quit completing. Self-completion modes require help desk or on-line web support. Interviewers, on the other hand, guide respondents in the response process and provide support, which generally results in less measurement errors (provided that interviewers are well trained in doing their job in order to reduce errors and interviewer effects as much as possible) The presence of an interviewer would assure that a questionnaire is fully completed. (Questionnaire design in a mixed-mode design context is discussed in Section 3.5.)

The communication strategy refers to the contact and reminding strategy, and should motivate and facilitate businesses to respond: business respondents should be motivated to complete a questionnaire. This also includes, e.g., the timing of dispatching a questionnaire (the communication strategy is discussed in Section 3.4.). The modes used in the communication strategy may differ from the data collection modes, e.g., a web questionnaire is used, while businesses are contacted using a paper advance letter, providing the web address and log-in codes.

The survey costs at the business side are called compliance costs or response burden. Response burden is affected by the three survey components discussed above: the mode of data collection, the questionnaire, and the survey communication strategy. High perceived and high actual response burden result in high risks of non-response and measurement errors. (For a detailed discussion on response burden we refer to Snijkers et al., 2013, pp. 303-358.)

When designing a survey, these considerations need to be taken into account, and trade-off decisions between quality and costs (both internal and compliance costs) need to be made.

2.4 Multi-source/Mixed-mode design drivers

Surveyors turn to mixed-mode designs when uni-mode designs are insufficient to achieve the required results within the available time and budget. In general, drivers for applying mixed-mode design are cost and non-response considerations. Additional considerations as mentioned by Dillman et al. (2009) are: improved timeliness of the response, improved coverage of the sampled population and reduced non-response errors.

The main drivers for introducing mixed-mode designs in official business surveys are budget cuts, response rate improvement, and response burden reduction: cheaper modes are introduced to get the same levels of response rates, while at the same time reducing response burden. As a consequence, trade-off decisions with regard to quality have to be made (and documented). The surveyor must be aware that new modes may impact the data quality (also when moving from one uni-mode design to another, as we have briefly discussed in Section 2.3); and in addition, the combination of modes may introduce mode effects, i.e., that respondents complete questions differently for the various modes (see also Section 3.5). This increases measurement bias. On the other hand, mixed-mode designs are introduced to reduce non-response rates and non-response bias caused by selective responses. As for costs, it should be noted that the data collection costs may be lower for mixed-mode designs, whereas the design costs increase.

To implement these goals, NSIs nowadays have data collection strategies, indicating how data for producing statistics are to be collected. In short, such a strategy may dictate that first data from various secondary administrative sources should be used, and only if this is not possible or insufficient, a survey can be conducted. The modes for data collection and their order of usage are also generally dictated by cost considerations: web is the dominant mode, followed by paper, and finally interviewer-administered modes. For example, Statistics Canada (Brodeur and Ravindra, 2010), Statistics Netherlands (Snijkers et al., 2011), Statistics New Zealand (2011), and Statistics Norway (2007) have implemented such a policy. The result of such a strategy is a multi-source/mixed-mode design for business data collection (Snijkers, 2008). In this module we focus on the mixed-mode aspects.

3. Design issues

In mixed-mode designs we try to find an optimal mix of modes, striving for the best possible data quality, while keeping survey and compliance costs (response burden) as low as possible. In this section we will discuss how to mix modes within constraints (as discussed above).

3.1 Parallel and sequential mixed-mode designs

Basically, there are two ways of applying a mixed-mode design in business surveys (Snijkers et al., 2013, pp. 359-430):

- A parallel or simultaneous approach, in which all mode options are offered to the respondents at once and the choice is left to them. Even though these options are offered with the intention to make it easy on respondents and to increase response rates, the outcome may be the opposite: these options may confront respondents with making a choice

that is difficult to make, as they do not know the consequences of their decision. As a result they may stick to the traditional mode, as this is what they know, or they may not respond at all. (Note that this decision is made prior to actually opening the questionnaire, and is therefore directed by the communication strategy as we will see in Section 3.3.)

- A sequential approach, in which a primary mode is offered first, with alternative modes offered in later stages to facilitate respondents and to increase response rates. Typically the least expensive mode is offered first, with a switch to more expensive modes in the next stages of the data collection process; the most expensive mode is being used in the final stage. This approach effectively uses survey finances, diminishes the need for respondents to choose a mode, and if used in an appropriate way can increase response rates (or at least increase the take-up rate for the primary mode as we will discuss in Section 3.3).

3.2 The most appropriate modes during the business survey data collection process

In business surveys, the most common modes are the self-completion modes. This has to do both with the response process within businesses, as well as cost considerations by the survey organisation. As we have seen in Table 1, the self-completion modes are the cheapest ones. As for the response process within businesses, the completion of a questionnaire may require data from various departments (see Section 3.4), which makes the completion of an interviewer-administered questionnaire cumbersome, time-consuming and expensive.

The fact that no interviewers are present puts a heavy load on the questionnaire design to ensure that all questions and instructions are correctly understood (i.e., the cognitive response process is performed correctly), and the respondent navigates correctly through the questionnaire. Also the full completion of a questionnaire is hard to control. In former days (up to about 2000), Statistics Netherlands had field managers visiting businesses to help them in completing questionnaires. This help facility has however been deleted because of budget cuts. Instead, help desk and on-line web support (including for instance a FAQ) is offered.

Interviewers may, however, be used in the data collection process in a number of ways, since personal communication is more effective than one-way communication. In the pre-field stage, businesses may be contacted on the phone to introduce the survey, to gain survey cooperation from the business management, to deal with gatekeepers, and to get the name of a contact person (a competent and knowledgeable respondent). During the field stage, interviewers can contact non-respondents for reminding, and motivate them to complete the questionnaire. An appointment could be made as to when a business will return the questionnaire. Also businesses may request a questionnaire in another mode, e.g., a paper questionnaire instead of a web questionnaire. In case of short questionnaires with an easy data retrieval process, the data may be collected at the spot. Paxson et al. (1995) advocate to use telephone follow-ups in addition to self-completion modes to encourage response and obtain the needed data. In these ways, we use the power of personal communication, and the persuasion and motivation skills of interviewers to increase response rates (Snijkers et al., 2013, pp. 303-430).

The more expensive modes, like using the telephone to actually collect the data, may not be applied for small and medium-sized businesses. This may be left for the more important businesses (e.g., the larger ones, or those with more than average turnover) within the various industry sectors. The

application of this design requires monitoring the response rates for subgroups during the fieldwork. The result is a tailored sequential web/paper/CATI mixed-mode design.

In addition, for the very large, multi-surveyed and indispensable businesses tailored data collection procedures may be implemented and applied by a special unit, aimed at reducing non-response and measurement errors, as well as reducing response burden (as we will discuss in Section 3.6).

3.3 Increasing web take-up rates

As we have seen above when discussing the data collection strategy, NSIs turn to web or electronic questionnaires as their primary mode. A major question now is: how to increase the web take-up rate, i.e., the proportion of businesses using the web questionnaire, without affecting overall response rates and data quality?

The evidence based on experiences in case studies indicates that a sequential approach is superior; the results indicate that with the parallel approach a newly introduced mode will hardly be used. A small-scale study by Hak, Anderson and Willimack (2003) explains this. They conclude that a major reason for sticking to the existing mode was that respondents saw no reasons for changing a routine that was convenient to them. To get to this decision, respondents compared the burdens of the existing mode with the perceived burden of the new mode. This applies to recurring surveys.

For one-time cross-sectional surveys (or a first wave in a recurring survey), a large-scale experiment embedded in a social survey conducted by Statistics Sweden provides evidence. This study shows that respondents have a tendency to use the mode that they have immediate access to. Holmberg et al. (2010) call this the “mode-in-the-hand principle”. In the experiment, a number of sequential approaches were compared to a simultaneous approach. The results indicated that the designs in which the paper option was presented in a stage later in the data collection process showed the highest web take-up rates, with comparable overall response rates. The results also suggested that the later in the fieldwork the alternative paper option was introduced, the higher the web take-up rate. We may assume that the mode-in-the-hand principle also is applicable to business surveys as a guiding principle for increasing web take-up rates, and points towards the sequential approach.

We will now give a number of specific examples of recent mixed-mode designs in business surveys as conducted by NSIs. The examples provide additional evidence on how to get a high response rate by use of a sequential mixed-mode design, i.e., increasing the take-up rate for a newly introduced mode, with unaffected overall response rates and data quality.

3.3.1 Example 1: introducing TDE at the UK Office for National Statistics (ONS)

In the UK, TDE is used for several ONS business surveys that collect nine or less data items. When TDE was introduced, respondents were sent a paper questionnaire with TDE offered as a simultaneous data collection mode: the TDE mode was indicated on the paper questionnaire. With this approach, response via TDE was generally around 20 to 30%. After a redesign, TDE was presented as the primary mode of data collection, and paper was offered as an alternative data collection mode: respondents received a letter indicating the use of TDE; they had to request the paper questionnaire. This approach resulted in an increase of the response rate via TDE to 80 or 90% (Jones, 2011; Thomas, 2007).

3.3.2 Example 2: Introducing a mixed-mode design for the Structural Business Survey at Statistics Netherlands

A second example is the sequential approach that was adopted for the introduction of the web mode for the Annual Structural Business Survey (SBS2006) conducted by Statistics Netherlands in 2007. In the first two contacts, the 63,644 respondents were only offered the web questionnaire. The paper questionnaire, that was available on request, was not mentioned in the letter. For the last reminder (the second or third reminder, depending on sector of the economy) a paper questionnaire was enclosed in the envelope. In all letters the web option was clearly promoted: in the middle of the letter login codes were provided. Before implementing this approach for the survey as a whole, it was tested in a field pilot in 2006 (SBS2005) with hopeful results (Snijkers et al., 2007). Based on the pilot results, it was decided to use the sequential approach in the next year for the whole sample. For the SBS2006, the web take-up rate was 80%, while 20% of the responding businesses used the paper questionnaire. The overall response rate of the SBS2006 was comparable to previous years: approximately 80%.

Response analysis (Morren, 2008) revealed that the percentage of web reporting increased with business size: from 78% for very small businesses to 89% for large businesses. For 24% of the businesses the mode of data collection was changed: they received the paper questionnaire with the 2nd or 3rd reminder. From these businesses 57% responded. Even though these businesses received a paper questionnaire, about one third used the web questionnaire. The mode could also be changed on request by the business: this was done by 4084 businesses. An interesting result here is the high response rate for businesses that requested a paper questionnaire: 91% (out of 4084). A voluntary request by respondents to receive a questionnaire in another mode seems a strong predictor for response. This indicates that making an alternative mode obtainable only on initiative of the respondent, would be a way to stimulate response.

3.3.3 Example 3: Introducing web questionnaires at the Australian Bureau of Statistics

A third example comes from the Australian Bureau of Statistics (Black and Ang, 2013). Like more NSIs, ABS is currently in the process of introducing web questionnaires in business and social surveys. In the May 2012 Employee Earnings and Hours Survey (EEH; a biannual survey) a sequential approach was applied: sampled businesses were given a link to an on-line questionnaire; a paper questionnaire was only sent out upon request by a business. ABS reports that this approach proved very successful, with a web take-up rate of 90%.

In addition, an analysis was carried out to provide reassurance that the new design did not impact on EEH estimates. The small amount of data obtained by other modes, however, limited the ability to detect systematic mode effects. Nevertheless, the analysis showed no systematic mode effects in the estimates. The analysis consisted of four parts:

1. An exploratory analysis, comparing the distributions of variables of interest for web and non-web respondents.
2. Comparing of EEH responses with data from other data sources for the same units. This involved comparing EEH web and non-web responses at the employer level with corresponding data provided by the same employer in other data sources. The values of common variables of interest for these units were compared using scatter plots, to examine

if the distributions for the web and non-web responses differed significantly. A more formal analysis was then conducted using linear regression analysis.

3. Modelling earnings and number of employees. Data from the May 2010 and May 2012 Average Weekly Earnings surveys (both paper surveys) was used to estimate how units common to both the 2010 EEH and 2012 EEH surveys would have responded if these units were provided with a paper form in 2012. The relationship between the modelled and actual 2012 EEH values for the web and non-web businesses was then compared.
4. Propensity score sub-classification. A logistic regression model was created to estimate the probability that each business in the EEH sample would respond via web. The sample was then grouped into five categories based on these estimated probabilities. A web mode impact was estimated within each category separately, and these were then combined to form an overall estimated impact.

Based on these results ABS decided to adopt the sequential approach for all its business surveys, and have web as the primary mode.

3.3.4 Example 4: Increasing web take-up rates in Sweden and Norway

Between 2005 and 2007, Statistics Sweden conducted a number of studies for web data collection designs in business surveys (Erikson, J., 2007; Erikson, 2010). Haraldsen (2009) studied the web take-up rates for business surveys conducted by Statistics Norway. These studies showed results in the same direction:

- Spontaneous web take-up rates for the simultaneous approach are low, between 5 and 25 %.
- Web take-up rates are increased significantly by eliminating paper in the first contacts.
- To get a high enough final response rate, alternative modes like paper questionnaires can be used in later stage (e.g., with reminders).
- Take-up rates are higher for respondents who already have experienced non-paper modes.
- Small businesses show the lowest take-up rates for web.
- Over the years, web take-up rates have increased.

3.4 Improving the respondent experience

A necessary factor that we need to take into account is the respondent factor. Even if we do not leave a choice for respondents with regard to the mode, we have to facilitate and motivate them. Nowadays, however, many businesses are used to completing web forms (for government regulations). As a consequence, they ask for web questionnaires, as they have the perception that this will reduce the burden of survey compliance. Still, this requires well-designed survey components.

Three components in the survey design affect web take-up rates: the communication strategy, the questionnaire, and a web portal (see Dowling and Stettler, 2007, for a more detailed discussion). With these three components we can influence the respondent's preferences with regard to mode, and facilitate the response process that is going on within businesses (see Snijkers et al., 2013, pp. 39-82). We can push a primary mode, but still be service-oriented. The question respondents will ask themselves when using an electronic questionnaire is: Will this make my life easier, and can I do this job quicker by using an electronic questionnaire? This is a cost-benefit analysis to estimate response burden, as we have seen Hak et al. (2003) also concluded.

For businesses, the response process starts when they are contacted in some way (e.g., with an advance letter) and the questionnaire is provided to them. The communication strategy (see also the theme module “Data Collection – Design of Data Collection Part 2: Contact Strategies”) indicates how businesses are contacted and followed-up in case of non-response, and is aimed at receiving timely, accurate and complete responses. This strategy can be a one-sided approach in which a survey organisation sends out questionnaires and assumes businesses to respond. Such an approach receives much criticism by businesses, and does not help to get cooperative businesses. An extended approach is a tailored and persuasive strategy that communicates the survey request and related instructions and procedures, and motivates and facilitates businesses to comply with the survey request. The survey communication strategy is an objective-driven and coherent plan of communication measures and actions. Such a strategy will improve the chances of getting respondents in the right mood for survey participation, and reducing (perceived) response burden by facilitating their survey-related work. In Sections 3.2 we have seen how such a strategy interacts with mode considerations, and Section 3.3 discussed examples of a communication strategy to increase web take-up rates. (Business survey communication is discussed extensively by Snijkers et al., 2013, pp. 359-430.)

When contacting businesses, we need to make a difference between the decision to participate, which is taken at a management level; and the actual completion of a questionnaire at an employee level. After businesses have decided to participate, they will start completing the questionnaire. This can be a complex process, in which various participants (e.g., data providers from various departments) are involved (see Snijkers et al., 2013, pp. 39-82, for a discussion on the response process). If respondents don't like a newly designed questionnaire in a new mode (like when introducing a web questionnaire), they will not use it, and in future contacts (in recurring surveys) it will be hard to convince respondents to use this mode (because of the bad experience). The implication of this is that we need to invest in questionnaires by developing them well, and tailoring them to the response process (see Snijkers et al., 2013, pp. 303-358, for a discussion on questionnaire design). Also questionnaires need to be tested thoroughly before using them in the field. Testing involves technical performance testing, cognitive testing and usability testing (see Snijkers et al., 2013, pp. 253-302, for a discussion on development, testing and evaluation methods).

With web questionnaires, the completion process starts when respondents go to the internet, enter the web address of the portal, and log-in; this is followed by the actual completion of the questionnaire and ends with submitting the data, and getting a feedback note saying that the data have been received and thanking the respondent. Also benchmark information can be provided; if this is to be an incentive, it should be mentioned as a promised incentive in the advance letter. To ensure that this process works well, also web portals need to be designed carefully, and tested for usability. Keywords in web site design are: easy to find, accessibility, and usability. A pitfall is that is assumed that respondents know how the internet works, and that they know what to do. Therefore the process needs to be easy, straightforward and logical for respondents (Snijkers et al., 2007).

By these investments in the communication strategy, the questionnaire and the web portal, respondents are likely to experience a reduced response burden. Statistics New Zealand (2013) calls this “Improving the respondent experience”.

3.5 *Planning for data quality and its assessment*

When introducing a mixed-mode design we need to assess whether the collected data are affected by the various modes, like ABS did in example 3: are there mode effects? In other words: show the collected data real-world levels and developments, or are they impacted by the survey design. The occurrence of mode effects (as well as survey errors as a whole) can be prevented by planning for data quality from the beginning. This involves a number of steps in the various stages of designing and conducting a business survey:

1. In the questionnaire design stage. In a mixed-mode design, for each mode a questionnaire needs to be developed. Here, two approaches can be adopted: 1. the questionnaires in all modes are exactly the same (e.g., translating a paper questionnaire one-on-one into an electronic questionnaire); 2. the questionnaires are tailored to the mode (i.e., all questionnaires make optimal use of the functionalities in the mode, while keeping the question wording and definitions, and routing the same). We believe that the second approach is the best way to go. In fact, we see no other option, since for electronic questionnaires businesses expect intelligent functionalities to be included (like automated routing, automated calculations, built-in edits, etc.; Snijkers et al., 2007; see Snijkers, 1992, for an overview of properties of electronic questionnaires). This approach is also recommended by Snijkers et al. (2013, pp. 303-358): in the design first focus on the issues that need to be addressed for a paper questionnaire (like wording of questions, response options, instructions, and order of the questions), and then improve the questionnaire by incorporating electronic functionalities. He states (ibid., p. 304): “As long as we have done our best within the paper format, we are less worried about possible mode effects that arise from improvements made in the web version.” This approach is followed by Statistics Netherlands for redesigning the Structural Business Survey questionnaire (see Example 2; Snijkers et al., 2007).
2. In the prefield stage, the questionnaires need to be tested whether they are valid measuring instruments (Snijkers et al., 2013, pp. 253-302). Also in this stage, sampled businesses in recurring surveys may be pre-notified (by sending a pre-notification letter) about changes in the mode, so they can be prepared for the new situation (Snijkers et al., 2013, pp. 359-430).
3. Next a pilot (or experiment) may be conducted, as was carried out by Statistics Netherlands in Example 2. A pilot is conducted to test the design in real-life conditions, i.e., to test if the survey design works as planned, to test if the survey production process works properly, and to study mode effects. Even though we have reduced errors by pre-testing the questionnaires, we cannot be sure about the results: for a business survey there are many uncertainties in the field that affect the survey outcomes. Therefore it is better to first test the design with a small part of the sample, instead of risking a whole fieldwork to go wrong. If possible, the pilot group needs to be a representative subsample of the population, thus applying an experimental design. It is our experience, however, that conducting an experiment with a properly defined control and experimental group, is hard to do in practice. Partly because we cannot fully control how businesses will use the various modes.

The pilot needs to be evaluated and analysed with regard to data quality issues as is done, e.g., by the ABS in example 3. In general, the following analyses could be carried out for key variables:

- Comparing estimates for the various modes, if the groups can be made comparable.
- Modelling over time for the same survey: comparing estimates for the same groups over time.
- Modelling over data sources: comparing data for the same units but from various sources in the same time span.

If the results from the pilot study are acceptable, and within pre-defined quality limits, the design can be implemented for the survey as a whole.

4. In the post-field stage, it is recommendable to evaluate the survey and conduct a quality assessment as discussed for the pilot (Snijkers et al., 2013, pp. 253-302 and pp. 431-458). In addition to the analyses listed in step 3, the editing of key variables can be monitored, by monitoring the number of edits for these variables, as well as the differences in value for these variables prior to editing as compared to edited values (Snijkers et al., 2013, pp. 431-504). If edits are included in the electronic questionnaire, this should show in the monitoring results: less post-field editing should be necessary for the electronic questionnaire.

3.6 Tailoring the mixed-mode design to business size

The mixed-mode design as discussed in the previous sections can be applied to the sample as a whole, which would be the case in social surveys. In business surveys, however, it is recommendable to tailor the design to the size of the businesses. As we have already discussed in Section 3.2, telephone non-response follow-ups can be conducted for small and medium-size. The very large businesses however require a more personal approach.

Since these large businesses are key in producing economic statistics they cannot be missed, and as a consequence these businesses are multi-surveyed. Special procedures for dealing with large businesses become more important in the context of globalisation (UNECE, 2011), with businesses organised on a global rather than national level. Also their data across surveys need to be coherent and consistent. To deal with these key businesses, NSIs have established special units, e.g., Statistics Canada (Sear et al., 2007), Statistics Netherlands (Vennix, 2012), Statistics Sweden (Erikson, A.-G., 2007), and US Census Bureau (Marske et al., 2007).

These units consist of specially trained managers, so called customer relationship managers, large enterprise managers, or account managers. Among other things, these relationship managers assist these businesses in the completion process, and provide information about the surveys (background, output, and changes). Their knowledge of the businesses in their portfolio is essential in this business-oriented approach: they know the situation of the businesses, know the surveys they receive, and understand the burden of receiving many questionnaires. These procedures are aimed at building and maintaining a good relationship with these key businesses, and over all surveys obtaining coherent, as well as timely, complete, and accurate data.

3.7 *Implementation of mixed-mode design for business surveys*

To conclude, the steps below can be considered for the implementation of a mixed-mode design for business surveys (Snijkers et al., 2013, pp. 359-430). With the multi-source/mixed-mode data collection strategies in mind, a general guideline is stated by Dillman et al. (2009, p. 422): plan for a mixed-mode design from the beginning.

Pre-field stage steps:

1. Use existing data sources (like existing survey data and administrative data) as much as possible. Only if needed, plan for a survey, with a mixed-mode design (possibly with the web as primary mode).
2. Optimise the questionnaire designs for the various modes, taking the business context and response burden issues into consideration. Start with paper, and then optimise the design for the web. Make sure that the questionnaire works properly for all major hardware platforms (Windows PCs, Apple computers, tablets), and web browsers. Pre-test all questionnaires to improve the respondent experience.
3. Design web portals and conduct usability testing. Make sure that the web portal is trusted, and not blocked by firewalls.
4. If possible, within time and budget constraints, conduct a pilot, to test the mixed-mode design and the survey production process.
5. Inform businesses (in recurring surveys) about changes in mode. Don't ask for the mode they would prefer, but inform them about the new primary mode that is coming up, and what they can expect.

Field stage steps:

6. Restrict access to paper, and apply a sequential approach: don't provide a paper questionnaire in the first contacts, but as an alternative in a later stage. In the letters mention that a paper questionnaire is available on request.
7. A mode switch can be done sooner or later. When to offer the paper questionnaire depends on the number of reminders, and the development of the response rate during the fieldwork (if response is falling behind, it is recommended to change to another mode).
8. Facilitate the use of the primary mode. In all letters, also the reminder letters that come with a paper questionnaire, clearly promote the web option. Provide support by a centralised help desk and on-line help (FAQs, contacts for technical and non-technical support, etc.).
9. In addition to self-completion modes, businesses can be followed-up by phone to encourage responding, and even collect the data. This can be tailored to, e.g., size, turnover, and industry.
10. Make access to web questionnaires easy from start to end. The entire process of finding the questionnaire, logging-in, opening and completing the questionnaire, and sending the data should be simple and straightforward. At the end of the process, provide feedback by confirming the receipt of the data, and say 'thank you'.
11. A special unit for large and multi-surveyed key businesses is responsible for contacting and building a relationship with these businesses.

Post-field stage step:

12. Evaluate the survey, and assess quality of the data to check for mode effects and improve the design (according to the Deming cycle: plan-do-check-act).

4. Available software tools

5. Decision tree of methods

6. Glossary

For definitions of terms used in this module, please refer to the separate “Glossary” provided as part of the handbook.

7. References

- Black, M. and Ang, L. (2013), Measuring the Impact of webforms in the Survey of Employee Earnings and Hours. ABS Methodological News, A Quarterly Information Bulletin, Australian Bureau of Statistics, March 2013, 4–5.
- Brodeur, M. and Ravindra, D. (2010), Statistics Canada’s new use of administrative data for survey replacement. Paper presented at the European SIMPLY Conference on Administrative Simplification in Official Statistics, Ghent, Belgium, Dec. 2–3.
- De Leeuw, E. D., Hox, J. J., and Dillman, D. A. (eds.) (2008), *International Handbook of Survey Methodology*. European Association of Methodology, Lawrence Erlbaum Associates, New York, London.
- De Leeuw, E. D. (2008), Choosing the Method of Data Collection. In: De Leeuw, E. D., Hox, J. J., and Dillman, D. A. (eds.), *International Handbook of Survey Methodology*, Lawrence Erlbaum Associates, New York, 113–135.
- Dillman, D. A., Smyth, J. D., and Christian, L. M. (2009), *Internet, Mail, and Mixed-Mode Surveys: The Tailored Design Method*, 3rd edition. Wiley, Hoboken, NJ.
- Dowling, Z. and Stettler, K. (2007), Factors influencing business respondents’ decision to adopt web returns. *Proceedings of the 3rd International Conference on Establishment Surveys (ICES-III), Montreal, June 18–21*, American Statistical Association, Alexandria, VA, 1028–1039.
- Erikson, A.-G. (2007), Large enterprise management – higher quality and lower burden through better relations. *Proceedings of the 3rd International Conference on Establishment Surveys (ICES-III), Montreal, June 18–21*, American Statistical Association, Alexandria, VA, 825–829.
- Erikson, J. (2007), Effects of offering web questionnaires as an option in enterprise surveys: The Swedish experience. *Proceedings of the 3rd International Conference on Establishment Surveys (ICES-III), Montreal, June 18–21*, American Statistical Association, Alexandria, VA, 1431–1435.

- Erikson, J. (2010), Communication strategies in business surveys – implications when web data collection becomes the main mode. Paper presented at the 3rd International Workshop on Business Data Collection Methodology (BDCM), Wiesbaden, Germany, April 28–30.
- Groves, R. M., Fowler Jr., F. J., Couper, M. P., Lepkowski, J. M., Singer, E., and Tourangeau, R. (2004), *Survey Methodology*. Wiley, Hoboken, NJ.
- Hak, T., Willimack, D. K., and Anderson, A. E. (2003), Response process and burden in establishment surveys. *Proceedings of the Section on Government Statistics, Joint Statistical Meetings, San Francisco, Aug. 3–7*, American Statistical Association, Alexandria, VA, 1724–1730.
- Haraldsen, G. (2009), Why don't all businesses report on web? Paper presented at the 4th International Workshop on Internet Survey Methodology, Bergamo, Italy, Sept. 17–19.
- Holmberg, A., Lorenc, B., and Werner, P. (2010), Contact strategies to improve participation via the web in a mixed-mode mail and web survey. *Journal of Official Statistics* **26**, 465–480 (available at www.jos.nu).
- Jones, J. (2011), Effects of different modes, especially mixed modes, on response rates. Paper presented at the Workshop on Different Modes of Data Collection, Eurofond, Dublin, April 6–7.
- Marske, R., Torene, L., and Hartz, M. (2007), Company-centric communication approaches for business survey response. *Proceedings of the 3rd International Conference on Establishment Surveys (ICES-III), Montreal, June 18–21*, American Statistical Association, Alexandria, VA, 941–952.
- Morren, M. (2008), The 2006 Structural Business Survey: Response Analysis (in Dutch: “De PS-2006: een evaluatie van de respons”). Research report, Statistics Netherlands, Heerlen.
- Paxson, M. C., Dillman, D. A., and Tarnai, J. (1995), Improving response to business mail surveys. In: Cox, B. G., Binder, D. A., Chinnappa, B. N., Christianson, A., Colledge, M. J., and Kott, P. S. (eds.), *Business Survey Methods*, Wiley, New York, 303–317.
- Sear, J., Hughes, J., Vinette, I., and Bozzato, W. (2007), Holistic response management of business surveys at Statistics Canada. *Proceedings of the 3rd International Conference on Establishment Surveys (ICES-III), Montreal, June 18–21*, American Statistical Association, Alexandria, VA, 953–958.
- Snijkers, G. (1992), Computer assisted interviewing: Telephone or personal? In: Westlake, A., Banks, R., Payne, C., and Orchard, T. (eds.), *Survey and Statistical Computing*, North-Holland, Amsterdam, 137–146.
- Snijkers, G., Onat, E., and Vis-Visschers, R. (2007), The Annual Structural Business Survey: Developing and Testing an Electronic Form. *Proceedings of the Third International Conference on Establishment Surveys (ICES-III), Montreal, June 18–21*, American Statistical Association, Alexandria, VA, 456–463.
- Snijkers, G. (2008), Getting data for business statistics: A response model. Paper presented at the 4th European Conference on Quality in Official Statistics, Rome, July 8–11.
- Snijkers, G., Göttgens, R., and Hermans, H. (2011), Data collection and data sharing at Statistics Netherlands: Yesterday, today, tomorrow. Paper presented at the 59th Plenary Session of the

- Conference of European Statisticians (CES), United Nations Economic Commission for Europe (UNECE), Geneva, June 14–16 (available at www.unece.org/fileadmin/DAM/stats/documents/ece/ces/2011/20.e.pdf).
- Snijkers, G., Haraldsen, G., Jones, J., and Willimack, D. (2013), *Designing and Conducting Business Surveys*. Wiley, Hoboken, NJ.
- Statistics Norway (2007), *Strategy for Data Collection*. Statistics Norway, Oslo (available at www.ssb.no/english/about_ssb/strategy/strategy2007.pdf).
- Statistics New Zealand (2011), *Statistics New Zealand's Collections Strategy for 2010-20: Transform Collections*. Statistics New Zealand, Wellington.
- Statistics New Zealand (2013), *Statistics New Zealand's Respondent Experience Strategy for 2013-20: Willing respondents, finding it easy*. Statistics New Zealand, Wellington.
- Thomas, P. (2007), *Using telephone data entry as a data collection mode for business surveys*. Paper presented at the 56th Session of the International Statistical Institute (ISI), Lisbon, Aug. 22–29.
- UNECE (2011), *The Impact of Globalization on National Accounts*. United Nations Economic Commission for Europe, New York/Geneva.
- Vennix, K. (2012), *The Treatment of Large Enterprise Groups within Statistics Netherlands*. Paper presented at the 4th International Conference on Establishment Surveys (ICES-IV), Montreal, June 11–14, American Statistical Association, Alexandria, VA.

Interconnections with other modules

8. Related themes described in other modules

1. Questionnaire Design – Main Module
2. Questionnaire Design – Electronic Questionnaire Design
3. Data Collection – Main Module
4. Data Collection – Design of Data Collection Part 1: Choosing the Appropriate Data Collection Method
5. Data Collection – Design of Data Collection Part 2: Contact Strategies
6. Data Collection – Techniques and Tools
7. Data Collection – CATI Allocation
8. Response – Response Burden

9. Methods explicitly referred to in this module

- 1.

10. Mathematical techniques explicitly referred to in this module

- 1.

11. GSBPM phases explicitly referred to in this module

1. GSBPM Sub-process 2.3: Design data collection methodology
2. GSBPM Sub-process 4.2: Set up collection
3. GSBPM Sub-process 4.3: Run collection

12. Tools explicitly referred to in this module

- 1.

13. Process steps explicitly referred to in this module

- 1.

Administrative section

14. Module code

Data Collection-T-Mixed Mode

15. Version history

Version	Date	Description of changes	Author	Institute
0.0.5	14-02-2013	first version	Ger Snijkers, Rob van de Laar	CBS (Netherlands)
0.1	24-06-2013	first complete version	Ger Snijkers	CBS (Netherlands)
0.2	06-12-2013	second version	Ger Snijkers	CBS (Netherlands)
0.3	27-01-2014	third version after review Editorial Board	Rob van de Laar	CBS (Netherlands)
0.3.1	28-01-2014	preliminary release		
1.0	26-03-2014	final version within the Memobust project		

16. Template version and print date

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