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Title: A Survey Data Quality Strategy: The Institutional Research Perspective

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A Survey Data Quality Strategy: The Institutional Research Perspective

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Abstract:

This paper intends to construct a survey data quality strategy for institutional researchers in higher education in light of total survey error theory. It starts with describing the characteristics of institutional research and identifying the gaps in literature regarding survey data quality issues in institutional research. Then it is followed by introducing the quality perspective of a survey process and the major components of total survey error. A proposed strategy for inspecting survey data quality is presented on the basis of five types of survey error and the characteristics of institutional research survey projects. The strategy consists of *quality measures* for each type of survey error, and *quality control* and *quality assurance* procedures for each of the quality measures. The major components in the survey data quality strategy are summarized in Table 2 in this paper, with elaborations in related sections. The paper ends with a discussion about the implications of the strategy for institutional researchers. A checklist for inspecting survey data quality is attached as an appendix.

Since the 1960s, institutional research (IR) has emerged as a profession and gradually become an organizational function of higher education institutions in North America. Its presence in higher education is a response to changing demands of society for its institutions, such as calls for increased accountability and efficiency (McLaughlin & Howard, 2001). Initially, IR appeared as a decentralized set of activities conducted in various offices throughout university/college campuses; however, its function has become centralized in institutional research offices.

Institutional research helps answer three questions essential to the sustained development of an organization: Where is the organization at this moment? Where is the organization going? And how can the organization best arrive at its desired end? (Middaugh, Trusheim, & Bauer, 1994, p.1) Institutional research fosters organizational learning (Leimer, 2009). Institutional research has increasingly becomes a core administrative function through its having become integrated into strategic planning and assessment process of the institution (Morest, 2009). It is anticipated that institutional researchers will not only continue to fulfill their core function by converting data into information but will also become change agents by actively engaging in the process of managing and leading institutional change (Swing, 2009).

What is institutional research about? In his seminal monograph on institutional research, Saupe (1990) defines institutional research as “research conducted within an institution of higher education to provide information which supports institutional planning, policy formation and decision making” (p. 1). As such, the main product of institutional research is information. There are multiple institutional research measures including those related to organizational inputs (e.g., students, faculty and staff, facilities, and revenues), processes (e.g., academic programs, program completion, quality, productivity, and strategic planning), outputs (e.g., graduates, student outcomes) and the external environment (e.g., financial considerations, employment market, government concerns, and regional accreditation) (Middaugh, Trusheim, & Bauer, 1994). The task of institutional researchers involves converting complex data to actionable information (Anderson, Milner, & Foley, 2008) and concerns three interdependent forms of “organizational intelligence” (Fincher, 1985): technical/analytical intelligence, issues intelligence, and contextual intelligence (Terenzini, 1993). Institutional research draws from various methodologies including applied research, program evaluation, policy analysis and action research depending on questions it needs to address (Saupe, 1990).

Institutional research distinguishes itself from higher education research in that institutional researchers are more concerned about knowledge about a specific institution or system of institutions whereas higher education researchers are more interested in advancement of theory and practice in higher education in general (Saupe, 1990; Terenzini, 1993). Another difference is the importance of the utilization or application of the information produced through institutional research. The use of information is viewed as an essential component in the "life cycle" of an institutional research activity. Along with other stages of design, collection, preparation, analysis, and dissemination, application of the research results and feedback received are the "primary determinant[s] of success" (Borden, Massa, & Milam, 2001, p. 200).

Institutional research involves three data sources: institutional information systems or administrative data (e.g., student enrolment data, faculty data), institutional surveys or in-house surveys, and external data sources (regional or national data, e.g., Integrated Postsecondary Education Data System in the United States.) (Borden et al., 2001). Although a locally prepared survey may be the best option for obtaining the needed information, information users in higher education institutions generally have higher levels of trust toward research derived from administrative data than that derived from survey data. A similar pattern is also found among higher education researchers and policy makers, who traditionally have less confidence in softer and more subjective measures such as survey data (Gonyea, 2005). At the same time, more than ever, the demands for external assessment and internal assessment have fueled an increase in the demand for quality survey data (Porter, 2004). As such, to increase the acceptance and use of survey data, increased efforts are required to improve survey data quality in both higher education research and institutional research.

Unfortunately, little literature is available that examines survey data quality issues in a *holistic* way for the purposes of institutional research professionals. There seems to be two gaps in the existing efforts to improve on survey methodology. First, while there is a large amount of literature addressing various aspects of a survey project (Croninger & Douglas, 2005; Gonyea, 2005; Porter, 2004; Presser, Couper, Lessler, Martin, Rothgeb, & Singer, 2004; Sanchez, 1992; Thomas, Heck, & Bauer 2005), there is lack of synthesis of this literature for the purposes of quality control. Furthermore, issues of survey methodology have yet to be approached from a survey quality perspective. Because survey quality is a complex issue with multiple dimensions, a lack of synthesis may be understandable—when one particular area is addressed in depth, it is hard to cover other areas and have the breadth of the topic. However, this synthesis of knowledge is necessary for any kind of survey project if the researcher is serious about the survey data quality, regardless of whether the research concerns multi-institutional surveys such as the National Survey of Student Engagement (NSSE) or in-house surveys specific to one institution.

The second gap is that while "serious" institutional researchers (Gonyea, Korkmaz, BrckaLorenz & Miller, 2010) are making efforts to improve survey data quality, they often do not rely on theories in survey methodology, such as total survey error. As a result, little can be found in the extant institutional research literature in reference to total survey error theory and its applications in institutional research. As such, for institutional research purposes, it is meaningful to look at survey data quality issues in light of the total survey error theory.

This task is more pressing in the unbalanced efforts among institutional researchers to improve the quality of data they are working with. How institutional research provides information support to a higher education institution is illustrated in a book that carries much weight in the field of institutional research – *People, Processes, and Managing Data* (McLaughlin & Howard, 2004). The book presents an information support cycle that involves three stakeholders through five stages of information management: the custodian/supplier (focusing on integrity of the data), the broker/producer (transforming the data into information), and the manager/user (taking the information and applying it to the situation); the center of this information support cycle is quality decision-making

(Figure 1). The institutional research function is identified as being mostly aligned to the information broker role while relating to the data custodian and the data user (p. 17). What merits attention is that the book only speaks to administrative data in an institution and does not address survey research projects. So the question remains unclear as to how the institutional research function fits into the information support cycle when survey data are involved.

Figure 1. Information Support Cycle in Institutional Research

In this context, this paper presents a model of a survey data quality strategy for institutional researchers in higher education in light of total survey error theory. In the following section, I briefly introduce the quality perspective of a survey process and the major components of total survey error. Then I will present the proposed strategy for survey data quality for institutional research purposes in a table with explanations to follow. The paper ends with discussions about the implications of the strategy for institutional researchers. It should be noted that this paper focuses on the big picture and the breadth of survey quality data issues in institutional research, rather than the depth of each issue. Readers interested to know more about a particular topic are encouraged to consult articles addressing individual issues for details.

1. The "Quality" Perspective of Survey Process and the Total Survey Error

A survey process can be viewed in two ways. First, it can be viewed from a *process perspective*, wherein one might examine all the steps and decisions that are required in a survey project, including: determining research objectives based on information needs, determining sampling methods, developing the survey instrument, administering the survey, conducting data analysis, and finally producing the survey report (Alreck & Settle, 1985; Biemer & Lyberg, 2003). This approach describes the survey process as a procedure that is mostly sequential but with iterations.

The second approach to a survey process is to view it from a *quality perspective*. This view does not focus on how best to implement each step in a survey process but concentrates on what problems may occur in each step and how to overcome or minimize the occurrence of those problems (Groves, Fowler, Couper, Lepkowski, Singer, & Tourangeau, 2004). In other words, it intends to examine errors that may occur in the survey process with a view of minimizing those errors threreby improving survey data quality. As such, the *quality* perspective is linked with survey errors and the concept of total survey error comes in.

Total survey error is the difference between a population mean, total or other population parameter, and the estimate of the parameter based on the sample survey (or census) (Biemer & Lyberg, 2003, p.36). Survey errors can be organized in different ways. Some categorize these into sampling error and non-sampling error (Biemer & Lyberg, 2003); others classify them into observational error associated with measurement and non-observational error associated with representation (Groves et al., 2004). Regardless of different ways of organizing survey errors, the total survey error consists of the following five types of survey error: measurement error, coverage error, sampling error, non-response error, and post-survey or data processing error (Biemer & Lyberg, 2003; Groves et al., 2004; Weisberg, 2005).

Each type of survey error creates the risk of variable errors and systematic errors, which can result in variance and bias respectively. Variance and bias are two measures of data quality; with variance being easier to measure and control than bias (Bailar, Herriot, & Passel, 1982; Czaja & Blair, 2005). In general, among the five types of survey error, the sampling error has a low risk of systematic errors whereas the other four types have a high risk of systematic errors (Biemer & Lyberg, 2003, p.59).

In a typical institutional research survey project, the target population is generally either students or faculty/staff members of the institution, and the sampling frame is usually available from the student information system or the human resources database. The target population often uses emails and online resources, and therefore web surveys are easier to administer than paper-based methods. Furthermore, the higher education institution usually has access to relatively advanced data entry and processing resources (e.g., software and research expertise), which may help reduce data processing errors. Given those characteristics, the risk of variable errors and the risk of systematic errors in each type of survey error may be different from those in a survey project in other contexts. Table 1 shows an indication of the risk of variable and systematic errors in the five types of survey error in an institutional research survey project.

Table 1: Risk of Variable and Systematic Error by Major Error Source in the Institutional Research Context

2. Survey Data Quality Strategy

The survey data quality strategy proposed in this paper addresses the five identified types of survey error in a framework of quality assurance and quality control.

There is a fine distinction between the two concepts: “Quality assurance ensures that processes are capable of delivering good products, while quality control ensures that the product actually is good” (Lyberg & Biemer, 2008, p. 426). As such, quality assurance is related to the survey process while quality control is related to the survey product. The characteristics of quality survey data need to be defined for the purposes of quality control and the characteristics of a quality survey process should be identified for the purpose of quality assurance.

With these considerations in mind, the proposed survey data quality strategy is comprised of three components: *quality measures*, which are the characteristics or indicators of quality survey data; *quality control procedures*, which are used to inspect the survey data and examine whether the data have those characteristics of quality survey data; and *quality assurance procedures*, which are used to inspect the survey process and check whether certain procedures were implemented during the survey process to ensure that the resulting survey data set will have those characteristics of quality survey data.

Table 2 shows the survey data quality strategy with the five types of survey error as one dimension, and the three areas of quality inspection for the survey data as the other. The strategy is also aligned with the two approaches to addressing the issue of survey errors: measurement and reduction (Czaja & Blair, 2005). The quality control procedures are aimed to measure and assess survey errors and the quality assurance procedures are intended to reduce survey errors.

Table 2. Summary of the Major Components in the Survey Data Quality Strategy

In the following sections, I will identify the quality measures and elaborate on the quality control and quality assurance procedures for each of the five types of survey error in the context of institutional research. Table 2 serves as a summary of those measures and their related procedures.

2.1 Quality Inspection for Measurement Error

Measurement error occurs when there are differences between the responses obtained and what was to be measured. Relating to measurement error, quality survey data are characterized by three indicators: validity, reliability and minimized response bias.

Quality Control Procedures

Validity is the extent to which the survey measure actually reflects the intended construct. Assessing validity is to inspect correlations. The validity of the survey can be determined by examining concurrent validity (measured by a positive correlation between the survey responses with responses to similar questions in other surveys) and divergent validity (measured by a negative correlation between the survey responses and answers to other questions that measure a different construct). When the measurement is consistent with the theory behind it, then the data have construct validity. Factor analysis is a method to inspect construct validity.

Reliability is a measurement of the variability of answers over repeated conceptual trials. It addresses the question of whether respondents are consistent or stable in their answers, and it is therefore also known as response variance. Reliability is a function of correlation of two survey estimates, and reliability in the responses can be assessed in three ways: internal consistency (typically measured by Cronbach's alpha), split-half reliability and test-retest reliability (both typically measured by the Spearman-Brown coefficient).

Response bias is a systematic deviation or discrepancy between the sample estimate and the true population parameter; in other words, the respondent mean response is consistently higher or lower than the true mean score of the population. Response bias can come from sources such as social desirability, acquiescence, yea- and nay-saying, prestige, threat, hostility, auspices, mental set, order and extremity (Alreck & Settle, 1985, p. 112).

There are two ways to assess response bias. One is to compare survey data with data or information from sources external to the survey. An example of this method is to check with the stakeholder or the sponsor of the survey project to find out whether the survey findings about a particular question is far different from their experience or knowledge. Another way of assessment is to evaluate the occurrence of certain response tendencies, such as respondents giving socially acceptable answers, avoiding using the extreme response categories of a rating scale, or giving the same answer to all alternatives in a rating scale (known as strong satisficing) (Groves et al., 2004).

Quality Assurance Procedures

Measurement error can be reduced through the following techniques. First, researchers should construct a good questionnaire that is based on a well-supported theory or conceptual framework, and improve question wording and questionnaire structure. As an institutional research survey project is often initiated by certain institutional needs, the survey instrument tends to be constructed mainly from experience and less from a literature-based conceptual framework. However, despite the applied nature of an institutional research project, a literature review should not be compeltely absent from the survey design process.

Second, cognitive interviews should be conducted to make sure that the target population understands the questions in the same way as the questionnaire was intended.

Third, adequate respondent behavior involves optimal completion of the cognitive process and sufficient motivation on the part of the respondent; therefore, the questionnaire should be designed and administered with a view to ensuring participants actually go through the four components of the mental processing in answering survey questions: comprehension, retrieval, judgment and response (Tourangeau, Rips, & Raskinski, 2000). An example of failing to do so is strong satisficing, which may occur when respondents skip the retrieval and judgment steps and proceed to response steps

(Groves et al., 2004). Questions can be asked regarding how the respondents complete the questionnaire and how they self-evaluate their motivation and ability while completing the questionnaire.

Fourth, for interviewer-administered surveys, procedures need to be taken to ensure adequate interview behavior, which is measured by low interviewer variance and can be best analyzed with multilevel analysis (Looseveldt, Carto, & Billiet, 2004).

2.2 Quality Inspection for Coverage Error

Coverage error occurs when differences between the sampling frame and the target population exist. Quality survey data are characterized by minimized discrepancy between the sampling frame and the target population.

Quality Control Procedures

Bias exists when some components in the target population are not available or accessible in the sampling frame. This may be caused by situations where elements in the target population do not, or cannot, appear in the sampling frame (i.e., *undercoverage*), units in the sampling frame are not in the target population (i.e., *ineligible units*), and several units in the frame are mapped onto the single element in the target population (i.e., *duplication*) (Groves et al., 2004). Therefore, researchers should check for those cases.

Another procedure for assessing the discrepancy between the sampling frame and the target population is to compare the specifications of the target population and the corresponding parameters of the sampling frame. As higher education institutions usually assign their students an institutional email address when they first enroll in their studies, the coverage error is not as big a threat to web surveys in institutional research as is found in other fields in general (Couper, 2000).

Quality Assurance Procedures

Researchers need to develop a working definition and clear specifications of the target population, and locate a readily available list that includes as many elements of target population as possible. In the context of institutional research, a typical target population is a student cohort with certain characteristics when they are applying for studies, are currently enrolled in certain programs of study, or have graduated within a certain time frame. As a post-secondary institution usually has a well-established student database, the sampling frame is often stable, complete and accessible. Therefore, the risk of variable errors and systematic errors related to coverage error are generally low and more controllable.

2.3 Quality Inspection for Sampling Error

Sampling error is the difference between the survey estimate and the population parameter as a result of taking the sample instead of the entire population. A good set of survey data is representative of the sampling frame by known demographic parameters. When probability sampling is used, margin of error is a commonly used measurement of the level of random sampling error. The commonly acceptable margin of error is less than 5% at the 95% confidence level.

Quality Control Procedures

Sample representativeness can be determined by comparing the frequency distributions of the obtained sample and those of the sampling frame by certain demographic characteristics. If the difference in the frequency distributions is negligible, then the obtained sample is considered as representing the sampling frame by those indicators.

Margin of error is influenced by variance of a variable and sample size: the smaller the variance is and the larger the sample size is, the smaller the margin of error becomes. There is a distinction between margin of error for a variable and margin of error for a survey: the margin of error for a survey uses the maximum variance (where the standard deviation equals 0.5) (Groves et al., 2004). Margin of error for a survey can be calculated if the total of the target population and the total number of respondents are known.

Quality Assurance Procedure.

The magnitude of sampling error is more controllable than other types of survey errors and therefore is considered as intentional error (Biemer & Lyberg, 2003). The sampling error can be controlled by making a good sample selection, which is featured by random selection of elements in the sampling frame and key subgroups of the population being well-represented in the sample. Appropriate implementation of a sampling procedure requires four considerations: probability sampling, stratification, clustering, and sample size. Sampling bias can be easily removed by giving all elements an equal chance of selection; sampling variance is reduced when the sample size is big and the sample is stratified and is not clustered (Groves et al., 2004).

An appropriate sampling strategy involves calculating a reasonable sample size. The sample size is determined by the sampling frame, expected margin of error, and anticipated response rate, data breakdown for analysis, and the resources available for the survey. Table 3 shows an example to illustrate this.

Table 3. An Example of Determining the Sample Size

With a sampling frame of 10,000 students, if the expected number of respondents is 300, then the margin of error is 5.57% at the 95% confidence level. If a response rate of 20% is anticipated, then a sample of 1,500 students is needed for the survey. If the 300 expected respondents are going to be broken down into subgroups for data analysis purposes, for example, according to the six schools or faculties of the institution, then in each subgroup, there are 50 respondents. This size of respondents is acceptable for descriptive statistical analysis. However, if the researcher intends to conduct inferential statistical analysis or multivariate data analysis, s/he may want to consider increasing the total expected number of respondents to 900, which results in a margin of error of 3.12% and a sample size of 4,500 when the anticipated response rate remains 20%. If the survey project is going to be administered in the web mode, the sample size will not matter much because the bigger size will not add costs to the survey; however, when the mail survey is used, the increased costs from questionnaire distribution, and data entry and processing will be a consideration for the sample size to be determined. This process of computing can be facilitated by using an online sample size calculation tool (e.g., http://www.raosoft.com/samplesize.html).

2.4 Quality Inspection for Non-response Error

Non-response errors occur when some people from the sample who were invited to participate in the survey do not respond to the survey request or fail to respond to some of the questions in the survey. Therefore, there are two types of non-response error: *non-responses at the unit level* and *non-responses at the question item level* (Biemer & Lyberg, 2003; Groves et al., 2004; Weisberg, 2005). *Non-response bias* occurs when the statistics computed from respondent data differ systematically from those based on the entire sample data.

Quality Control Procedures for Unit Non-responses

The measurement of non-response bias is the function of the non-response rate and the difference between the respondent and non-respondent estimates (Biemer & Lyberg, 2003). As the non-response rate is the proportion of eligible survey recipients who did not respond to the survey, it can be calculated from the response rate. As such, a quality survey data set is characterized by a reasonable response rate and insignificant difference between respondents and non-respondents with regard to the characteristics of interest to the survey.

The response rate can be calculated in two ways: one is I/(I+R+NC+O-IN) (I: completed questionnaires; R: refusals; NC=non-contacts; O: others (e.g., those who cannot understand due to language problems); IN: ineligible respondents); the other is simply I/(S-IN) (I: completed questionnaires; S: survey recipients; IN: ineligible respondents).

Three methods can be used to assess the difference between respondents and non-respondents. First, assess the degree to which non-respondents will interact with the topics or issues of the survey. Usually, those who are highly involved with the topic of the survey are more likely to respond than those who are not and those who have neutral opinions about the topic or have less experience are more likely to discard the questionnaire (Alreck & Settle, 1985). For example, when an institution is conducting a survey targeting at its current students to find out how they have used its library services, it is important for the researcher to bear in mind that the obtained responses will over-represent the characteristics of those actual library users as those who have used the library services are more likely to respond to the survey. Therefore, it is erroneous to use the data to draw a conclusion about the library use pattern of all current students. Second, compare survey respondents' demographic characteristics with those of the sampling frame and find out whether the respondents under-represent some sub-groups in the sampling frame and whether members of the under-represented groups tend to answer some of the substantive survey questions somewhat differently than others (Czaja & Blair, 2005). Third, examine the characteristics of the late respondents. Those who respond to the very last follow-ups may have similar characteristics to people who never respond, and hence, the responses from late respondents can be used to infer what the non-respondents' would have answered (Suskie, 1996).

Quality Control Procedures for Item Non-response

Similar to the unit non-response error, item non-response error is a function of the item non-response rate and the difference between item respondents and non-respondents. Item non-response results in missing data. Hence, the characteristics of a quality survey data set at the question item level are two: a reasonable proportion of missing data for responses to each question, and an insignificant difference between respondents and non-respondents to each question item.

Investigation into missing data and the difference between item respondents and non-respondents involves item non-response analysis. A relatively large proportion of missing data for question items should be reported as a red flag for further investigation. Item non-response analysis involves examining (a) whether non-response occurrence is related to certain demographic characteristics of the respondents, or in other words, whether a particular group of respondents tends to fall short of substantial responses than others, and (b) whether the non-responses to various question items are related.

Item non-response analysis can be conducted in three ways: (a) calculate the proportion of missing data for each question; (b) decide the characteristics of missing data: missing completely at random, missing at random, or missing not at random (Allison, 2002); (c) investigate the variables with a large proportion of missing data.

Quality Assurance Procedures for Non-responses

Quality assurance procedures are derived from three types of unit non-response: non-contacts (failure to reach the survey recipients), refusals (recipients' decline of the survey request), and recipients' inability to participate (Groves et al., 2004). The third situation also applies to item non-response. Survey non-response has been increasing and much of the non-response is due to rising rates of refusals. A particular problem for institutional research survey projects is multiple surveys of students and the resulting survey fatigue (Porter, Whitcomb, & Weitzer, 2004).

The reasons for non-responses can be social (e.g., survey fatigue) or demographically related (e.g., male students may be less likely to respond to a survey request), and can be related to questionnaire design and survey administration. The factors related to survey design are more controllable than social or personal factors.

Various techniques can be used to reduce the three types of non-response from survey design points of view (Czaja & Blair, 2005; Groves et al., 2004; Porter ,2004). Examples for reducing non-contacts are to obtain accurate contact information of the sampled recipients, and avoiding having one's invitation to the survey marked as spam when using web surveys. Effective methods to combat refusals are notification about the survey prior to its launch, courteous initial contact messages (letter or email), the manner of requesting participation (e.g., the tone of the request, the signature, salience, and ensured confidentiality), a reasonable number of reminders, and appropriate timing of data collection, and the use of incentives. To help with the ability to participate, the survey instrument should be in reasonable length, be easy to read, ask for relevant, available, or accessible information rather than inestimable information (Groves et al., 2004).

2.5 Quality Inspection for Post-survey Error.

Post-survey error refers to all the errors that occur in the data processing process after the survey data are collected. Reliable findings and valid conclusions rely on correct data processing procedures for both individual data and aggregate data. Literature on error control is small relative to other types of survey errors and data processing is considered as a neglected error source in survey research (Biemer & Lyberg, 2003).

Quality Assurance Procedures

Various data processing activities after data collection can be organized into three types of procedure: data cleaning, data adjustment, and data analysis. Data cleaning involves inspecting accuracy of data entry and checking for outliers. Data adjustment involves considerations of using weights, handling missing data, or creating composite variables. Data analysis involves inspecting assumptions, choosing appropriate statistical techniques, and conducting statistical computing. When open-ended questions are used, coding is required. Inspecting weaknesses in coding structure and coder variance are two quality control procedures for coding (Groves et al., 2004). While numerous resources on statistics and survey methodology are available to address how to correctly and appropriately implement each of these procedures, quality control seems to rely, to a large extent, on the expertise of individual researchers.

3. Implications

The survey data quality strategy presented in this paper has two practical implications for institutional researchers.

First, survey data quality requires the use of multiple indicators. Survey data quality is multi-dimensional. This means that relying on one single indicator to evaluate survey data is a misleading practice. An example for this is the myth about the response rate. Institutional researchers sometimes hear such comments from information users as “With such a low response rate, the survey results are problematic” and “The response rate of the survey is high so the sample represents the population well”.

The survey data quality strategy (see Table 2) suggests that a reasonably high response rate is simply one of the indicators for quality data though a very important one. In other words, difference between responses and non-responses needs to be considered when the researcher assesses the unit non-response error; and quality indictors derived from other types of survey error (e.g., sample representativeness) need to be included in the evaluation. Also, the response rate does not speak to the representativeness of survey responses, which is a separate indicator for non-response bias. Therefore, a relatively high response rate *reduces* the risk of non-response bias; however, this single indicator does not necessarily lead to the conclusion that the survey data have low non-response bias if the non-respondents are very distinctive on the survey variable (Groves et al., 2004). As such, the strategy helps debunk some myths about survey data quality and encourages researchers to examine other quality indicators in addition to the response rate.

Secondly, it is important to document survey data quality. The survey data quality strategy lends more importance to quality documentation. The strategy proceeds from types of survey error based on the theory of total survey error, and consists of quality measures for each type of survey error, and quality control and quality assurance procedures that address each of the quality measures. What is contained in Table 2 is, as a matter of fact, a variety of ways for deriving evidence for survey data quality and the procedures for collecting the evidence. Therefore, in the final analysis, the task of an institutional researcher is to collect evidence regarding various characteristics of the obtained survey data to convince information users that the survey data that have been collected are good for certain conclusions. The more evidence is identified and presented, the greater trust will be gained from the information users. This evidence collection process requires documentation.

The information about the identified evidence relating to survey data quality is called “metadata” (i.e., data about data). Four types of metadata can be used to document survey data quality (Groves et al., 2004): definitional (investigated constructs, target population, sampling frame, coding terminology), procedural (data collection procedures), operational (data cleaning, data adjustment and data analysis procedures), and systems (data set format, file location, retrieval protocol, codebook).

In an institutional research project report, a detailed description of the methodology employed in the study usually is provided in an appendix (Bers & Seybert, 1999). The appendix is a good place in a survey report to document the evidence for survey data quality. A psychometric portfolio is also recommended for reporting evidence (Gonyea et al., 2010).

The purpose of documentation is to communicate the characteristics of the survey data set and the procedures by which to obtain quality indicators, if there is any, so as to build and enhance trust among information users in survey findings and help them interpret the findings in an appropriate way. On the basis of the elements in the survey data quality strategy in Table 2, I have developed a checklist (see the Appendix) for institutional researchers to facilitate their documentation efforts.

4. Concluding Thoughts

This paper presents a survey data quality strategy in light of the theory of total survey error for the purpose of institutional research that is conducted in higher education institutions. The strategy consists of indicators of quality data (quality measures), and procedures to inspect the survey data and the survey process (quality control and quality assurance procedures). The strategy is summarized in Table 2 and elaborated in Section 2 of this paper, with an attached checklist for institutional researchers.

Here are two final thoughts about survey data quality issues.

The first thought is related to how “survey data quality” fits in “survey quality”. *Survey quality* is recognized as a three-level concept (Lyberg & Biemer, 2008). The three levels are product quality (i.e., “the set of product characteristics ideally established with the main users”), process quality (i.e., “a well-designed and tightly-controlled process”), and organizational quality (i.e., “reliable organizational characteristics to ensure that the organization is capable to develop dependable processes that can deliver quality products”) (p. 428). The three levels are interdependent: organizational quality is required for process quality and process quality is required for product quality. All the three levels contribute to quality decision-making.

Survey data quality is actually part of the product quality of a survey and “is achieved through process quality” (Biemer & Lyberg, 2003, p. 24). The survey data quality strategy mainly addresses two out of the three levels of survey quality: the product quality and the process quality. Organization quality is more concerned with organizational culture and information management, and involves information infrastructure for quality survey data. It is not being addressed in the strategy presented in this paper.

The second thought is related to how survey data quality stands in the information support cycle in institutional research. When the survey data quality strategy proposed in this paper fits into the information support cycle (McLaughlin & Howard, 2004) (see Figure 1), the institutional researcher actually takes the bulk of responsibilities in this cycle – the responsibilities of both the Custodian and the Broker, and implements the larger proportion of the information support cycle – from identifying concepts to delivering a report, while working with the Manager. In contrast, when administrative data are used, the institutional researcher usually does not get involved as much in the stages of collecting and storing data. Therefore, the role of the researcher is of greater importance in the information support cycle when a survey project is conducted. This may provide another reason for further investigation into survey data quality issues and making efforts to improve survey data quality to better fulfill the information support function of institutional research.

In the context where attention to details and quality control is recognized as a personal and professional dimension of effectiveness in institution research (Knight, 2010), it is hoped that this paper has contributed to filling in a gap in literature of survey quality control for institutional research purposes.

Figure 1. Information Support Cycle in Institutional Research

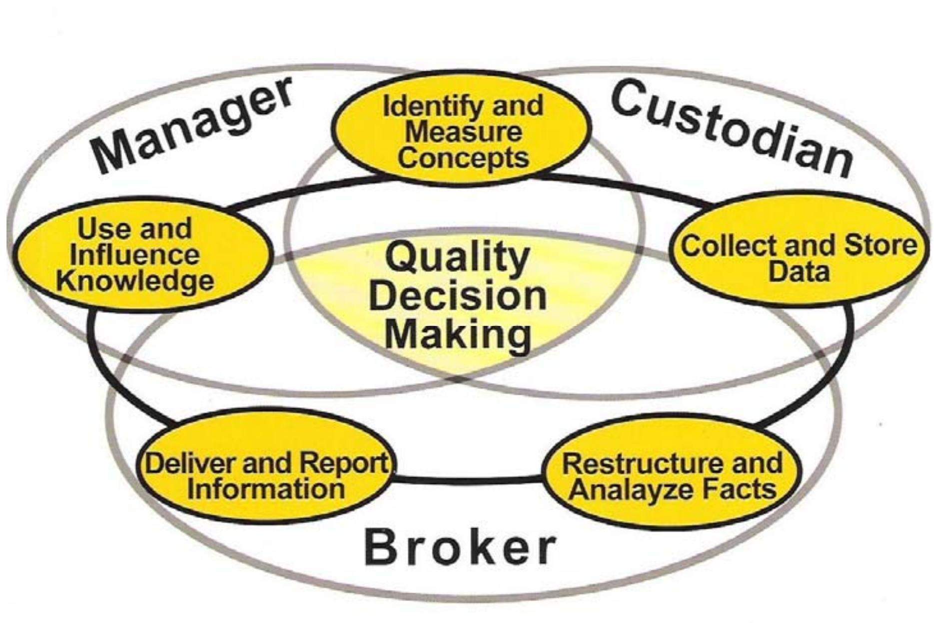

Table 1. Risk of Variable and Systematic Error by Major Error Source in the Institutional Research Context

Types of Survey Error	Risk of Variable Error	Risk of Systematic Error
Measurement error	High	High
Coverage error	Low	Low
Sampling error	High	Low
Non-response error	Low	High
Post-survey/Data processing error	High	Low

Table 2. Summary of the Major Components in the Survey Data Quality Strategy

Types of error	**Quality Measures (Indicators of Quality Data)**	**Quality Control Procedures (inspecting the survey data)**	**Quality Assurance Procedures (inspecting the survey process)**
Measurement error	1). Validity 2). Reliability; 3). Minimized response bias	1). Assess validity by checking construct validity (e.g., factor analysis), concurrent validity, and divergent validity 2). Assess reliability by checking internal consistency, split-half reliability, test-retest reliability 3). Assess response bias by o comparing survey data with data or information from sources external to the survey; o checking response tendencies	Construct a good questionnaire; Conduct cognitive interviews; Ensure adequate respondent behavior; Ensure adequate interviewer behavior (if interviewer-administered)
Coverage error	Minimized discrepancy between the sampling frame and the target population	Check whether there exist undercoverage, ineligible units, or duplications in the sampling frame; Compare the specifications of the target population and the corresponding parameters of the sampling frame	Develop a working definition and clearly defined specifications of the target population; Locate a readily available list that includes as many elements of the target population as possible
Sampling error	1). Sample representativeness 2). Reasonable margin of error	1). Compare the distributions of obtained sample with those of the sampling frame by certain demographic characteristics; 2). Make sure the margin of error is below 5% for expected number of respondents at the 95% confidence level	Appropriate implementation of sampling procedure; Calculate a reasonable sample size based on the size of the sampling frame, the expected margin of error, data breakdown for analysis, the anticipated response rate, and the resources available for the survey

Table 2. (Cont'd)

Types of error	Quality Measures	Quality Control Procedures	Quality Assurance Procedures
Non-response error	At the unit level: 1). A reasonable response rate; 2). Insignificant difference between respondents and non-respondents	1). Calculate the response rate: Response rate= I/(I+R+NC+O-IN) or I/(S-IN) 2). Assess the difference between the respondents and the non-respondents by: o Assess the level of interactions of non-response with the topics; o Compare survey respondents' demographic characteristics with those of the sampling frame; o Examine the characteristics of the late respondents.	Use techniques in the process of questionnaire design and survey administration to combat: o Non-contacts: o Refusal: o Inability to participate:
	At the item level: 1). A reasonable proportion of missing data in responses to each question 2). Insignificant difference between respondents and non-respondents to each question	Do item non-response analysis by 1). Calculating the proportion of missing data for each question 2). Deciding whether the data are missing completely at random 3). Investigating the variables with a large proportion of missing data	
Post-survey error	Correctness in processing individual cases and aggregate data	Rely more on expertise of individual researchers	Carefully perform the procedures of o Data cleaning o Data adjustment o Data analysis

Table 3. An Example of Determining the Sample Size

Expected number of respondents	Margin of Error (95% confidence level)	Anticipated Response Rate	Sample Size
300	5.57%	20%	1500
400	4.80%	20%	2000
500	4.27%	20%	2500
600	3.88%	20%	3000
700	3.57%	20%	3500
800	3.32%	20%	4000
900	3.12%	20%	4500

Note: The sampling frame is 10,000 students.

Appendix: A Checklist for Inspecting Survey Data Quality

Questions to detect measurement error:

❑ Is there any evidence that shows the reliability of the survey instrument?
❑ Is there any evidence that shows the validity of the inference?
❑ Is there any pattern or tendency in the responses? Are there any cases where the same answer was given to all the question items?

Questions to detect coverage error:

❑ Were the specifications of the target population clearly defined? Did the parameters of the sampling frame correspond with the specifications of the target population?
❑ Were there any undercoverage, ineligible units or duplications in the sampling frame?

Questions to detect sampling error:

❑ Was the sample size reasonable? (How many respondents did you expect to get? What margin of error was expected? What response rate was anticipated?)
❑ What sampling method was used? Was the method appropriate? Did you give equal chance of selection? For which subgroups did you give unequal chance of selection (if using stratification)?
❑ With the number of the respondents and the total target population, what was the margin of error? Was the obtained margin of error reasonable?

Questions to detect non-response error:

❑ Was the response rate reasonable?
❑ Considering the topic of the survey, who may have been more likely to respond to the survey and who may have been less likely to respond?
❑ How did the profile of the respondents compare with that of the target population (or sampling frame) by certain demographic characteristics (e.g., campus, program type, credential, gender, age, etc.)?
❑ How were key subgroups represented in the respondents?
❑ In what questions did you have a relatively large proportion of missing data? Why was it? Did you report the missing data?

Questions to detect post-survey error:

❑ Did you treat data with non-response bias as representing the characteristics of the total population?
❑ How were the data cleaned? Was the procedure appropriate?
❑ How were the data coded? Was the procedure appropriate?
❑ How were the data weighted? (if applicable) Was the method correct?
❑ How were the data imputed? (if applicable) Was the method appropriate?
❑ What statistical techniques were used? Had the assumptions been inspected? Were the statistical procedures properly implemented?

References:

Allison, P. D. (2002). *Missing data.* CA, Thousand Oaks: Sage Publications.

Alreck, P. L., & Settle, R. S. (1985). *The survey research handbook*. Homewood, IL: Richard D. Irwin, Inc.

Anderson, D. K., Milner, B. J., & Foley, C. J. (2008). From complex data to actionable information: Institutional research supporting enrollment management. *New Directions for Institutional Research, 137,* 71-82.

Bailar, B. A., Herriot, R. A., & Passel, J. S. (1982). The quality of federal censuses and survey data. *Review of Public Data Use, 10,* 203-218.

Bers, T. H., & Seybert, J. A. (1999). *Effective reporting*. Tallahassee, FL: The Association for Institutional Research.

Biemer, P. P., & Lyberg, L. E. (2003). *Introduction to survey quality*. Hoboken, NJ: John Wiley & Sons, Inc.

Borden, V., Massa, T., & Milam, J. (2001). Technology and tools for institutional Research. In R. D. Howard (Ed.), *Institutional Research: Decision Support in Higher Education* (pp. 201-209).Tallahassee, FL: Association for Institutional Research.

Couper, M. P. (2000). Web surveys: A review of issues and approaches. *Public Opinion Quarterly, 64,* 464-494.

Croninger, R. G., & Douglas, K. M. (2005). Missing data and institutional research. *New Directions for Institutional Research, 127,* 33-50.

Czaja, R., & Blair, J. (2005). *Designing surveys: A guide to decisions and procedures.* Thousand Oaks, CA: Sage Publications.

Fincher, C. (1985). The art and science of institutional research. *New Directions for Institutional Research, 46,* 17-37.

Gonyea, R. M. (2005). Self-reported data in institutional research: Review and Recommendations. *New Directions for Institutional Research, 127,* 73-89.

Groves, R. M., Fowler, F. J., Couper, Jr. M. P., Lepkowski, J. M., Singer, E., & Tourangeau, R. (2004). *Survey methodology.* Hoboken, NJ: Wiley-Interscience.

Gonyea, R., Korkmaz, A., BrckaLorenz, A., & Miller, A. (2010). *Building a psychometric portfolio: Evidence for reliability, validity, and other quality indicators in survey data collection.* Paper presented at the forum of the Association for Institutional Research, Chicago, IL.

Knight, W. (2010). In their own words: Effectiveness in institutional Research. *AIR Professional File, 115*.

Leimer, C. (2009). Taking a broader view: Using institutional research's natural qualities for transformation. *New Directions for Institutional Research, 143,* 85-93.

Looseveldt, G, Carton, A., & Billiet, J. (2004). Assessment of survey data quality: A pragmatic approach focused on interview Tasks. *International Journal of Market Research, 46,* 65-82.

Lyberg, L. E., & Biemer, P. P. (2008). Quality assurance and quality control in surveys. In E. D. de Leeuw, J. J. Hox, & D. A. Dillman (Eds.), *International handbook of survey methodology* (pp. 421-441). New York, NY: Lawrence Erlbaum Associates.

McLaughlin, G. W., & Howard, R. D. (2004). *People, processes, and managing data.* Tallahassee, FL: Association for Institutional Research.

Middaugh, M. F., Trusheim, D. W., & Bauer, K. W. (1994). *Strategies for the practice of institutional research: Concepts, resources, and applications.* Tallahassee, FL: Association for Institutional Research.

Morest, V. S. (2009). Accountability, accreditation, and continuous improvement: Building a culture of evidence. *New Directions for Institutional Research, 143,* 17-27.

Porter, S. R. (2004). Raising response rates: What works? *New Directions for Institutional Research, 121,* 5-21.

Porter, S. R., Whitcomb, M. E., & Weitzer, W. H. (2004). Multiple surveys of students and survey fatigue. *New Directions for Institutional Research, 121,* 63-73.

Presser, S., Couper, M. P., Lessler, J. T., Martin, E., Martin, J., Rothgeb, J. M., & Singer, E. (2004). Methods for testing and evaluating survey questions. *Public Opinion Quarterly, 68,* 109-130.

Sanchez, M. E. (1992). Effects of questionnaire design on the quality of survey data. *Public Opinion Quarterly, 56,* 206-217.

Saupe, J. L. (1990). *The functions of institutional research.* Tallahassee, FL: Association for Institutional Research.

Suskie, L. A. (1996). *Questionnaire survey research: What works.* Tallahassee, FL: Association for Institutional Research.

Swing, R. L. (2009). Institutional researchers as change agents. *New Directions for Institutional Research, 143,* 5-16.

Thomas, S. L, Heck, R. H., & Bauer, K. W. (2005). Weighing and adjusting for design effects in secondary data analyses. *New Directions for Institutional Research, 127,* 51-72.

Terenzini, P. T. (1993). On the nature of institutional research and the knowledge and skills it requires. *Research in Higher Education, 34(*1), 1-10.

Tourangeau, R., Rips, L. J., & Rasinski, K. (2000). *The psychology of survey response.* Cambridge: Cambridge University Press.

Weisberg, H. F. (2005). *The total survey error approach: A guide to the new science of survey research*. Chicago, IL: University of Chicago Press.