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e-Surveying and Respondent Behaviour: Insights from the Public Procurement Field

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Abstract. e-Surveys have emerged as among the most widely used methods of collecting primary data from firms. In spite of their prevalence we know relatively little about how firms react to them. This paper takes a closer look at respondent behaviour during the e-survey process by analysing data from 4747 suppliers. Among the key findings are a low rate of response, fast response times and a preference for submitting responses between 08.00 and 11.00. In terms of survey completeness, respondents answered 35 of the 48 survey questions, on average, and spent approximately seven minutes doing so. The time of day at which the response was submitted and the date of response was significant in explaining survey completeness. So too was firm size and nationality. Notably, the smaller the supplier the more complete the survey response. The implications of these findings for e-surveying in the management field are discussed within.

Keywords: Survey, behaviour, response rate, procurement, suppliers.

1. Introduction

The advent of web-based surveying or e-surveying has been among the most significant methodological developments in social science over the last number of decades. Among its many attractions, e-surveying has dramatically reduced the cost of collecting primary data, eliminated the need for time-consuming manual data entry and enabled researchers to access populations that are geographically dispersed or otherwise difficult to connect with (Akl et al. 2005; Shin, Johnson and Rao, 2011; Weimiao and Zheng, 2010). It has made surveying eminently more practical for researchers with limited budgets, time and resources. Admittedly, it has also come with downsides, not least its failure to achieve response rates comparable to mail, fax and telephone survey modes (Al-Subaihi, 2008; Fisher and Herrick, 2012; Hardigan, Succar and Fleisher, 2012). Even with this and other methodological and technical caveats, e-surveying has established itself as the preferred mode of systematically gathering data in the current era.

The public procurement field has been no exception to this trend. e-Surveys of buyers and suppliers regularly appear in published articles and have become an accepted and valid means of conducting research (Flynn, McKeivitt and Davis, 2015; Hawkins and Muir, 2014; Saastamoinen, Reijonen and Tammi, 2017). This has coincided with another significant development in the procurement domain, namely: buyer and supplier databases. The emergence of e-procurement has meant that most buyers and suppliers are now registered on business-to-business (B2B) and business-to-government (B2G) websites. For example, Tenders Electronic Daily (TED), which advertises government contracts available throughout European Union (EU) member states, contains the contact details for hundreds of thousands of public buyers and many millions of suppliers. Such databases are, for the first time, helping policy makers and researchers to identify their populations of interest and survey them. As an example of this, the European Commission and PwC recently undertook a survey of TED-registered firms on their tendering activity and success rates in the European public procurement market (PwC, 2014).

In spite of its growing importance as a research tool, we still know relatively little about how buyers and suppliers react to e-surveying. For instance, how quickly do they respond to the survey invitation? Do they complete the survey in a single sitting or spread it out over two or more days? How much time do they spend answering survey questions? How many survey questions do they typically answer out of the total and how many do they skip? Are there behavioural and organisational factors associated with higher rates of survey completion? If so, what are they? These are by no means trivial matters. Ultimately, they go to the heart of issues to do with the quality of our survey data and the integrity of our research and its conclusions (Bosnjak and Tuten, 2001). Missing data from unanswered questions, for example, reduces response quality

and can even lead to the elimination of cases from further analysis (Sanchez-Fernandez, Munoz-Leiva and Montoro-Rios, 2012).

Until recently it was difficult to generate any meaningful data that could be used to address these questions. With mail surveys there was no way of accurately gauging how much time respondents had spent answering the questions or whether individuals answered some questions before discarding the questionnaire. Advances in off-the-shelf survey software packages, however, have opened up a whole new range of opportunities for data analytics. Their strength lies in being able to capture a series of data points related to each respondent's engagement with the survey, including the IP address, time and date the survey was initially opened, time and date survey was finally submitted and much else besides. Using these survey software packages researchers can collect not only answers to their substantive questions but also harvest information on the behaviour of each respondent during the response process. Such para-data or meta-data is among the benefits of web-based surveying and is helping researchers to gain a fuller appreciation of the dynamics of the survey response process (Bosnjak and Tuten, 2001).

Against the backdrop set out above, the purpose of this paper is to examine the survey response process in a public procurement context. It does so using data obtained from 4747 suppliers that responded to a survey on public sector tendering (see Flynn and Davis, 2017a, 2017b for the substantive results of the study). The objectives of the study can be stated thus:

Objective 1: To investigate supplier respondent behaviour during an e-survey, paying particular attention to rate of response, speed of response, hour of response, duration of response and survey completeness.

Objective 2: To test predictors of e-survey completeness using behavioural and organisational factors.

The intended contribution of our research is twofold: (1) to provide a detailed account on the e-survey response process from a supplier perspective and (2) to identify actions that social scientists can reasonably take to enhance the quantity and quality of responses to their e-surveys. The structure of this paper is as follows. The next section reviews the body of literature on e-surveying and highlights its main foci. The third section describes the methodology of this study. In particular, it details the content of the survey instrument and how it was implemented among a population of suppliers registered on e-Tenders. e-Tenders is the official site for the advertising of government contracts in Ireland. The fourth section reports on the findings of the study, which includes both descriptive and predictive statistics pertaining to the survey response process. The fifth section discusses the import of the findings. Its contribution to survey methods

in the business field is set out. Acknowledgement is also made of the limitations of the study as well as recommendations for future research on this topic.

2. Survey literature

There is a substantial body of research dedicated to the science of surveying. In the pre-internet period the emphasis was on techniques designed to increase response rates to mail surveys. Research by Dillman (1978), in particular, was influential in shaping our understanding of the conditions under which individuals are more or less likely to respond to survey requests. In recent years attention has turned to web-based surveys and their implications for primary data collection (Frippiat, Marquis and Wiles-Portier, 2010; Keusch, 2015). There are two major strands to this emergent research stream. The first is comparative in form, examining the effectiveness and efficiency of e-surveying relative to mail, phone and fax survey modes. The second is predictive in form, seeking to identify the factors that determine outcomes such as response rate and data quality. Each of these two strands is discussed in further detail in the sub-sections that follow.

2.1 Comparison studies

How e-surveying compares to the traditional survey methods of mail, fax, phone and interviewer-administered is a question that has pre-occupied methodologists over the last twenty years. The literature is replete with empirical studies comparing e-surveying with one or more of these traditional survey methods on dimensions like response rate, response speed, representativeness, resource implications and data quality (Al-Subaihi, 2008; Greenlaw and Brown-Welty, 2009; Hardigan, Succar and Fleisher, 2012; Heiervang and Goodman, 2011; Lin and Ryzin, 2012; Messer and Dillman, 2011; Millar and Dillman, 2011; Shin, Johnson and Rao, 2011; Yetter and Capaccioli, 2010). The findings to emerge from these and similar studies suggest that e-surveying outperforms the traditional survey methods on some dimensions by facilitating fast, efficient and relatively costless data collection. At the same time, the findings point to a number of caveats that need to be attached to e-surveying, particularly as regards lower response rates. These are subject to further discussion below.

On the plus side, e-surveying is widely held to be more resource efficient than mail, phone or interview administered methods (Shin, Johnson and Rao, 2011). In many cases the cost of e-surveying amounts to little more than paying a subscription fee to a software service provider. By contrast, surveying a population sample via mail can easily run into thousands of pounds after paying for postage, stationery and labour. The time and cost of administering a survey to a large sample is higher still. Evidence of this, Lin and Ryzin (2012) determined in their study that the

cost per response was \$4.43 for mail-distributed surveys and \$0.72 for web-distributed surveys. Similarly, Heiervang and Goodman (2011) calculated that face-to-face data collection cost four times as much per respondent as web-based data collection. As well as cost effectiveness, e-surveying is associated with reduced data collection periods. Early studies in this field detected that e-surveying generates quicker replies than the traditional mail method, thus making it time-efficient in terms of data gathering (Akl et al. 2005; Griffis, Goldsby and Cooper 2003).

It is not all positive as far as e-surveying is concerned. Direct comparisons between e-surveys and the traditional methods have typically found that the former produce lower response rates. Hardigan, Succar and Fleisher (2012), for example, achieved a response rate of 26% with a mail survey but only 11% with an e-survey. Likewise, Al-Subaihi (2008) reported that telephone contact yielded a 95% response rate as against 30% for email contact. Postal surveys also outperformed web-based surveys in Messer and Dillman's (2011) experiment by a statistically significant margin. The same pattern can be observed across many other studies involving population cohorts as diverse as elected representatives and educators (Fisher and Herrick, 2012; Shin, Johnson and Rao, 2011; Yetter and Capaccioli, 2010). This is problematic. Low response rates increase the likelihood of non-response error i.e. making generalisations based on data drawn from respondents who are not representative of their population (Gomm, 2008). Explaining the disparity in response rates, we can point to a fatigue factor resulting from the sheer volume of research requests that individuals receive via email, as well as wariness over opening unsolicited emails from unknown senders (Sanchez-Fernandez, Munoz-Leiva and Montoro-Rios, 2012).

Apart from resource efficiency, response speed and response rate, methodologists have probed possible variations in item completion and data quality between e-surveying and the traditional survey methods. In some studies web-based surveys have produced the same or even higher levels of item completion than postal surveys (Liu, 2017; Wright and Ogbuehi, 2014), although the opposite effect has also been observed (Heiervang and Goodman, 2011). In reference to data quality, Shin, Johnson and Rao (2011) reported higher data quality from web surveys, measured in terms of item responses to closed and open-ended questions. Researchers elsewhere have concluded from their analyses that the mode of data collection has no statistically significant effect on data quality (Akl et al., 2005; Dodou and Winter, 2014). Interestingly, studies are now moving beyond the postal versus web dichotomy to probe for differences in data quality collected across different internet-enabled devices e.g. personal computers versus mobile phones (Lee, Kim and Couper, 2018; Mavletova, 2014).

2.2 Predictive studies

Another prominent line of inquiry in this field focuses on how to increase response rates to e-surveys. It has its antecedents in research carried out by Dillman (1978) into the factors that determine response rates in mail surveys. Weimiao and Zheng (2010) review the extensive body of work in this area, noting how it takes in aspects related to web survey development e.g. number of questions; web survey delivery e.g. use of pre-notifications and offering of incentives; survey population characteristics; and technical issues around the software used to collect responses. In one of the earliest studies, Cook, Heath and Thompson (2000) demonstrated that the number of contacts made with the population sample, the issuing of a pre-survey notification and personalising email correspondence had the greatest impact on final response rate. Following on, Deutskens et al. (2004) was able to confirm that shorter questionnaires have higher response rates and that incentives in the form of vouchers and lotteries can induce response in long and short e-surveys, respectively.

Latterly, scholars have developed and refined this line of inquiry. Van Veen, Goritz and Sattler (2016) returned support for the hypothesis that pre-notifying the targeted population sample of an impending e-survey increases response rate and reduces item non-response. If a prepaid cash incentive is used alongside pre-notification, the effect becomes even more pronounced. The salutary effect of incentives on responses to web-based surveys is also illustrated by Biemer et al. (2018) in a study of US households. Soliciting engagement from potential respondents matters too, as Petrovcic, Petric and Manfreda (2016) show. In their case issuing a plea for help to the population sample improved response rates. Inserting a personalised salutation into email correspondence also appears to elicit co-operation from targeted individuals (Munoz-Leiva et al., 2010; Sanchez-Fernandez, Munoz-Leiva and Montoro-Rios, 2012). In sum, we can say that investigating the determinants of responses rates to e-surveys is an area that has attracted and continues to attract interest from methodologists.

For all the empirical research that has been undertaken into e-surveying, we still know relatively little about the actual response process. As is clear from the above literature review, methodologists have concerned themselves with how e-surveying compares against the traditional survey methods as well as the tactics that should be employed to maximise response. What they have not done to any satisfactory degree is trace the response process from start to finish or detail how individuals interact with e-surveys. As a result, questions related to timing of response, length of response and behavioural and organisational factors affecting survey completion rates have gone largely unanswered. One exception to this is Wright and Ogbuehi

(2014) who compared duration of survey response across administered, web-based and paper-based surveys. Their contribution notwithstanding, significant gaps in knowledge remain. The aim of this paper is to begin to address these gaps. The next section describes how the survey data used in our analysis was collected.

3. Methodology

As part of a larger study into public procurement an e-survey was carried out on suppliers competing for public contracts in Ireland. Ireland has a centralised procurement system and all public contracts valued at €25,000 or above are advertised on a government-managed website called e-Tenders. In order to be able to identify and tender for these public contracts with the Irish government, firms must first register on e-Tenders. Likewise, public buyers must have an account on e-Tenders to be able to advertise their available contracts. This is beneficial from a research perspective. Essentially, it makes it possible for researchers, with the permission of the relevant authority¹, to access the relevant population. Heretofore it was a major challenge to even determine the population of buyers and suppliers operating in the public sector marketplace, never mind survey them.

At the time of the study there was approximately 60,000 registered supplier accounts on e-Tenders. Each of the 60,000 supplier representatives registered on e-Tenders was emailed and invited to participate in the research. Each email had an embedded hypertext link to our survey instrument. Two email contacts were made in total. The first marked Day 1 of the survey period. The second was on Day 12 of the survey period. The latter was sent to express gratitude to those persons who had already submitted their response and to remind persons who had yet to submit their response to please do so. Issuing a reminder has been found to be among the most effective ways to increase response rates in survey-based research (Muñoz-Leiva et al., 2010), hence its inclusion in this study. The survey period ended 31 days after contact was first made with the population of suppliers.

The survey instrument contained 48 questions relevant to public contracting (see Appendix A). It was formatted and managed using SurveyMonkey, which is a dedicated survey software package. There was five sections in the survey: background information; tendering activity; tendering ability; experience of business-friendly actions; and identifying contract opportunities. Each section of the survey had its own page. Respondents could gauge their progress by means of a completion indicator visible at the top of their screen. The design of the instrument followed best practice advice (Andres, 2012). Questions were written in simple, purposeful English. Jargon

¹ The relevant authority here is the Office of Government Procurement, Ireland.

and technical language was avoided. Only closed questions were used, meaning that respondents chose from a pre-defined set of mutually exclusive answers. This was done in the interests of respondent convenience as well as reliability of measurement. For some questions the pre-defined set of answers was a drop-down menu. For others it was situated directly underneath the question and respondents were asked to tick a box. Adding variety in this way helps to break the monotony of answering a large number of formal questions.

All questions could reasonably be answered without having to consult organisational literature. Respondents did not have to disclose any information that could identify themselves or their firm. The first page dealt with contextual information about the firm e.g. size, age, turnover, nationality, sector, etc. Categorisation schemes were employed to make the subsequent data analysis easier e.g. firms could select one of four options to indicate their size: 1-9 employees; 10-49 employees; 40-249 employees; 250+ employees. After the first page the survey moved to asking questions specific to public sector tendering. A mix of numeric, binary-choice (yes/no) and Likert scale questions was used throughout. The underlying objective in all of this was to maximise response by being user-friendly while at the same time upholding the validity of the survey instrument.

The survey instrument was assessed for content validity in two ways. Initially, it was pre-tested among ten suppliers with experience of public sector tendering. Their feedback was sought on each of the 48 questions and the accompanying response sets. Apart from some recommended minor changes to question phrasing, they approved the content, structure and length of the survey. Following on from this, the survey instrument was presented to three procurement academics. Their assessment was positive in much the same way, although they did advise that several of the Likert scale items that related to tendering capabilities be re-worded. Once this pre-testing and assessment process was complete, the survey was ready for distribution.

4. Results

The results from the data analysis are set out below. Sections 4.1-4.6 concern the behaviour of respondents in terms of their rate of response, speed of response, hour of response, duration of response and survey completeness. Together these sections feed into Objective 1 of the study, which is to investigate supplier respondent behaviour during e-surveying. Section 4.7 tests behavioural and organisational predictors of survey completeness and is linked to Objective 2 of the study.

4.1 Rate of response

The total number of responses received over the 31 day data collection period was 4747, which gives a response rate of just under 8% ($4747 \div 60000$). While in absolute terms the number of

responses was high, in proportional terms it was low. As with all survey research, it is not the rate of response *per se* that is important but rather the representativeness of respondents (Anseel et al., 2010). With this in mind we tested for representativeness by comparing the characteristics of early and late respondents (Armstrong and Overton, 1977). This test assumes that late respondents share the same characteristics as non-respondents and, as such, are proxies for non-respondents. If late respondents are not statistically different from early respondents across relevant organisational characteristics, then respondents are assumed to be broadly representative of the population from which they are drawn.

For the purposes of our analysis we compared early and late respondents across five variables: firm size, tendering experience, typical value of contract tendered for, number of contracts tendered for in 2014 and success rate in tendering in 2014. Early respondents represented the first 100 persons to participate in the research. Their response was received within hours of the survey going live. Late respondents represented the last 100 persons to participate in the research. Their response was received over three weeks after contact was first made. T-tests for Equality of Means were performed in respect of each of the five variables. The tests returned no statistically significant differences ($p > .05$) between early and late respondents on any of the five variables (see Table 1). On this basis we are led to believe that the 4747 respondents are representative of the population of suppliers competing for public contracts in Ireland.

TABLE 1
Early versus Late Respondents

Variable	Operationalisation	Mean score		Sig.
		Early resp.	Late resp.	
Firm size	1-9 staff = 1 10-49 staff = 2 50-249 staff = 3 250+ staff = 4	1.76	2.02	.09
Tendering experience of firm	numeric	12.69	12.60	.97
Typical value of contract tendered for	<25k = 1 25-130k = 2 130-250k = 3 250-500k = 4 500- 1 million = 5 1 million+ = 6	2.33	2.43	.69
Number of contracts tendered for in 2014	numeric	7.57	8.81	.56
Success rate in tendering in 2014	1-100%	26.52	26.54	.99

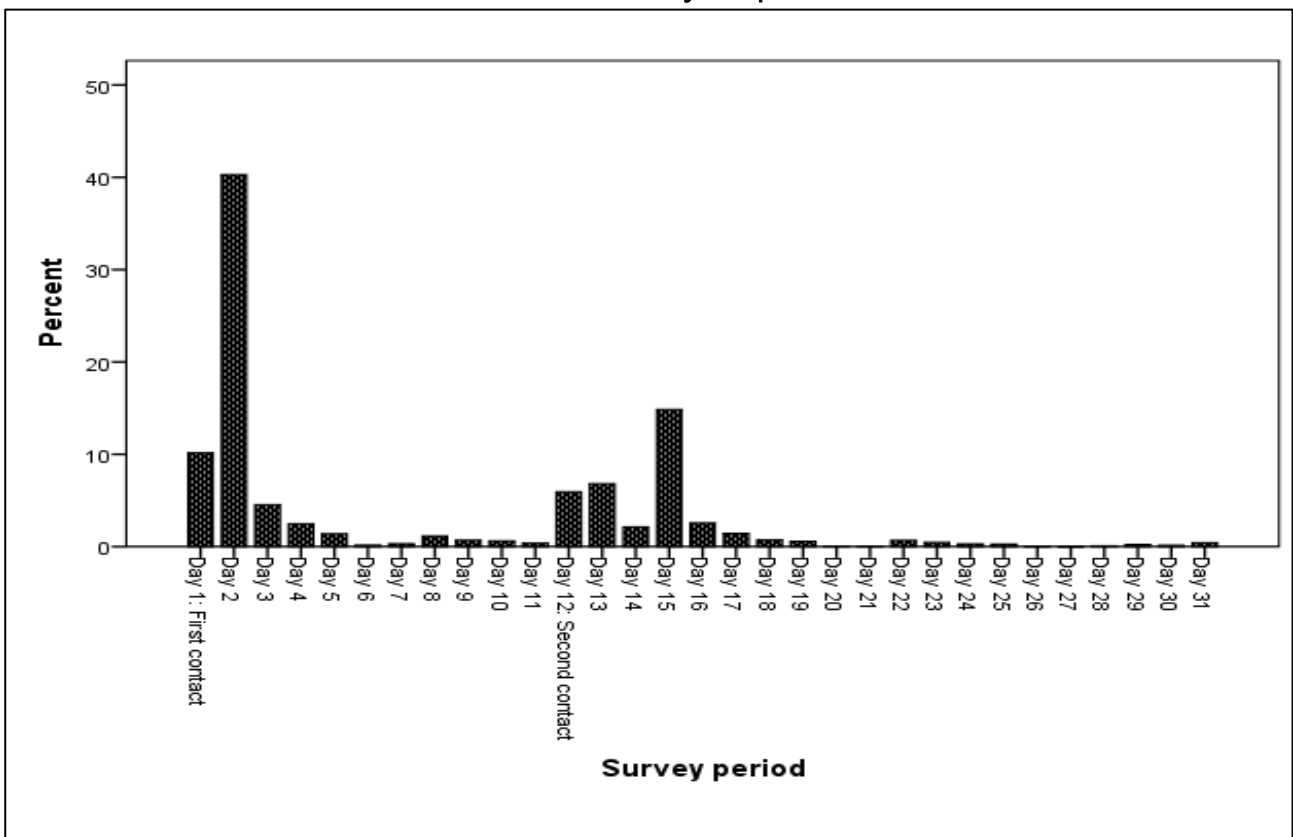
4.2 Timeline of response

Referred to above, the survey period spanned 31 days. It began on Monday, 19th of January 2015 (Day 1) and ended on Wednesday, 18th of February 2015 (Day 31). Responses started to register almost immediately after emailing the survey to suppliers. By the end of Day 1 485

responses had been received, which is 10.2% of the final total. By the end of Day 2 an additional 1912 responses had been received, which is 40.3% of the final total. This means that within 48 hours of the survey going live half the number of final responses had been received. Responses continued to flow in over the following days, albeit at a reduced rate. Day 3 saw 215 responses (4.5% of the final total) and Day 4 118 responses (2.5% of the final total). The number of responses reduced to double and even single digits between Days 5-11, amounting to just 4.8% of the final total.

In an attempt to generate additional responses, a reminder email with an embedded hypertext link to the survey was sent out on Friday, January 30th 2015 (Day 12). The follow-up email succeeded in bringing about an increase in response. On Day 12 282 responses were received. This resurgence continued over the next three days, with 323 responses received on the Saturday, 102 on the Sunday and 705 on the Monday. Together these four days account for 29.7% of the total number of responses. Like the pattern observed after the first mailing of the survey, the rate of response decreased sharply in the days directly proceeding the second mailing. Across the remaining fifteen days of the survey period only 261 responses were received, or 5.5% of the final total. The timeline of survey responses is depicted in Figure 1.

FIGURE 1
Timeline of Survey Response



4.3 Single versus multiple day response

Approximately 99% of survey responses were started and ended on the same day. In the remaining 1% of cases (n = 54) surveys were started on one day and resumed the following day or later. Of the 54 cases that did not start and end the survey on the same day, the majority submitted their response within two days after first commencing the survey. The longest interval between starting and finishing the survey was fourteen days. Table 2 provides a detailed breakdown of the figures for single versus multiple day response.

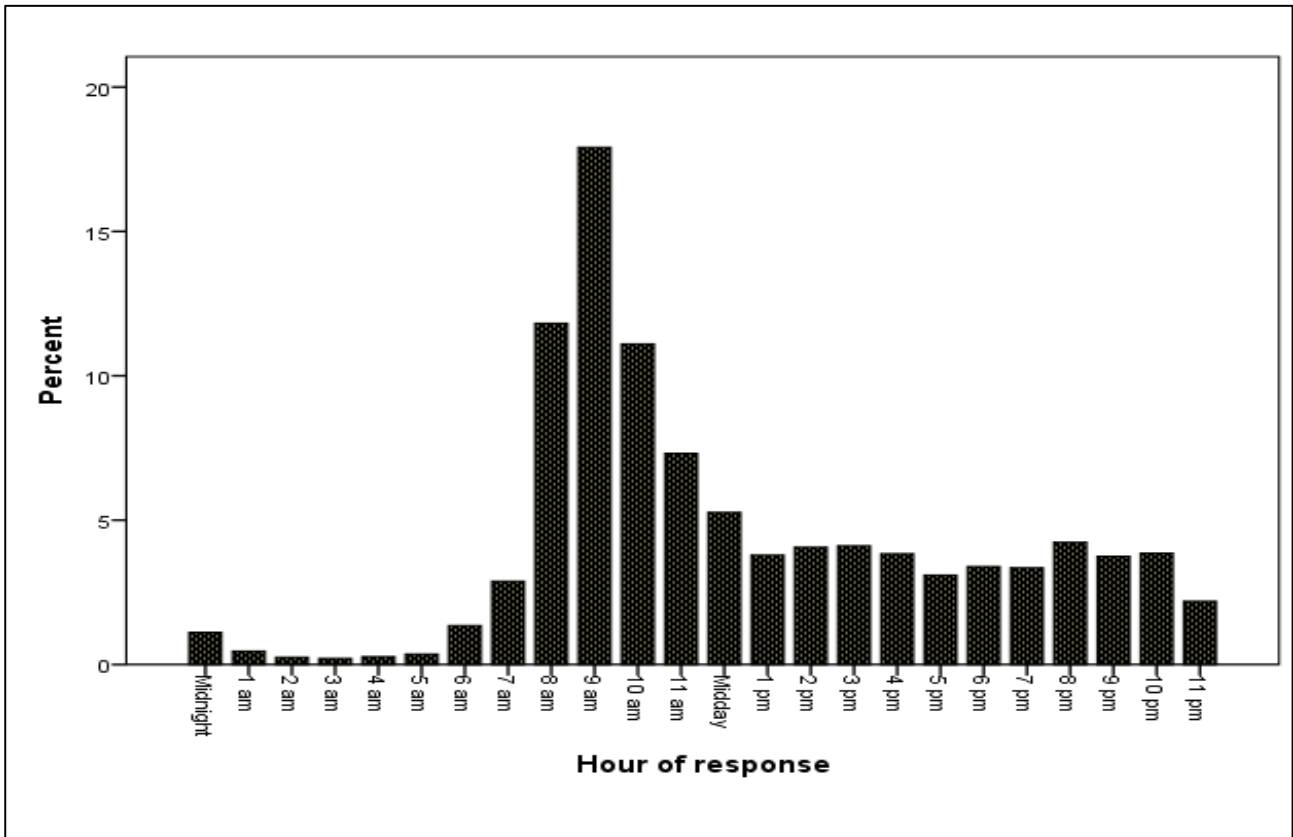
TABLE 2
Single versus Multiple Day Response

	Frequency	%
Started and ended on the same day	4693	98.9
Ended one day later than the start day	28	0.6
Ended two days later than the start day	12	0.2
Ended three days later than the start day	5	0.1
Ended four days later than the start day	1	<0.1
Ended five days later than the start day	2	<0.1
Ended six or more days later than the start day	6	0.1
Total	4747	100

4.4 Hour of response

Analysis of the hour recipients started the survey provides some interesting results (see Figure 2). The most common hour for individuals to start the survey was 09.00. Approximately 18% of all survey responses were started at this time. The second and third most common hours to start the survey were 08.00 and 10.00, with each accounting for approximately 11% of responses. This leaves little doubt that the commencement of the work day was the favoured time for individuals to start responding. Outside of this three hour morning period 11.00 and 12.00 were the most popular times for respondents to start the survey. Throughout the day and into evening time i.e. from 13.00 to 23.00 there was a comparatively low but constant rate of engagement with the survey. The number of surveys started between 00.00 and 07.00 was minimal. The pattern stayed the same even when firms operating outside the GMT zone were excluded from the analysis.

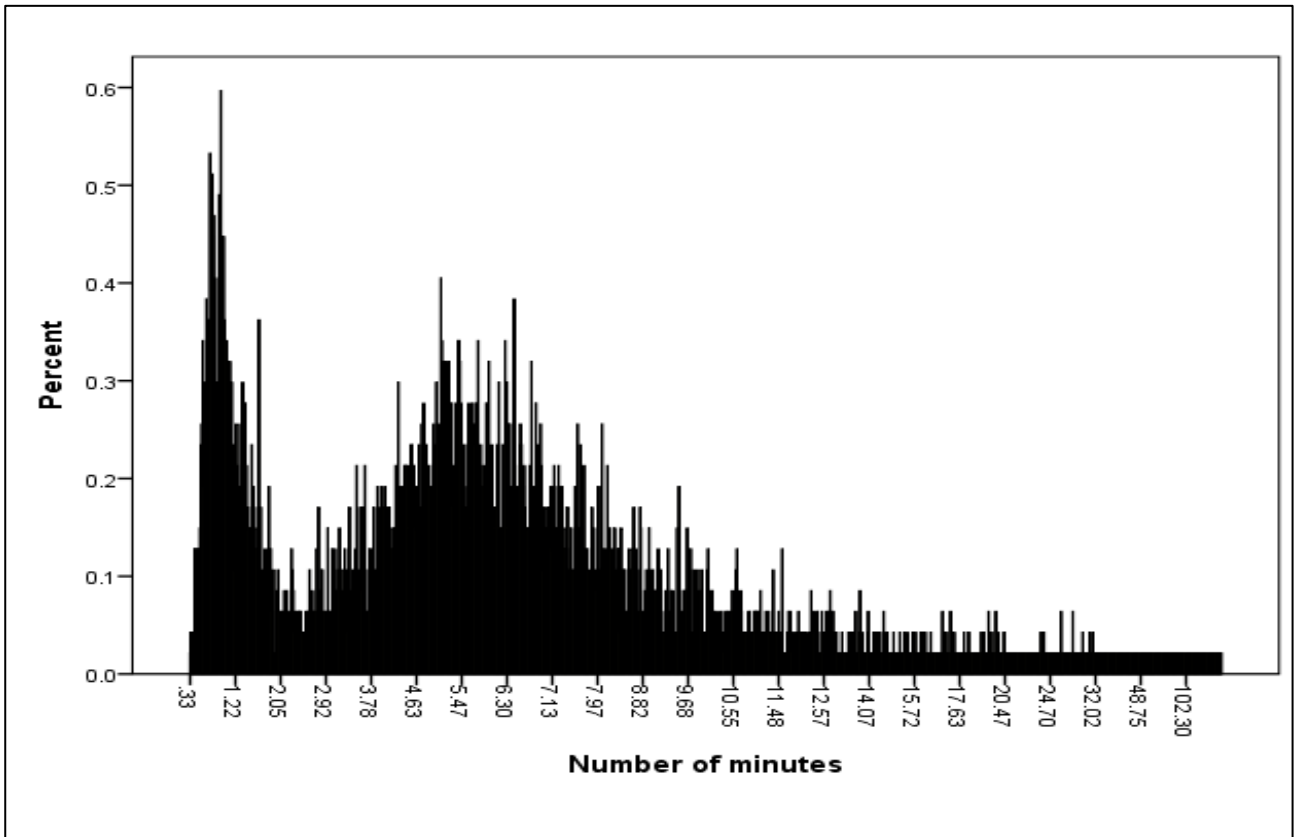
FIGURE 2
Hour of Response



4.5 Duration of response

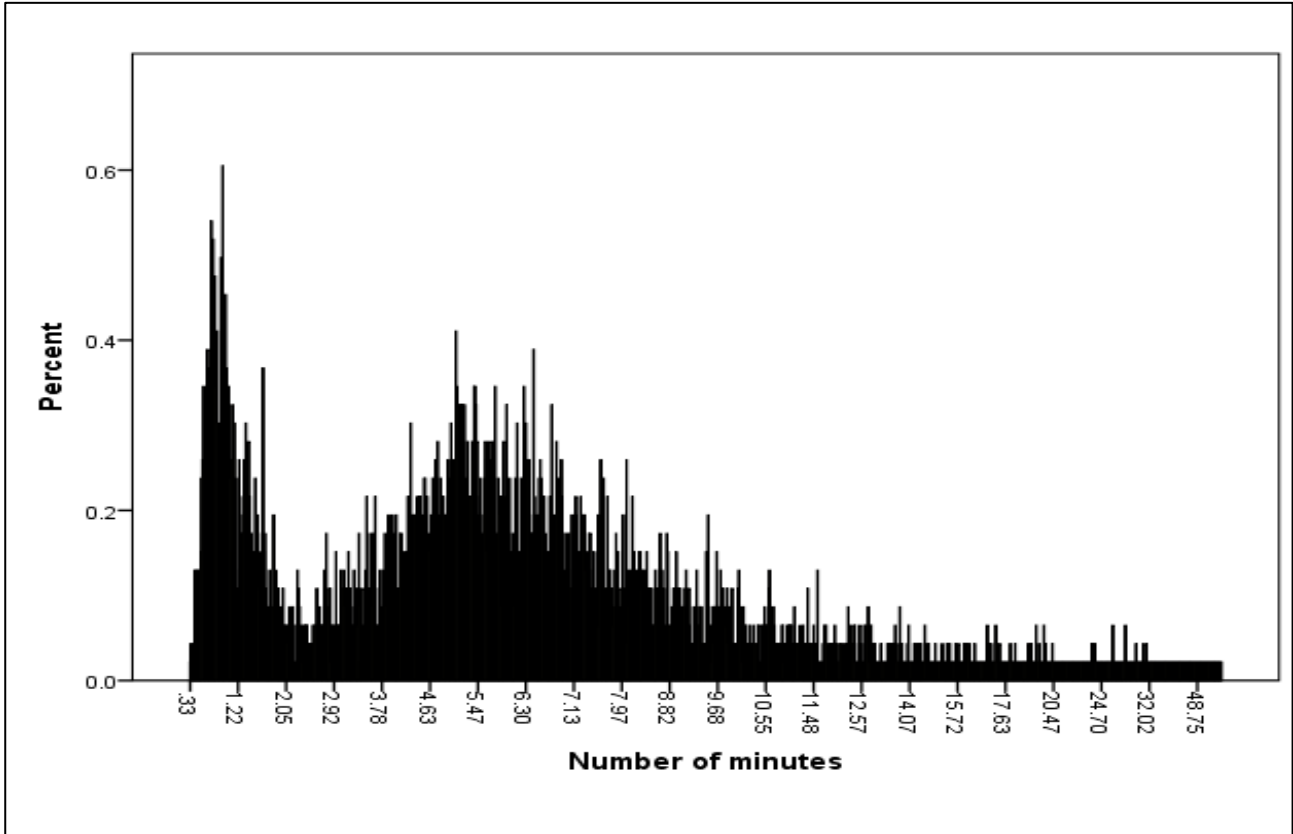
The amount of time taken by respondents to answer the survey questions was also investigated. To calculate it we subtracted the time at which respondents commenced the survey (hh:mm) from the time at which they ended the survey (hh:mm). This was done for all respondents except where cases extended over two or more days (n = 54). Their inclusion would have grossly inflated measures of central tendency. For example, in one case there was a fourteen day interval between a respondent starting and ending the survey. The results from this calculation are as follows. The mean time between starting and ending the survey was 9.46 minutes. The median time was 5.73 minutes. The minimum time was 0.33 minutes and the maximum time was 665.52 minutes. The distribution of values for respondents who started and ended the survey in a single day is represented in Figure 3a.

FIGURE 3a
Time Spent on Survey



Indicated by the maximum time, some respondents started the survey at one point during the day and returned to it several hours later. It would certainly not take anyone 665.52 minutes (11 hours) to answer 48 relatively straightforward questions. To investigate this outlier group further we isolated responses that exceeded 60 minutes between start and finish time. Sixty minutes was deemed to be the upper limit that any respondent could reasonably spend answering the questions in a single sitting. A total of 64 cases were identified that exceeded the 60 minute threshold. Closer inspection showed that these 64 cases had either started the survey in the early morning and returned to it in the afternoon or started it in the afternoon and returned to it in the late evening. When the analysis was re-run without these outliers the mean score reduced to 6.94 minutes. We believe that this is a more accurate estimate of the average amount of time that respondents spent answering the questions. The distribution of values for respondents who started and ended the survey within a 60 minute period is represented in Figure 3b.

FIGURE 3b
Time Spent on Survey (Adjusted)



The distribution of values in Figure 3b gives some indication of how respondents engaged with the survey. In the first instance we can see that a significant proportion of respondents, approximately 25%, did not spend much more than 3 minutes on the survey. This is because they only answered the questions on the first page of the e-survey before quitting prematurely. Beyond this initial cluster, half of all respondents fall within 3-8 minute range. The fourth quartile stretches from 8 to 60 minutes. The ranges are captured in Table 3.

TABLE 3
Quartile Ranges for Time Spent on Survey

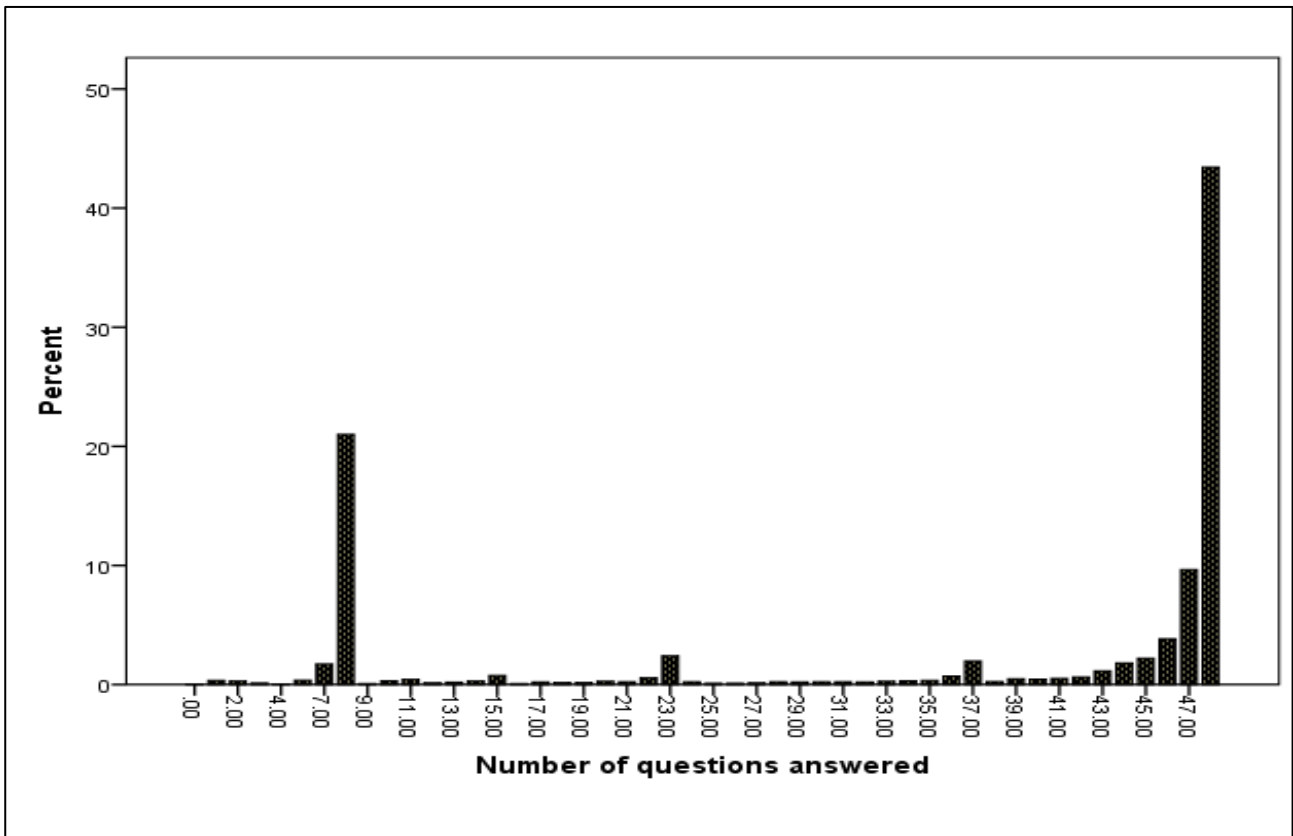
Quartile	Minutes
Lower quartile	0.33 - 3.16
Lower middle quartile	3.17 - 5.67
Upper middle quartile	5.68 - 8.13
Upper quartile	8.15 - 59.90

4.6 Survey completeness

The survey contained 48 questions in total. The mean figure for number of questions answered was 35.17. The median figure was 47. Approximately 43.3% of respondents answered all 48 questions (n = 2062). This means that the majority of responses were incomplete. Incompleteness ranged from not answering any question (n = 2) to answering 47 out of the 48 questions (n = 458). As is evident in Figure 4, a relatively high percentage of respondents

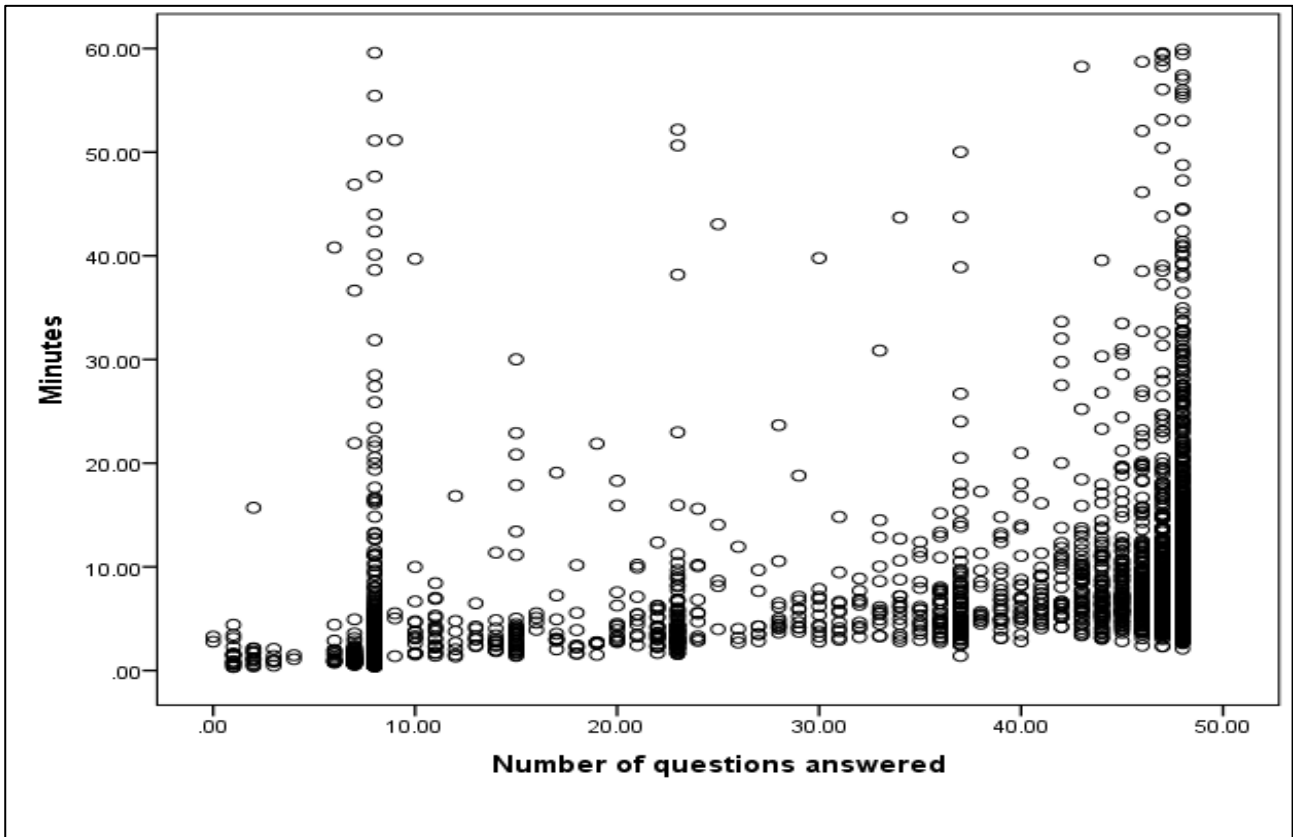
answered eight questions. There is an explanation for this occurrence. As referred to already, the first page of the e-survey contained eight questions relating to the characteristics of the firm. Almost a quarter of respondents (n = 998) answered these eight questions but did not progress any further in the survey. Further analysis revealed there to be statistically significant differences between these 998 firms and the 2062 firms that answered all questions ($p < .05$). Specifically, the former cohort were bigger in size, in terms of number of employees and revenue, and older than the latter.

FIGURE 4
Survey Completeness



Consistent with expectations, we found that the number of questions answered correlated with the length of time spent on the survey (see Figure 5). The Pearson’s Correlation Co-efficient is 0.38, which is statistically significant at $p < .01$. It is notable that there is in the region of 20 cases that answered the first eight questions but took 20 minutes or more between starting and finishing their involvement with the survey. This may be due to respondents dipping in and out of the survey, possibly as a result of indecision over whether to complete it. On the whole, the length of time respondents spent on the survey is proportionate to the total number of questions that they answered.

FIGURE 5
Time Spent on Survey Correlated with Number of Questions Answered



4.7 Factors affecting survey completeness

As part of the analysis we tested a number of predictors of survey completeness i.e. total number of questions answered. The first predictor we considered was date of response. We divided date of response into two waves. The first wave comprised responses that came in before the reminder notification was issued: 19/01/2015 – 29/01/2015. The second wave comprised responses that were received after the reminder notification was issued: 30/01/2015 – 18/02/2015. Our analysis found a small but statistically significant difference between first and second wave respondents on survey completeness ($p < .01$). First wave respondents answered 35.70 questions, on average, which is almost 1.5 more than second wave respondents (see Table 4).

TABLE 4
Date of Response and Survey Completeness

Timing	N	Mean	Std. Dev.	95% Confidence Level		Min.	Max.
				Lower Bound	Upper Bound		
First wave	2952	35.70	16.98	35.09	36.32	0	48
Second wave	1795	34.29	17.49	33.48	35.10	0	48
Total	4747	35.20	17.19	34.68	35.66	0	48

The hour at which respondents started the survey was next considered as a predictor of survey completeness. For the purposes of analysis we grouped respondents into one of four time

periods. These were: 00.00-05.00, 06.00-11.00, 12.00-17.00 and 18.00-23.00. The period of day or night respondents started the survey is statistically significant in predicting survey completeness ($p < .01$). Respondents who started the survey in the evening time, 18.00-23.00, answered, on average, 36 questions. This is the highest level of survey completion of the four groups. Respondents who started the survey in the afternoon, 12.00-17.00, answered, on average, 33 questions, which is the lowest level of survey completion of the four groups. Respondents in the am periods answered 35 questions, on average (see Table 5).

TABLE 5
Hour of Response and Survey Completeness

Time	N	Mean	Std. Dev.	95% Confidence Level		Min.	Max.
				Lower Bound	Upper Bound		
00.00-05.00	127	35.18	16.99	32.19	38.16	6	48
06.00-11.00	2486	35.34	17.27	34.66	36.02	0	48
12.00-17.00	1148	33.46	17.65	32.44	34.49	1	48
18.00-23.00	986	36.72	16.29	35.70	37.74	0	48
Total	4747	35.17	17.19	34.68	35.66	0	48

Apart from date and hour, we tested if organisational characteristics had any bearing on survey completeness. Firm size was the first organisational factor tested (see Table 6). Firm size was measured by reference to number of employees. Consistent with the current EU definition, four size categories were employed. These were as follows: 1-9 employees (micro enterprise), 10-49 employees (small enterprise), 50-249 employees (medium enterprise), and 250+ employees (large enterprise). Firm size was found to be statistically significant in accounting for variance on survey completeness ($p < .01$). Interestingly, firm size and survey completeness are inversely related. The bigger the firm the fewer the questions it answered. While micro-enterprises answered 37 questions and small firms 35 questions, the corresponding figures for medium and large firms were 32 questions and 28 questions respectively.

TABLE 6
Firm Size and Survey Completeness

Firm Size	N	Mean	Std. Dev.	95% Confidence Level		Min.	Max.
				Lower Bound	Upper Bound		
Micro	2330	37.55	15.71	36.91	38.19	1	48
Small	1191	35.79	16.91	34.83	36.75	2	48
Medium	643	32.71	18.40	31.28	34.13	2	48
Large	530	28.05	19.01	26.43	29.67	1	48
Total ^a	4694	35.37	17.07	34.88	35.86	1	48

^a Does not equal group total, 4747, due to missing values.

Firm nationality was the second organisational factor tested in respect of survey completeness (see Table 7). Firms were categorised according to whether they were based in Ireland, Northern Ireland, the UK, the EU or Rest of World. Like firm size, nationality is statistically significant in accounting for variance in survey completeness ($p < .01$). Firms based in Northern Ireland and

Ireland had the highest rate of survey completeness at 38 and 36 questions answered, respectively. By contrast, firms based in the UK and the EU answered, on average, 32 questions. Firms from Rest of World were situated between these two groups, having typically answered 35 questions.

TABLE 7
Firm Nationality and Survey Completeness

Jurisdiction	N	Mean	Std. Dev.	95% Confidence Level		Min.	Max.
				Lower Bound	Upper Bound		
Ireland	3275	36.24	16.61	35.68	36.81	2	48
Northern Ireland	160	38.51	15.71	36.05	40.96	8	48
UK	741	32.68	18.09	31.37	33.98	6	48
EU	296	32.25	18.03	30.19	34.31	3	48
Rest of World	188	35.09	17.13	32.63	37.56	7	48
Total ^a	4660	35.45	17.00	34.97	35.94	2	48

^a Does not equal group total, 4747, due to missing values.

5. Discussion

The migration of surveys online has had a profound effect on research in the social sciences. It has drastically lowered the cost, time and effort of data collection, thus enabling large-scale studies to be carried out on limited budgets (Frippiat, Marquis and Wiles-Portier, 2010; Keusch, 2015). It has also made it easier to access geographically dispersed and difficult to identify populations. Public buyers and suppliers can certainly be described as falling into both of these categories, which is one of the reasons why researchers have often struggled to survey them. Another advantage of e-surveying is that we can now capture meta-data on the response process (Bosnjak & Tuten, 2001). In other words, it allows us as researchers to get a sense of how targeted populations engage with surveys in ways never imaginable with the traditional mail method. This is only a recent development, however, and little has been reported on it. Hence, we decided to analyse meta-data from 4747 suppliers to better understand the response process in e-surveying.

The first observation to be made is the speed with which suppliers in our study responded to the survey. Within hours of the survey being sent out almost 500 responses had been received. By the end of day two this figure had reached approximately 2400, representing over half of the final tally. The level of response reduced substantially thereafter. A reminder notification then produced an upswing and approximately 1400 new responses were received in the days directly proceeding the second contact. This type of response pattern is not without precedent. Flynn, McKeivitt and Davis (2015) received a substantial proportion of total responses within the first 24 hours of emailing their survey, after which rates sharply reduced. The observed phenomenon of rapid response followed by equally rapid drop-off is in marked contrast to the traditional mail

survey. For instance, Messer and Dillman (2011) found that responses to mail surveys are low in the first week, but pick up thereafter. For practitioners, our findings on timeline of response implies that the survey cycle time can be compressed when using the web to gather data. Conceivably, 7-10 days is sufficient, with a reminder notification issued at the midway point to maximise response.

Another pattern to emerge from our analysis is the hour of day at which responses are submitted. There appears to be a preference to respond at the beginning of the workday, signalled by the fact that 40% of respondents commenced the survey between 08.00 and 11.00. This is logical given that staff tend to deal with their correspondence at the outset of the working day. The optimal time to issue e-surveys is, therefore, early in the morning. This way it will be waiting in the recipient's inbox at a time when they are likely to be answering work-related requests. Of course, recipients can complete the e-survey any time they desire, be it inside or outside of work hours. Evident from our findings, approximately 25% of individuals opted to respond outside of regular office hours (18.00 – 07.00). This underlines one of the core strengths of e-surveying relative to the traditional mail method, namely: the flexibility it affords recipients over when and where to complete it. It is also one of the reasons why responses to e-surveys are returned at a much faster rate than mails surveys.

As researchers we hope that respondents will give due thought and consideration to our survey questions. The quality of our data and the credibility of any conclusions that we infer from it depend on a considered response. Yet the amount of time respondents spend answering survey questions is an area that is rarely if ever discussed in research studies. Instead, concern primarily rests with boosting response rate and avoiding non-response error (Weimiao and Zheng, 2010). In our study respondents spent, on average, just under seven minutes answering the survey questions. While there was 48 questions to negotiate, each had a pre-defined response set and individuals only had to select one answer. Furthermore, no typing was required. All of this would have allowed respondents with a reasonable knowledge of their firm's tendering activities to progress quickly through the survey. The overwhelming majority of respondents finished their response in a single sitting. In only 1% of the 4747 cases did a response extend over two or more days. This points to a prosaic truth when it comes to e-surveying: very few recipients revert back to an e-survey; they either complete it on opening the hypertext link or else do not engage at all.

Among the main advantages of e-surveying is the data trail it leaves behind. This marks it apart from the traditional mail method. As Bosnjak & Tuten (2001, p. 4) have commented in respect of the latter, "we do not know whether a potential respondent received the questionnaire at all,

read it, and began answering it". This is not the case with e-surveying. In our study we were able to identify not only the approximate 43% who constituted complete responders, but also item non-responders i.e. persons who skipped several questions but still reached the end of the survey, along with "answering drop-outs" i.e. persons who answered questions at the start of the survey but then quit prematurely (Bosnjak and Tuten, 2001). The latter comprised almost 1000 respondents who ended their involvement after page one of the survey. As our findings demonstrate, there are various degrees of completion with e-surveying. What is more, premature exit and item non-response appear to be very much part of the process – something which Lynn (2008) acknowledged previously. The most effective way to combat this problem is to design surveys that are simple to understand, do not take long to complete and are relevant to the audience (Andres, 2012).

What factors influence survey completeness? This is another important question that has received scant attention in the literature on survey methodology. Our findings indicate that responses submitted early on in the survey period, for one, are associated with a marginally higher number of questions answered. They also show that evening time is best for eliciting answers from respondents and afternoon time the worst. Perhaps of most interest from a research perspective is the finding that firm size and survey completeness are inversely related. That is, the bigger the firm the fewer the questions it answers. In our study micro-enterprises, on average, answered almost ten questions more (37.5/48) than large enterprises (28/48). Despite being endowed with less resources and operating with less formalised procedures, micro-enterprises appear more inclined to engage with e-surveys and answer the questions asked. Rationalising this effect, we point to the fact that smaller firms are under-represented in public procurement markets. For instance, SMEs' current share of the public procurement market in the UK is only 25% (House of Commons Library, 2015). Precisely because of their relative disadvantage smaller firms have more of an interest in registering their experiences of competing for public contracts. For practice, this finding means that researchers should consider exclusively targeting micro and small firms if survey completeness is their priority.

5.1 Limitations and future research

While our study sheds new light on the response process in e-surveying, it does have some limitations. To begin with, the analysis is based on data gathered from firms competing for public sector contracts with the Irish government. To what extent the results are generalizable across all business contexts is moot. For this reason it is recommended that future research obtain and analyse data on e-survey response behaviour from other jurisdictions or sectors for comparison purposes. As a starting point, we recommend research on UK-based firms given the institutional

similarities between the Ireland and the UK. Moreover, business-to-government (B2G) sites in the UK like Contracts Finder, Sell2Wales, Public Contracts Scotland and eTendersNI make such data collection and analysis feasible. Performing this type of comparison would help to establish if, for example, the inverse linear relationship between firm size and survey completeness is an international phenomenon.

Another limitation of the study concerns the behavioural and organisational predictive factors we tested against survey completeness. Our use of four factors cannot be said to be exhaustive. Therefore, scholars should explore what effect other factors have on the number of questions answered and/or the likelihood of achieving a complete response. For example, incentives in the form of nominal cash sums, vouchers and lottery tickets are a popular tactic used by researchers to stimulate higher surveys response rates (Biemer et al., 2018; Millar and Dillan, 2011; Van Veen et al., 2016). It would be instructive to test the impact that these incentives have on completeness and data quality when e-surveying suppliers and buyers. As per Lee, Kim and Couper (2018) and Mavletova (2014), scholars could also examine if the type of internet-enabled device on which the survey is undertaken – PC versus tablet versus smartphone – influences total number of questions answered.

6. Conclusion

This paper set out to describe and explain respondent behaviour during e-surveys. In terms of the first objective, the results show that rates of response to e-surveys are low, speed of response is rapid, and the start of the workday is when respondents are most likely to engage. The results also show that respondents spend a relatively short amount of time answering questions, approximately seven minutes in our case, and a significant proportion either quit prematurely or else do not answer all questions asked. In terms of the second objective, explaining respondent behaviour, we find that a number of factors influence survey completeness. For instance, first-wave respondents and evening-time respondents submitted, on average, more complete surveys. Particularly noteworthy is that firm size and survey completeness are inversely related. This was an unanticipated and quite intriguing finding to emerge from our study and we recommend that future research explores it further.

Appendix A: Survey Instrument

	QUESTION	RESPONSE SET
No.	<i>Section A – Background Information</i>	
1	What is the legal form of your firm?	Sole Trader Partnership Limited Company Unlimited Company Registered Charity
2	How many staff are employed in your firm?	1-9 10-49 50-249 250+
3	What was the annual turnover of your firm for the most recent financial year in which accounts were submitted?	< 2 million euro 2-10 million euro 10-50 million euro 50+ million euro
4	Which sector does your firm belong to?	Manufacturing Services Construction Other
5	How many years has your firm been trading?	0-5 6-10 11-20 21+
6	In which jurisdiction is your firm based?	Ireland Northern Ireland UK Rest of Europe Rest of World
7	What is the predominant market focus of your firm?	Local (within 30km of your base) Regional (within 120km of your base) National International
8	Does your firm compete in foreign markets?	No Yes
	<i>Section B – Tendering Activity</i>	
9	How many years' experience does your firm have in tendering for public sector contracts?	Numeric
10	How many people are ordinarily involved in preparing a tender on behalf of your firm?	Numeric
11	What is the typical value of a public sector contract your firm competes for?	<25,000 euro 25-130,000 euro 130-250,000 euro 250-500,000 euro 500-1,000,000 euro 1,000,000+ euro
12	How many public sector contracts did your firm tender for in 2014?	Numeric
13	How many public sector contracts did your firm win in 2014?	Numeric

14	What percentage of public sector contracts tendered for in 2014 did your firm succeed in winning?	1-100%
15	What percentage of your firm's 2014 revenue has come from public sector contracts?	1-100%
<i>Section C – Tendering Ability</i>		
16	Please rate your ability to influence buyer needs prior to tender	1-5 scale
17	Please rate your ability to communicate value proposition to inform tender specification	1-5 scale
18	Please rate your ability to promote goods and services to public sector prior to tender	1-5 scale
19	Please rate your ability to satisfy qualification criteria of tender requirements	1-5 scale
20	Please rate your ability to understand evaluation criteria of tenders e.g. MEAT	1-5 scale
21	Please rate your ability to effectively respond to evaluation criteria	1-5 scale
22	Please rate your ability to receive feedback on submitted bid and search contract award notices	1-5 scale
23	Please rate your ability to successfully manage an awarded contract	1-5 scale
<i>Section D – Experience of Business-friendly Actions</i>		
24	From your experience of tendering do buyers provide written feedback?	No Yes
25	From your experience of tendering do buyers enable online submission of tenders?	No Yes
26	From your experience of tendering do buyers engage with the marketplace before going to tender?	No Yes
27	From your experience of tendering do buyers accept reasonable variants to the specifications set down in the request for tender?	No Yes
28	From your experience of tendering do buyers publish Prior Information Notices (PINs) regarding future purchasing intentions on eTenders?	No Yes
29	From your experience of tendering do buyers advertise all supplies contracts worth 25k or more and works contracts worth 50k or more on eTenders?	No Yes
30	From your experience of tendering do buyers publish contract award notices on eTenders?	No Yes
31	From your experience of tendering do buyers divide contracts into lots?	No Yes
32	From your experience of tendering do buyers encourage consortium bids?	No Yes
33	From your experience of tendering do buyers ensure that their framework agreements give small suppliers the opportunity to compete?	No Yes

34	From your experience of tendering are buyers flexible in the type of proof of financial capacity they accept?	No Yes
35	From your experience of tendering do buyers use standard tender documentation?	No Yes
36	From your experience of tendering do buyers use relevant and proportionate financial capacity criteria?	No Yes
37	From your experience of tendering do buyers set down insurance cover requirements that are relevant and proportionate to the contract?	No Yes
38	From your experience of tendering do buyers allow tenderers to self-declare their financial capacity?	No Yes
39	From your experience of tendering do buyers allow tenderers to self-declare that they can obtain the required insurance cover?	No Yes
<i>Section E – Identifying Contract Opportunities</i>		
40	Are you familiar with Irish government policy for increasing SME participation in public procurement?	No Yes
41	When did you last update your firm's registration details, company profile and business alerts on eTenders?	Year
42	Are you aware of recent policy developments for centralising public procurement in Ireland, including the setting up of the Office of Government Procurement?	No Yes
43	Do you find out about contract opportunities from www.etenders.gov.ie ?	No Yes
44	Do you find out about contract opportunities from websites of public sector organisations?	No Yes
45	Do you find out about contract opportunities from press (local/national)?	No Yes
46	Do you find out about contract opportunities from word of mouth?	No Yes
47	Do you find out about contract opportunities from direct contact from a public buyer?	No Yes
48	What percentage of the contracts that your firm tendered for over the last 3 years was sourced through eTenders?	1-100%

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