

A DYNAMIC TECHNIQUE FOR CONDUCTING ONLINE SURVEY-BASED RESEARCH

by Robert J. Bonometti and Jun Tang

EXECUTIVE SUMMARY

Business research often requires use of survey-based techniques for data acquisition. In the past, researchers had to rely on manual methodologies for survey distribution, data entry, and analysis. These approaches were generally characterized by uncertain (often low) response rates; batch processing of collected data; protracted time periods spanning survey distribution to processed statistical results; and inability to make “mid-course corrections.” These deficiencies are exacerbated for research on global competitiveness issues which requires international data gathering activities; however, they can be mitigated, if not completely eliminated, by the use of dynamic web-based survey methods. This paper discusses the advantages of web-based survey technologies with direct back-end database interfaces and analytical frameworks, and presents illustrative results from development and use of such a tool.

INTRODUCTION AND PROBLEM ELUCIDATION

Business research often involves gathering of empirical data from various sources, including firms in a targeted industry study, governmental agencies that regulate particular industries, and other organizations. In many research programs, the preferred instrument for data collection is a survey-based assessment tool. The protocol for conduct of the survey generally involves several stages, including:

- Design of the survey questionnaire itself
- Determination of appropriate targeted organizations to contact and request completion of the data collection survey
- Selection of a suitable survey marketing and distribution methodology, based on factors that include anticipated response rate, cost of distribution and subsequent collection of results, timeliness of the data collection process, etc.
- Collection of results submitted by respondents, and
- Analysis of the collected data, generally by statistical techniques.

Our focus in this paper’s discussion is an approach that can significantly improve the efficacy, timeliness, and efficiency of the last three stages, namely marketing and distribution, collection, and analysis of the survey instrument.

A number of methodologies are currently available to researchers today for marketing, distribution, collection, and analysis of survey instruments. Table 1 summarizes these different approaches and presents advantages and limitations associated with each one. As can be quickly surmised from this table, none of the traditional methodologies achieves high performance in all four areas of marketing, distribution, collection, and analysis.

The central thesis of this paper is that a new alternative methodology has emerged that offers the prospect of superior performance in all four areas. This new alternative is enabled by several recent technology advances, including the global availability of Internet connectivity, interactive web page technologies, and the direct integration of front-end web-based data collection instruments with back-end databases and analytical engines. The upshot is a faster, better, and cheaper approach to the collection and analysis of data for business research studies. In particular, the advantages of faster speed, lower costs, and expectation for higher response rates are accentuated for studies on global competitiveness issues that necessarily require survey marketing, distribution, and collection of data from multiple international sources.

DESCRIPTION OF A NEW METHODOLOGY

Interactive form-oriented web pages provide a highly available platform for survey-based research data collection. Using standard web form components such as check boxes, option buttons, and text entry boxes enables the researcher to develop a comprehensive survey instrument with a user-friendly web-browser interface that respondents will be able to quickly and easily complete. Direct integration of submitted responses into a web-server hosted database enables immediate accumulation of survey results that can then be automatically processed to display up-to-the-minute snapshots of the progress being made over time.

TABLE 1

Descriptions, Advantages & Limitations of Traditional Methodologies for Survey Marketing, Distribution, Collection & Analysis

Methodology	Description	Survey Marketing	Survey Distribution	Data Collection	Analysis
Physical Hard-copy	Paper-based survey instrument distributed at a conference or industry event	Comments: Ads, announcements, posters, etc must be used at the event Advantages: Relatively low marketing costs Limitations: Limited to event attendees; researcher(s) must attend event	Comments: Interested parties acquire and complete survey Advantages: Just incur reproduction costs; low ratio of non-submitted forms to total forms Limitations: Limited to attendees	Comments: Manual collection of forms Advantages: Can ramp up marketing effort at event if response rate is initially low Limitations: Data must be manually transcribed & entered in analysis software package	Comments: Manual, non-real-time
Kiosk Terminal	Electronic survey on a computer terminal available at a conference or trade show	Comments: Ads, announcements, posters, etc must be used at the event Advantages: Relatively low marketing costs Limitations: Limited to event attendees; researcher(s) must attend event	Comments: Interested parties visit kiosk to complete survey Advantages: Very low distribution costs but researcher(s) must attend Limitations: Limited to attendees; may need multiple kiosk terminals	Comments: Best approach has data automatically posted to a database for later analysis Advantages: Data may be automatically posted to database for analysis Limitations: Number of simultaneous survey acquisitions limited to # of kiosks used	Comments: Can support real-time analysis
Postal Mail	Mail paper survey instrument to potential takers	Comments: Marketing and distribution are combined Advantages: Respondent gets a hard-copy of the survey Limitations: Relatively expensive with often poor response rates		Comments: Via return postal mail Limitations: Relatively slow (“snail mail”) process; must manually enter into database	Comments: Manual, non-real-time
Facsimile	Fax’ed survey form manually completed and Fax’ed back	Comments: Marketing and distribution are combined Advantages: Respondent gets a hard-copy of the survey; Confirmation via Fax receipt Limitations: Relatively expensive with often poor response rates		Comments: Via return Fax Limitations: Respondent may avoid long distance return Fax; overall relatively slow (faster than postal); data manually entered	Comments: Manual, non-real-time
Telephone	Verbally administered survey via phone	Comments: Marketing and distribution are combined Advantages: May be able to persuade respondent to participate Limitations: Expensive & time consuming for the researcher		Comments: Slow, tedious, manual process Advantages: Real-time clarification Limitations: Expensive, time consuming, data must be manually entered into database	Comments: Manual, non-real-time
Electronic Mail	Embed survey in E-mail body or attachment, respondent completes and E-mails back	Comments: Marketing and distribution are combined Advantages: Relatively fast and relatively low-cost Limitations: Bulky (large) e-mail messages; Respondent may ignore (misinterpreted as “junk mail” or spam)		Comments: Respondent can complete survey when time permits Advantages: Asynchronous completion; researcher may use an application or program to transfer responses into database Limitations: Loads down researchers e-mail client and mail server	Comments: Researcher may utilize automatic real-time analysis or manual non-real-time

Web Site Form (not DataBase Connected)	Interactive form on a web site (but not using database connectivity)	Comments: Requires separate marketing (direct postal mail or e-mail) Advantages: Relatively fast; low-cost Limitations: Respondents may not act on marketing “tickler” and actually visit the web site to complete survey	Comments: Interactive web form Advantages: Fast and low-cost Limitations: Distribution ineffective if respondent doesn’t act on marketing “tickler” and actually visit web site to complete survey	Comments: Web form is not directly and automatically linked to survey database Advantages: Familiar browser interface Limitations: Intermediary steps required to post survey responses to database	Comments: Automatic real-time analysis or manual non-real-time
	In-Person Administered by researcher at respondent’s office or at a conference	Comments: Requires successful marketing interaction before appointment Limitations: Requires prior arrangements via e-mail or postal mail; very expensive	Comments: Manual distribution Advantages: Researcher can interact w/ respondent in real-time Limitations: Extremely costly and demanding on researcher’s time	Comments: Manual Advantages: Researcher can ask for clarification or provide detailed explanation in real-time Limitations: Very slow and very expensive	Comments: Manual, non-real-time

TABLE 2

Description and Advantages of a Best-Practices Methodology for Survey Marketing, Distribution, Collection, and Analysis

Methodology	Overall Description	Survey Marketing	Survey Distribution	Data Collection	Data Analysis
Integrated All-Electronic Survey Technique	E-mail marketed form-oriented web site with automatic direct integration of submitted responses into a web-server hosted database, coupled to an analytical engine for statistical analysis and presentation of up-to-the-minute database content	Comments: Short, efficient E-mail marketing “tickler” with embedded hyperlink to survey web site Advantages: Very low marketing costs; hyperlink to web site makes access fast and easy and thus motivates respondent to participate	Comments: Web-based Advantages: Very low cost; fast and efficient	Comments: Direct web-database connectivity Advantages: Fully automated posting of responses to database; fast and efficient	Comments: Automatic real-time analysis Advantages: Researcher has continuous insight as survey results are accumulated; facilitates “mid-course” corrections in survey instrument if necessary

Marketing the survey is efficiently and easily accomplished by electronic mail notifications. Marketing via e-mail offers several distinct advantages, including:

- One-click linking to the web-based survey instrument directly from a hyperlink embedded in the body of the e-mail message itself, which enhances the likelihood that a notification recipient will actually complete the survey instrument itself
- Fast and easy secondary distributions to other potential respondents based on a limited list of by-name addressees, with an appropriate request in the message for forwarding to other members of the addressees organization or industry group
- Extremely low-cost basis for marketing and distributing the survey instrument.

Of course, other modes such as direct (postal) mailings, advertisements or flyers distributed at conferences and professional meetings, faxes, etc. may also supplement the e-mail solicitations to generate awareness and understanding of the research study among targeted respondents, and to promote their participation in the data collection effort.

We consider the approach discussed in this paper to be a best-practices methodology because it categorically outperforms all other modalities in the four areas of survey marketing, distribution, collection, and analysis, and it offers distinctive advantageous features which the other approaches can not match. Table 2 presents a summary of the characteristics for this approach.

To illustrate the methodology discussed here, we present a case study based on a recent data collection effort for a sponsored research project. Ample “how-to” comments are provided so that other researchers may follow our approach, investigate its utility for their own research agendas, and experiment with modifications to the approach that we used. The work reported here was performed under a grant (Award Number ELC-01-015) from the Virginia Center for Innovative Technology (CIT) that provided partial funding for the conduct of a feasibility study related to development of a Technology Innovation Center in the domain of strategic decision support. The Feasibility Study involved a twelve month (later extended to 15 months) program that would address and analyze all issues related to establishment of the proposed Strategic Decision Support – Technology Innovation Center (SDS-TIC) at our University, including the following specific tasks:

- Establish the rationale for the proposed center by documenting interests, needs and requirements of Virginia companies in this arena

- Determine the nature and frequency of education and training programs that industry desires from the Center
- Establish working relationships with potential partners in industry and academia that would complement the resources and competencies resident at our institution
- Develop and deliver four prototype executive mini-courses in the area of strategic decision support technologies and methodologies
- Develop a detailed operational plan for the Center, including source and uses of all funds required
- Identify additional potential funding contributors to the SDS-TIC.

Given that current and emerging technological capabilities are enabling coherently integrated strategic frameworks for business analysis, strategy development, and resource allocation, our project team believed that the proposed SDS-TIC would have high impact and significant payoffs for the Virginia business community, especially the high technology sectors. The web-based survey instrument that we developed was aimed principally at accomplishing the first two objectives in the above list of project tasks. The following section describes this work.

A REPRESENTATIVE WEB-BASED SURVEY INSTRUMENT

There are various technologies and approaches to creating a database integrated web-based survey instrument. The methodology that we used, and that is described here, derives from Microsoft’s ActiveX Data Objects, or ADO, technology. We utilized back-end software based on Microsoft’s Office Suite of products: Access for the database management system, Excel for data analysis and plotting, and Powerpoint for presentation of the results. A number of good references are available for those interested in exploring other technologies and/or in understanding the details of realtime web form –to- database connectivity, including resources that we have cited in our References section of this paper. *Mammino* presents a good summary of web-database connectivity approaches. Recent versions of various software applications have made web-database connectivity more user-friendly to implement; see, for example, the discussion of FrontPage 2002 wizards for dynamic database interactivity in *Cockburn and Zucker*.

FIGURE 1

Screen Shot Showing Representative Survey Questions from Our HTML Form

Survey of Virginia Companies

- What industry group best characterizes your company? [Select only one]**
- Your company's operations are based: [Select only one]**
 - ☐ at one location in Virginia
 - ☐ at multiple locations in Virginia
 - ☐ at multiple locations across the US including one or more locations in Virginia
 - ☐ at multiple locations across the US but with no locations in Virginia
- Your company does business with customers: [Select only one]**
 - ☐ exclusively within Virginia
 - ☐ regionally
 - ☐ throughout the United States
 - ☐ internationally
- Your company's annual gross sales: [Select only one]**
- Number of employees: [Select only one in each row]**

In your entire company	less than 20
At your location	less than 20
- Your role in the company: [Select only one]**

WebMaster Dr. Bob Bonometti
Send mail to rbonomet@su.edu with questions or comments about this web site
Copyright © 2002, Shenandoah Center for Strategic Decision Support. All rights reserved.
Revised: 06/13/03

Although we are no longer actively collecting data for the decision support survey, the actual survey instrument that we developed and deployed is still available on the Web for those interested in exploring its entire structure. Of course, interested researchers can examine the source code behind the browser's display of the form itself, and our implementation may also serve as a template for others to develop and customize their own survey instruments. The survey is located at <http://www.su.edu/bsb/sds/survey/StdPage.htm>

We begin our tour of the system we developed at the front-end – the web based form itself. There were four basic types of question/response structures that were used:

1. Questions for which the respondent was to select one and only one of the available choices utilized option (or "radio") buttons if the number of selections was small (say half-a-dozen or less), or drop-down list boxes were used when many choices were available. An example of this form of question was an inquiry about the

respondent's position in his or her organization.

2. Questions for which the respondent was to select all of the available choices that were applicable utilized check boxes. An example of this form of question was an inquiry about different decision support frameworks which are operational in the respondent's firm.
3. More complex question/response structures were designed using option buttons and/or checkboxes in parallel or nested configurations. For example, question number 11 illustrates a nested configuration that asked about the respondent's frequency of use of his or her office computer across a set of basic office functions such as internal and external organizational communications, and personal information management (contact information, calendar, etc.). Another example that illustrates a parallel configuration of responses is seen in question number 16, which presented a large number of specific decision support technologies and asked two questions: whether the respondent's company

had the specific technology in place already as an operational capability, or whether the company would be interested in leveraging that specific technology to enhance their decision making processes.

4. Text responses were also used on the survey instrument using free-form input textboxes for purposes such as obtaining the respondent's e-mail address and asking if there were other person(s) in the respondent's organization that should be contacted with a request to complete the survey instrument.

The typical amount of time required for a respondent to complete the survey instrument was about five to ten minutes, which we considered to be both adequate to our data collection objectives and fast enough to avoid potential respondent's losing interest due to an excessive demand of their time. Figure 1 presents a screen shot showing representative survey questions from our HTML form.

Several consistency checks and form-field validations were employed to ensure that respondents properly completed the survey. For example, entry of a valid e-mail address was required in order for the respondent to be able to access and complete the survey, and code was developed to test that an entry had been made in the respective textbox and that the entry had the correct syntax for a valid e-mail address. Of course, other client-side checks could also be utilized such as requiring a response to every question item before accepting the input data for upload to the web server (we did not use such a check in our survey).

Direct connectivity of input data uploaded to our web server from a respondent's browser was of course the distinguishing feature of this approach vis-à-vis a simple web form. As noted above, various technologies and products are available to the researcher to accomplish web-database connectivity. Two of the most popular approaches are those based on Microsoft's ASP.NET technologies (formerly Active Server Pages), and Cold Fusion MX from Macromedia. We will briefly discuss some of the features of our design below.

Server-side includes were used to incorporate separate ASP files that contained the actual code for linking to the database file residing on the web server. One of the #include files (adovbs.asp) contained ActiveX Data Objects (ADO) constants for VBScript while the actual database connection was specified in the included file dsn.asp. The code to establish the database link to our Access file, survey.mdb, was:

```
strDSN="Driver={Microsoft Access Driver (*.mdb)};DBQ="
& Server.MapPath("survey.mdb")
```

```
Set objConn=
Server.CreateObject("ADODB.Connection")
objConn.Open strDSN
```

As an example of the HTML coding for a particular question, the following code fragment creates the form question number 3 which would appear in the user's browser as illustrated in Figure 1:

```
<tr>
  <td width="23" valign="top"><font face="Arial,
Helvetica, sans-serif"
  size="3"><b><font
color="#FF0000">3.</font></b></font></td>
  <td colspan="6" valign="top"><font face="Arial,
Helvetica, sans-serif"
  size="3"><b><font color="#FF0000">Your
company does business with customers: <font
color="#00FF00">[Select
only one]</font></font></b></font></td>
</tr>
<tr>
  <td width="23" valign="top">&nbsp;</td>
  <td colspan="6" valign="top"> <font face="Arial,
Helvetica, sans-serif" size="3"
  color="#000000">
    <input type="radio" name="CompanyCustomer"
value="A043">
    exclusively within Virginia</font></td>
</tr>
<tr>
  <td width="23" valign="top">&nbsp;</td>
  <td colspan="6" valign="top"> <font face="Arial,
Helvetica, sans-serif" size="3"
  color="#000000">
    <input type="radio" name="CompanyCustomer"
value="A044">
    regionally </font></td>
</tr>
<tr>
  <td width="23" valign="top">&nbsp;</td>
  <td colspan="6" valign="top"> <font face="Arial,
Helvetica, sans-serif" size="3"
  color="#000000">
    <input type="radio" name="CompanyCustomer"
value="A045">
    throughout the United States</font></td>
</tr>
<tr>
  <td width="23" valign="top">&nbsp;</td>
  <td colspan="6" valign="top"> <font face="Arial,
Helvetica, sans-serif" size="3"
  color="#000000">
    <input type="radio" name="CompanyCustomer"
value="A046">
```

internationally </td>
</tr>

Note the use of alphanumeric codes (such as “A046”) to link each response to a distinct field in our database. Actual posting of the user-entered response data to the database is accomplished via the code

```
<form name="Survey" method="post"
action="submit.asp">
```

The next element of our integrated system was the Access database that received the input data. We built 5 tables to organize the data. A question and an answer table related the item responses themselves, which were identified by an alphanumeric code as illustrated above, to the actual wording of the questions and the response choices. These tables helped organize the database and make it readable to someone other than the database designer, but they were not essential to the data collection and organization itself. A respondent table captured basic information about each respective respondent including e-mail address (required), name (optional), and a date-time stamp indicating when the input data was received by the web-server. The respondent table enabled testing for multiple survey submissions from the same respondent (which we of course did not want) and if a respondent already was logged in our database they received a message from the web-server indicating that they had previously submitted the survey, and inquiring as to whether or not the respondent wanted to cancel the prior entry and re-take the survey in its entirety. The fifth table was the heart of our data collection database. This Result table recorded the response to every item in the questionnaire. Each row of this table corresponded to a unique respondent, identified by a key field based on e-mail address. The columns of the table corresponded to every response item in the survey. For questions that presented a list of choices to the respondent we used a simple logic value to indicate whether a specific item had been selected or not (“0” indicated “not selected” and “1” indicated “selected”). The total number of columns was 251. All of the text entry responses that we employed related to respondent identification or suggested referrals, so our particular Results table did not require text data elements except for the respondent’s e-mail address (but they can certainly be used for surveys that require free-form text responses to some questions). Figure 2 presents the format of the Results table (actual respondent e-addresses have been replaced with dummy addresses, only a few records are shown for illustration purposes, and we show just a subset of the 251 columns required for the entire database).

We chose to use an Excel workbook for data analysis and graphing since the requisite tools were readily available and importing the Access data into Excel was a straightforward application of OLE (Microsoft’s object linking and embedding) technology. The Excel workbook’s first worksheet simply captured the raw data from the Access database and provided full text annotations of the respective survey questions and answers (to aid human interpretation and analysis). To screen out submitted surveys that were blank we used a simple row sum check and eliminated blank submissions from further consideration (this of course could also be done at the front-end browser checks before data is uploaded but we did not implement that approach). We used separate worksheets to aggregate responses for each question and plot the results. Figure 3 illustrates one such worksheet (using a subset of all the survey responses received).

Incorporation of the resulting plots into a presentation format was easily achieved using OLE linking between Powerpoint slides and the Excel plots. Use of links made updating automatic and we had an ongoing assessment of survey results as data were accumulated over a number of weeks on our web site.

SUMMARY

This paper has discussed a new approach for the conduct of surveys to collect business research data. The advantages of web-based survey technologies with direct database interfaces were compared with traditional methodologies such as in-person interviews, mailed survey instruments, and others. The proposed best practice methodology mitigates, if not completely eliminates, the deficiencies of the more traditional methods such as uncertain (and often low) response rates; batch processing of collected data; protracted time periods spanning survey distribution to processed statistical results; and the inability to make “mid-course corrections” to survey marketing and the survey instrument itself in real-time as results are accumulated. All of these deficiencies are exacerbated for research in global competitiveness issues which requires international data gathering activities. We presented illustrative results from the development and use of a database integrated web-based survey instrument developed and used in one of our grant-sponsored research efforts.

FIGURE 2

Format of Result Table in Access

Microsoft Access

File Edit View Insert Format Records Tools Window Help

Type a question for help

tblResult : Table

Email	A069	A070	A071	A072	A073	A074	A075	A076	A077	A078	A079	A080	A081	A082	A083	A084	A085	A086	A087	A088	A089	A090	A091
Test1@univ.edu	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
Test2@univ.edu	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0
Test3@univ.edu	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Test4@univ.edu	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0
Test5@univ.edu	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Test6@univ.edu	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0
Test7@univ.edu	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
Test8@univ.edu	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Test9@univ.edu	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
Test10@univ.edu	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
Test11@univ.edu	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0
Test12@univ.edu	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0
Test13@univ.edu	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0
Test14@univ.edu	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Test15@univ.edu	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Test16@univ.edu	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0
Test17@univ.edu	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0
Test18@univ.edu	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1
Test19@univ.edu	0	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Test20@univ.edu	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0

Record: 20 of 20

tblAnswer : Table

AnswerID	Answer	AnswerType	QuestionID
69	Senior Executive (CEO, COO, Owner/Partner/ Corporate Presic	Radio	6
70	Executive Manager (Group/Line-of-Business President, CFO, C	Radio	6
71	Vice President/Executive Director/Director	Radio	6
72	Senior Manager/Senior Member of Technical Staff	Radio	6
73	Business Staff Professional (Strategic Planning, Finance, Accou	Radio	6
74	Junior Management/Technical Staff Professional	Radio	6
75	less than 1 year	Radio	7
76	1 to 2 years	Radio	7
77	2 to 3 years	Radio	7
78	3 to 5 years	Radio	7
79	5 to 10 years	Radio	7
80	10 to 20 years	Radio	7
81	more than 20 years	Radio	7
82	High School graduate	Radio	8
83	College graduate	Radio	8

tblQuestion : Table

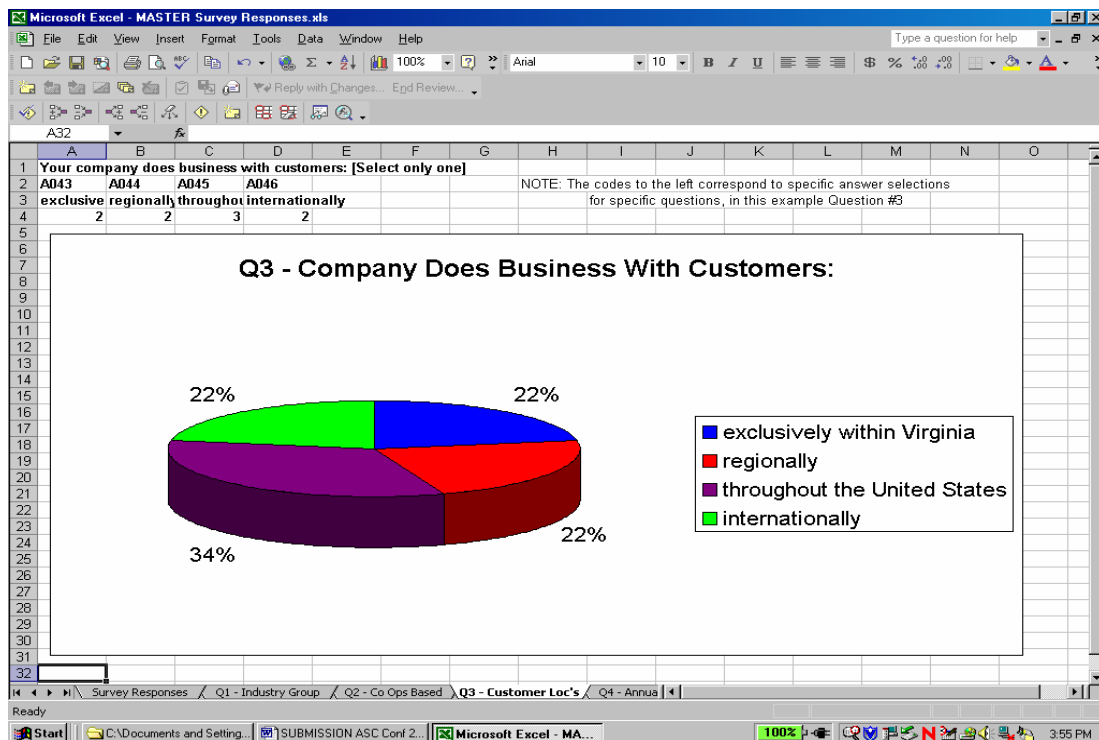
QuestionID	Question	Que
1	What industry group best characterizes your company?	Single
2	Your company's operations are base:	Single
3	Your company does business with customers:	Single
4	Your company's annual gross sales:	Single
5	Number of employees:	MultipleEmr
6	Your role in the company:	Single
7	Number of years you have been with your current company:	Single
8	Your highest level of education:	Single
9	Your age bracket:	Single
10	What do you regard as the most important use of your personal comp	Single
11	How often do you use your computer for:	Multiple
12	How familiar are you with decision support technologies and systems?	Single
13	Are you interested in using decision support technologies and/or syste	Single
14	Does your company currently utilize decision support technologies and	Single
15	What type of decision support infrastructure does your company curre	Multiple

Datasheet View

Start C:\Document... SUBMISSION... B2 : Datas... tblResult : ... tblAnswer : T... tblQuestion : ... 100% 5:48 PM

FIGURE 3

Representative Worksheet for a Particular Survey Question



REFERENCES

- Bai, Xue et. al. (2003). *The web warrior guide to web programming*. Boston: Course Technology.
- Buyens, J. (2002). *Web database development*. Redmond: Microsoft Press.
- Cockburn, J., & Zucker, W. (Eds). (2001). *Microsoft FrontPage version 2002*. Redmond: Microsoft Press.
- Kalata, K. (2002). *Introduction to ASP.NET*. Boston: Course Technology.
- Mannino, M. V. (2004). *Database design, application development, and administration*. Boston: McGraw-Hill Irwin.
- Morrison, M. & Morrison, J. (2000). *Database-driven web sites*. Cambridge: Course Technology.
- Rob, P. & Semaan, E. (2004). *Databases design, development and deployment using Microsoft Access*. Boston: McGraw-Hill Irwin.

Robert J. Bonometti is Byrd Professor of Information Systems and Computer Technology in the Harry F. Byrd Jr. School of Business at Shenandoah University in Winchester, Virginia.

Jun Tang is the Chief Technology Officer of Advanced Legal Technologies LLC in Stephenson, Virginia.

Copyright of *Competitiveness Review* is the property of American Society for Competitiveness and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.