Fact-Based Understanding of Business Survey Non-Response

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Abstract: A 2007-2008 two-nation business survey was carried out by two universities and supporting business development agencies. The intention of describing small and medium sized enterprises (SMEs) and their use of information technology and cooperation was disrupted by a very low response rate. Some practices concerning nonresponse (Rogelberg & Stanton, 2007) are discussed and implemented. The collected data are compared to data known in advance from registers for the nonresponding companies. Also, a second data set with concise answer information from nonrespondents was obtained by phone for categorization of the nonrespondents. Finally the nonresponse is related to data about contact between the companies and business development agencies to illuminate interest as the dependent variable. The article is an investigation into nonresponse at the organizational level and demonstrates throughout the article how facts obtained by other methods (multi mode) besides the central survey can improve the understanding of nonresponse.

Keywords: business survey, fact-based, nonresponse, self-selection, regional development, SMEs

1. Selection and nonresponse

The object for this article on nonresponse is a research survey carried out in 2007-2008 addressing the issues of electronic business and company networks in small and medium sized production companies in two adjoined European national regions (in Germany and Denmark).

The focus on the nonresponse implies that this article is not driving at descriptive measures presenting the level of ICT use or the degree and benefit of networking in the companies. Instead the description of the survey will target factors potentially influencing the nonresponse.

The postal survey was carried out on a random selection at each country of around 500 companies from official registries.

1.1 Selection bias and nonresponse bias

When the sample frame is not appropriate for the population that was intended for the survey research we are facing a coverage error. This coverage error is expressed as members of the survey population not having a known non-zero (often equal) chance of being included in the sample (Dillman, 2007, p. 196). Normally what is experienced is that some appropriate members are not included in the sample frame and thus have a zero chance of being selected for the survey. Thus they are not covered.
Non-enforced surveys always include an ultimate strong element of self-selection. Even though a company has been selected for the sample it is only when there is a response from the company that the selection is truly fulfilled. Within the sample there is thus self-selection occurring. Basically nonresponse would not present a problem if it was randomly distributed. However, to the degree that interest lies behind the self-selection we can expect that variables affecting the decision to participate could also affect the answers to the variables in the questionnaire. Consequently the bias of self-selection will then lead to results that are not representative for the population thus creating nonresponse bias. The primary goal when investigating nonresponse is to validate the obtained responses by demonstrating that the nonresponse is either insignificant in size or random (and thus not causing bias). However, in this article even with nonresponse bias we have the secondary goal of obtaining data from additional sources and turning this information into facts bringing understanding and further raise ideas to obtain more valid information on nonresponse.

1.2 Selection from a national registry

The population is SME companies within the production area in the two regions.

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In Denmark a central registry was available including software for selection. The selection from the initial 646.395 companies was filtered primarily upon the NACE codes (the European standard industrial classification). Production companies were targeted through the NACE codes in the range 15.00 to 37.20 (manufacturing) plus the codes between 72.21 and 72.22 (software). This brought the number of companies down to 48.262. The selection on NACE codes is based on the several (up to four) NACE codes supplied by the firm. "Production" might thus not be the main field of the company and the investigation ends up with overcoverage.

The companies should be located in a national region operationalized as a selection based upon postal codes which resulted in a set of 10.174 companies. The standard European complete definition of SME companies also includes economic measures of the company (European Commission, 2005). For practical reasons we concentrated on the attribute of number of employees (small companies have 10-49 employees and medium size companies 50-249 employees). Only few companies reported in the questionnaire figures outside the 10-250 employees. The final selection included common company types (limited, partnership, and individually owned) thus reducing the number of companies to 1.431.

Overcoverage caused by the broad definition of "production", the not fully precise regional boundary definition, and imprecise account of number of employees can obviously influence response-rates as some companies might experience themselves as not belonging to the defined population. Because of indications that this only affected very few companies this issue of overcoverage has not been empirically investigated.

The frame was lastly processed by the random selection of 505 companies for the sample. For these companies some registry variables were transferred (the selection criteria mentioned above plus appropriate contact information).

1.3 Selection from the local registries

In Germany a registry of companies placed at an organization of the regional companies served as the data source for our selection procedure. It is part of the general responsibilities of this organization to maintain this repository and the companies within the region are obliged to pay a yearly membership fee as well as to frequently report business figures. The assumption was made that a number of 500 companies could be found meeting the same criteria used for the national based selection procedure in Denmark as described above.

However, the list contained fewer companies than expected and a comparison to a company database maintained by participating business development agency revealed that some relevant companies were not included. It is assumed that the discrepancy between the two lists was caused by the latter list containing a more up-to-date status. This was confirmed when during the survey it turned out that some of the companies were closed down, had moved to another region, or had quite different numbers of employees than registered in the first list. With additions from the business agency list the total number of 526 companies for the sample was reached.

2. Response and nonresponse from the survey

The paper questionnaires with postage paid addressed envelope for easiest return was mailed out in the two regions in August (Germany) and September 2007 (Denmark).

The questionnaire was directed to the person responsible for production in the company. This should secure that the person would understand the questions as well as being able to supply the relevant information. The questionnaire included a field for reporting the name and position in the company of the respondent. From the Danish side - where this information is entered into the database - it is observable that a good third of the questionnaires were answered by the CEO while to a lesser degree the information was delivered by a production manager followed by several positions within the economic side of the company (including bookkeeper). As several companies are small the CEO can often be the owner and the bookkeeper might be the person also managing production while the CEO takes care of sales.

2.1 Nonresponse rates in the survey

Only a small number of companies returned the questionnaire without reminder. 32 Danish questionnaires of the 505 questionnaires mailed out were received. On the German side - where the mailing out of questionnaires took place a bit earlier in time - some questionnaires were received in late December as the survey was extended to a total of 526 companies. The response rate in both regions together was thus initially 8.4%. (87 received questionnaires of the 1031).

This very low response rate early triggered taking reminding actions. It was not expected that a mailed reminder to the companies would accomplish much more than the initial mailing. Instead a process of phone contacts was initiated. The phone method of contact was chosen because the change of in media-channel to more directness was considered helpful for the follow-ups and because follow-ups on the reminder could be carried out quickly. Furthermore, the phone reminder included the potential to further qualify the nonresponse as note taking was accompanying the phoning process. The reminding procedure was carried out on the basis of a randomly selected group among the nonrespondents of the companies. The systematic phone contacts to the companies lead to an overall increase of the response rate. On the Danish side 32 of the reminded companies returned the questionnaire and on the German side the number went up with 11 companies. When receiving the questionnaire the date was noted. The distribution of the received questionnaires is shown in Figure 1 below.

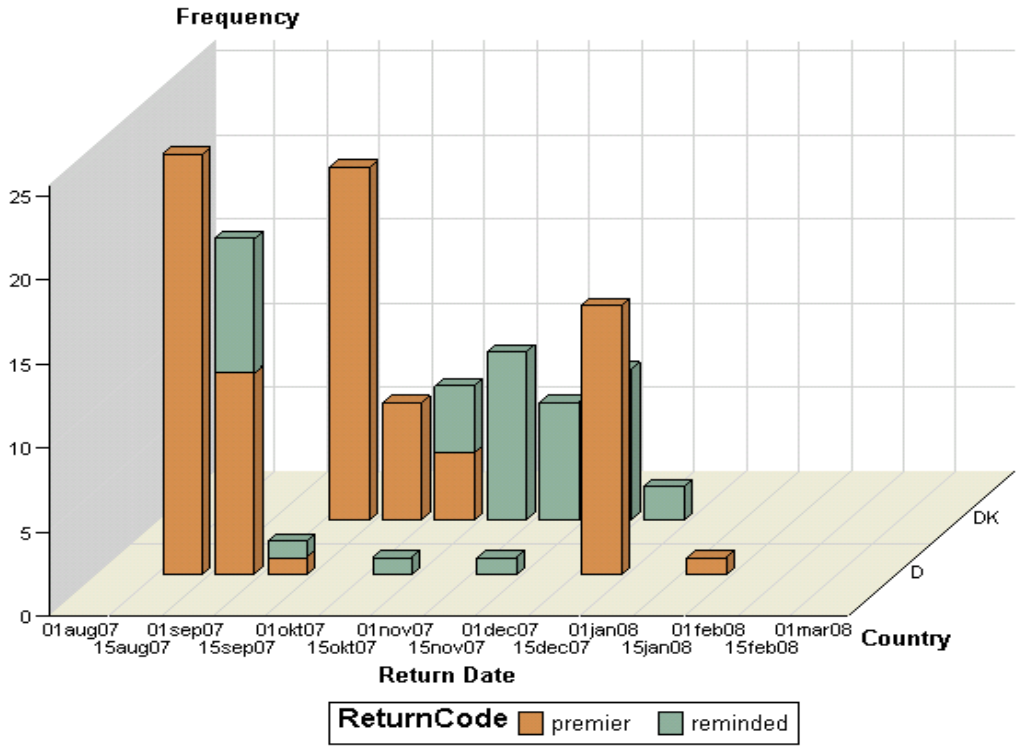

Figure 1: Received questionnaires distributed on response date, country, and reminder

The overall response of the survey gained and reached 12.6%. (64 and 66 respectively, 130 of 1031 companies).

2.2 Response rates in other SME surveys

Business surveys are known to produce unsatisfying response rates. An investigation of 183 business surveys since 1990 showed an average response rate of 21% (carried out by Paxson in 1992 (unpublished); referenced in Dillman (2007, p. 323)). Similar work by Baruch (1999) is referenced in Rogelberg and Stanton (2007) when reporting that the typical survey response rate in 1975 was 64,4 % but dropping to 50% in 1995. Baruch also found a lower response rate when the units were organizations and states in the abstract that "It is also recommended that a distinction is made between surveys directed at individual participants and those targeting organizational representatives" (Baruch, 1999, p. 421). Furthermore, we believe that some changes are more prevalent among SMEs

- such as company name change, address change, mergers etc. - and that these changes are among the possible causes of low response rates.

In studies of response rates for business surveys it is observed that: "an authoritative sponsor and a legal mandate clearly produce higher response rates among businesses" and "university survey researchers appear to suffer from substantially higher nonresponse rates in business surveys than do government agencies" (Willimack et al., 2002, p. 214, 215). It is hardly surprising that the more official data collections are able to obtain response rates up to 90%. In addition to carrying the official badge of legitimacy official surveys might even be directly legally enforcing the answering. However, the problem of nonresponse in business surveys is even higher when we turn to studies of SMEs. Business surveys are often investigating the larger companies and not the small and medium size companies. This is furthermore accentuated as Northern American SME studies are covering companies with up to 500 employees compared to the 250 in Europe (used in our research).

A recent regional SME study on "Enterprise competencies for effective information systems and information management: a quantitative and qualitative study of the SME sector within Wales" (Jones et al., 2003) used a similar study approach as our project. The quantitative questionnaire investigation obtained a response rate of 26%.

In a large study on eBusiness carried out at the Cranfield School of Management in 2002 (Daniel et al.) 6.500 SME companies were selected. After "de-selection" a response rate of 10.4% were obtained. The researchers' acceptance of the interest-based "de-selection" from companies not considering nor presently using eBusiness makes the response rates unusable for evaluation of the survey. These SME figures are compared to an investigation of 13.500 larger firms where a surprisingly even lower response rate (4.5%) was obtained (Daniel & Grimshaw, 2002, p. 139).

In Singapore small business were investigated with an immediate impressive survey response rate of 40.6% (Thong, 1999). The rate is obtained by 166 companies responding out of original 1200 companies that are scaled down to 409 because the other companies had moved or simply ceased to exist. This is another example of "de-selection" or positively phrased self-selection. The mortality of the companies in this investigation is of a magnitude that ought to make that issue the focus of attention. The high response rate could be said to only cover very steady companies. An equally high response rate of 42% was obtained in an Australian survey reported in Goode & Stevens (2000).

Forty years ago response rates below 80% were often considered worth improving. Bachrack and Scoble (1967) made an extra effort with a special follow up and obtained an 83% response rate. These days the company response rates at 40% are gaining respect and surveys even go as low as 4% without much consideration (Daniel & Grimshaw, 2002). In our survey investigation of SME companies the response rate of 12.6% is thus considered within reasonable and expected limits. However, none of these response rates guarantee the power of valid generalization.

2.3 Relationship and confusion between survey error and nonresponse

Dillman investigates in his work on surveys the errors based on coverage, sampling, measurement, and nonresponse (2007, p. 11). Dillman exemplifies that the error categories can often be mistaken and confused as some (non-professional) surveyors will note that follow-ups are not necessary as with about 1000 questionnaires the accuracy will be about 3% (Dillman, 2007, p. 194). Statements like that clearly focus on sampling error theory while disregarding the error affected by other sources.
To illustrate the severe effects of nonresponse we will exemplify through the possible extremes. When we for instance find that 64 of the 130 answering companies report that they maintain an internet-site in English language we can calculate that to 50%. Based upon the small sample of 130 companies the 95%-confidence interval is calculated to a proportion between 0.41 and 0.59 when we are not taking the nonresponse into account. However, on one extreme we could assume that all of the non-responding companies (901) in reality do have an English internet-site (result: 965 of 1031 = 94%). Secondly, we could at the other extreme assume that none of the nonresponse companies have an English internet-page (result: 64 of 1031 = 6%). Thus according to our calculations obtained with inclusion of possible nonresponse we can assume that the factual percentage is to be found somewhere between 6% and 94%. That level of inaccuracy implies that further investigation into the reasons of nonresponse will be valuable in order to be able to react on the results from the investigation. Figure 2 illustrates how rates of nonresponse at 20%, 40% and 80% affect the recalculated confidence interval.

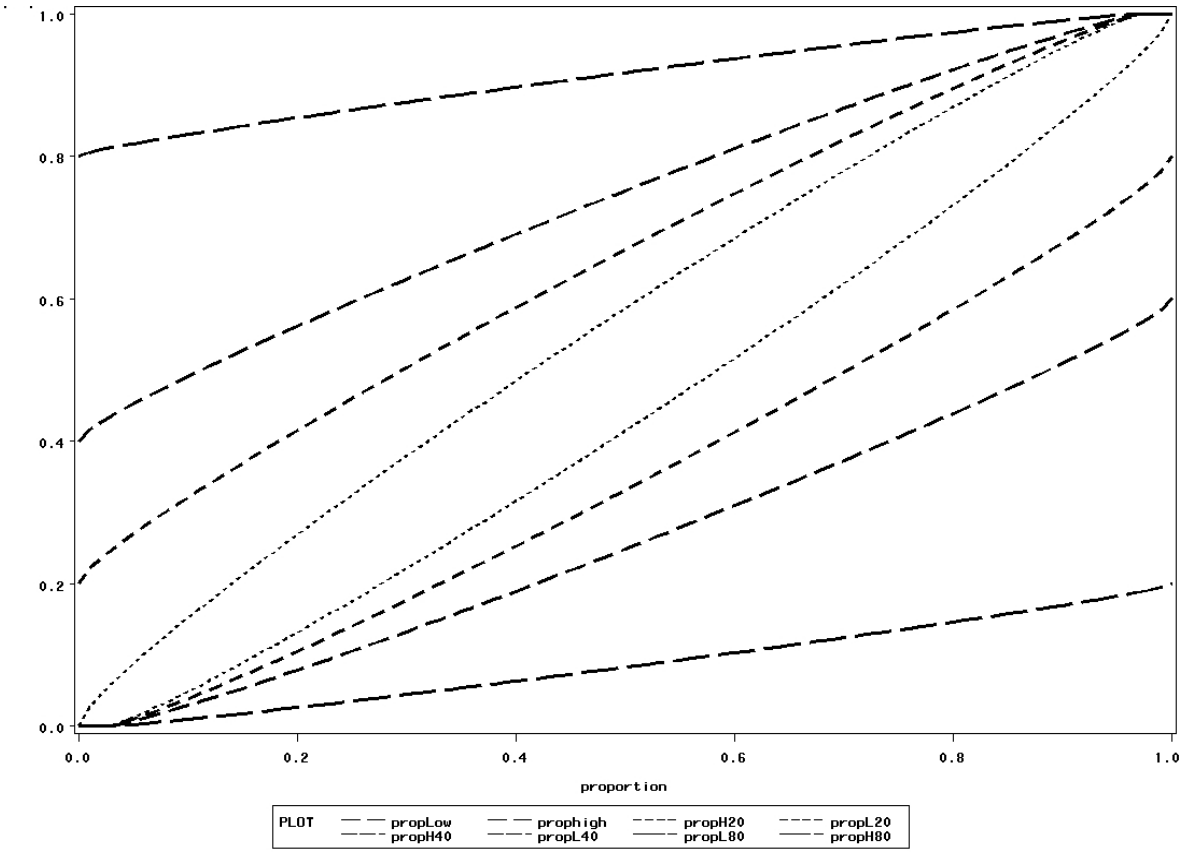

Figure 2: Confidence intervals recalculated for per cent of nonresponse

Figure 2 exemplifies how high rates of nonresponse result in very broad confidence intervals that are practically ruining the possible information about the found proportion. With 80% nonresponse even the most extreme proportion can be turned in the other direction e.g. as 0% found in the survey cannot guarantee that 80% cannot be found in the population.

3. Investigations into nonresponse

Lynn identifies several reasons for nonresponse:

> *"a. Failure of the data collector to locate/identify the sample unit*
>
> *b.Failure to make contact with the sample unit*
>
> *c.Refusal of the sample unit to participate*
>
> *d.Inability of the sample unit to participate (e.g. ill health, absence, etc.)*
>
> *e.Inability of the data collector and sample unit to communicate (e.g. language barriers)*
>
> *f.Accidental loss of the data/questionnaire" (Lynn, 2008, p. 37)*

In this company survey the registry on the Danish side is judged to be very well updated as the selected companies existed and the corresponding addresses seemed to be correct. This observation is based upon the fact that the postal service did not return the mail. On the German side the register was less well updated. The categories concerning inability or accidents are considered less relevant for this survey as a company is contacted and an able person should be available. The central category concerning nonresponse for this study is thus the refusal from the company towards participation in the survey.

3.1 Comparison between responding and nonresponding companies

Rogelberg and Stanton (2007) name the comparison of responding companies and the nonresponding companies with regards to known company attributes like size; age etc. as "archival analysis" in their overview of "nonresponse bias impact assessment strategy (N-BIAS)" that is regarded as a list of "best practices". Such comparisons of survey results from the completed sample

with known values from the sample frame are a search for differences. The table below shows (Table 1) that in our research the observed differences were not found to be significant (95% level).

Table 1: Archival analysis means for size (no. of employees) and age (established year) for responding and non-responding companies (Denmark only)

Attribute	Responding	Non-responding	Significance
No. of employees	43,8	44,9	non-significant
Established year	1974,2	1976,6	non-significant
	N = 64	N = 441	

The comparisons are made in order to obtain evidence that generalizations are not (yes, not!) possible. Armstrong and Overton (1977) are referencing George Gallup (1972) that the method "comparison with known values for the population" could have hindered the failure of Literary Digest when the magazine wrongly predicting the outcome of the Roosevelt-Landon election in 1936. However, not finding significant differences simply preclude these specific variables as having a significant effect on the answering pattern and this is not supplying logical support that there is no difference between the responding and the nonresponding companies. The method is then a demonstration of the fact that we have not pin-pointed the company attributes that effect the company to decide for the response or the nonresponse. Without confirmed theory of nonresponse this test can at best only prove that our sampling results are invalid for generalization by being supported by significant difference.

3.2 Imputation for nonresponse

Imputation is a method of "filling in a value for each missing value" (Rubin, 1987, p. 11). This is the introductory message in Rubin's book on the more advanced method of "multiple imputation" that he is advocating. Imputation sounds like a simple procedure and Donald Rubin concentrates in the immediate following on the advantages of this imputation primarily that the imputation makes it possible to use complete-data methods. With computations of incomplete data like calculating the average of a vector of values where one or more values are missing must necessarily result in the resulting value becoming undefined or "missing". Imputation completes the vector. However, an obvious and still interesting question is which value to select for imputation. Software including features for imputation will typically provide several imputation procedures like: mean, hot-deck, regression etc. (Matignon, 2007, p. 180). The question of selecting the imputation procedure is not simple and the advantages of the different methods are typically given in the form of their easy computability. Rubin (1987) is aware of the added costs of imputation and remarks that the efforts should be regarded relative to the alternatives such as "field efforts aimed at reducing nonresponse or increasing sample size". This illustrates that even at the highest level of expertise - where Rubin certainly belongs - we can experience that the absolute number of respondents is regarded as the central measure that matters most in the evaluation of a survey. Rubin also continues that the imputation can be improved by relying upon the data collector's knowledge. It ought to be noted that this is likely to generate all kinds of interesting errors when the data imputator first is following a hypothesis when performing the imputation and then secondly is trying to find evidence of the same hypothesis in the data. And will quite likely succeed in that. This is serious implementation of a self-fulfilling prophecy. A variation of this approach is used in the regression techniques applied for extending the coverage in an Internet based survey to a larger population (Dever et al., 2008) although the authors in their conclusion write about the respondents: “Whether estimates from this restricted group can be used to make inferences about a larger population depends on whether households that have Internet access are different from the general population of households” (op. cit., p. 59). We are still waiting for the miracles.

Among the hypothesis based imputations are the group of methods of extrapolations.

3.3 Extrapolation to nonresponse

The extrapolation technique for investigation of nonresponse bias is named "wave analysis" in N-BIAS (Rogelberg & Stanton, 2007). The "data collector's knowledge" is argued to be that if late respondents at a second point in time differ in an explicit direction from the early respondents then the nonrespondents will differ likewise at a third point in time (imputation by regression and projection). The easy solution is obtained when the observations do not differ, because then - voila - this will in the same stream of thought imply that nonrespondents do not differ from the respondents. However, this is not a logical conclusion to the unknown. The method was applied in some of the earlier

mentioned studies with a welcomed result: "No significant differences were found between the responses of these two groups for either of the surveys. It was therefore concluded that the responses received were unlikely to contain a non-response bias." (Daniel & Grimshaw, 2002, p. 139). Similar comparison calculations using Mann-Whitney rank tests were performed by Goode and Stevens although they are more cautious when concluding: "However, determining nonresponse bias is error-prone, and the results of the response analysis above may be inaccurate" (Goode & Stevens, 2000, p. 137).

Goode and Stevens are right being cautious as they are also referencing Filion that 25 years earlier investigated the method. Even though Filion in the discussion in the article wrote more positively about the method - although including that this opinion was based upon a survey with a response rate of around 70% - he concludes: "Observations in this study should warn researchers against assuming that respondents do not differ from nonrespondents" (Filion, 1975, p. 492). In our opinion the key lies in obtaining further information about the nonrespondents.

3.4 Information from the nonrespondents

In our study the feeble response rate early called for some extra action in order to obtain questionnaires from more of the companies in the sample. In the chosen reminding phone process it was sought to obtain direct contact with the person that by the company was considered responsible for the further processing of the questionnaire. Reaching this designated person could involve several phone calls and through the process remarks were noted and reacted upon (e.g. sending new questionnaire or stopping phoning the company). The answers did not contain that much variation and the noted text were later distributed into the ten categories shown in Table 2 below. These categories was further collapsed into the fewer general categories shown to the right in the table.

Table 2: Categorization of remarks received in the reminding process carried out by phone

	Country		Both	Total	Nick-
	Germany	Denmark			name
Does not have the questionnaire (a new is sent)	43	45	88		
	9.31	10.20			
The proper person does not have the questionnaire (a new is sent)	11	33	44		
	2.38	7.48			
Will download the questionnaire	1	5	6		
	0.22	1.13			
Questionnaire has already been returned (but has not been received)	1	6	7		
	0.22	1.36			
Will locate the questionnaire, look into the matter, a message is given	21	5	26	171	Passive
	4.55	1.13			polite
Don't have the time	61	58	119	119	Passive
	13.20	13.15			busy
Have no interest in this area	34	74	108		
	7.36	16.78			Active
Never answers that, don't give this kind of information	47	7	54	162	missing interest
	10.17	1.59			
Phone number does not exist	20	2	22		Not there
	4.33	0.45			
Not reachable	35	28	63	85	
	7.58	6.35			
Not included in the phone campaign	186	178	364	364	Not selected
	40.69	40.36			

	Country		Both	Total	Nick-name
	Germany	Denmark			
Total nonresponse	460	441	901	901	
Response	66	64	130	130	
Total	526	505	1031	1031	

Nonresponse is classified as "passive" when "the nonrespondent may have wanted to return the survey, but because of circumstances or happenstance, could not" (Rogelberg et al., 2003, p. 1105) and are because of their random character believed not to be creating nonresponse bias (Rogelberg and Stanton, 2007, p. 200). We have explicitly included the labels "polite" and "busy" to this passive group. The categorization "polite" is used as some companies are believed choosing to avoid giving the phone caller an explanation for not returning the questionnaire. Naturally there might have been postal problems, but some companies requested and were sent the questionnaire three times in total - and still stayed in the nonresponse group. We are also considering the "polite" answers as "socially acceptable" although not "socially desirable" answers (Phillips & Clancy, 1972) and thus maybe more planned than argued in the Rogelberg articles. Several other reasons are also believed crucial for nonresponse e.g. vacation period, holidays, workload situation etc. These possibilities have not been systematically investigated in this research.

The "active" nonrespondents choose not to respond. According to Rogelberg and Stanton (2007, p. 201) this group can bear serious nonresponse bias. It is remarkable that companies in Denmark more directly and specifically are expressing their non-interest in this research while the German active nonresponse companies tend to express general norms of the company as an explanation. This could be a cultural difference between Denmark and Germany. You could say that the expressed "non-interest" is somewhat close to being in opposition to the interviewer, while the general psychological reaction when approached by the interviewer (a stranger) would be not to disagree or raise opposition. Rogelberg and Stanton introduce a 15% active nonresponse "best practice" limit. The active nonresponse in this research is on the edge of this percentage (162 nonrespondents of 1031 targeted for the survey). We believe this fact indeed compromises the generalizability of the survey which is why we have looked further into other methods of obtaining more information to elucidate the area of nonresponse.

3.5 Mixed mode methods

When applying another collection method for obtaining data the procedure is labeled as using "mixed mode survey" (Dillman, 2007, p. 217). Dillman is refering to an early study (Hochstim, 1967) that showed how groups of people reported their health as excellent differed by the mode of data collection as there was a drop from 44% for personal interview to 37% by telephone and 30% by mail. A typical technique was earlier adding telephone surveys to postal surveys when contacting different members of the sample in order to obtain data values for the same variables. Later other modes have been employed such as e-mail (Schaefer & Dillman, 1998). These days mixed mode methods often includes the possibility of a web questionnaire and Meckel et al. (2005) have conducted such a questionnaire effort on SME companies. The rationale was and is that with parallel mixed mode efforts the respondent will have a choice of mode. For less sensitive questions the mode does not appear to have significance for the answering pattern. Often mixed mode is carried out sequentially and by the additional effort and by using another mode of communication the response rate is likely to grow. The nonrespondents from the first effort (e.g. the postal questionnaire) will to some degree choose to respond to the survey when contacted by phone.

The follow up made in our investigation is utilizing mixed mode methods. However, our (repeated) telephone contacts were not designed to obtain information concerning the variables in the survey. The telephone mode method was acting as a go-between in order to be able to resend the questionnaire in paper form to an interested person in the company. However, the design of the telephone process did supply us with the benefit of obtaining more information about the nonrespondents.

The comparison to known values - the "archival analysis" (Rogelberg & Stanton, 2007) - can also be regarded as a type of mixed mode method where the respondents are the same (the sample) and some variables are obtained both from the register and also for validation purposes obtained in the

questionnaire. The "archival analysis" is obtaining the archive data from another source and consequently also through another mode.

Other types of methods for including other sources of data can likewise be regarded as variants of "mixed mode". The inclusion of further information on the nonrespondents must typically be obtained though other modes.

3.6 Inclusion of external data

Generating data from nonresponse is a fundamental impossibility. Logic then leads to a search for sources external to the nonrespondents. This is partly found in the available registers. Another possibility is observation, tracing, or surveillance of behavior. We are using the following operational proxy.

When considering active nonresponse the interest of the respondent is believed to be the key explanation. We are expecting companies with more interest in the subject of ICT and networking also to be more in contact with the regional business development agencies. The interest, beliefs, and experiences of the nonresponse companies cannot be investigated directly. We are applying a view in the other direction as we expect this contact can be observed reciprocally. Our operationalization generates data about contact with the companies from development agencies collected from two sources that proved to be in significant agreement. We are expecting that companies where the development agencies already have had contact in the past will more often be accepting the invitations from development agencies and participate in the survey because of their interest in the development issues. If this hypothesis is supported we may conclude that some not interested companies outside contact are severely more difficult to reach both for development agencies as well as for participation in university surveys concerning ICT.

Table 3: Survey participation and contact with business agency (Denmark only)

Survey	No contact	Contact	Total
Nonresponse	413 88.3%	28 75.7%	441
Participation	55 11.3%	9 24.3%	64
Total	468	37	505

The relationship between having the contact and participation in the survey proves significant (Table 3). Because of the small numbers calculation of significance is based upon Fisher's Exact Test.

4. Conclusion and hindsight

It is possible to obtain a significantly higher response rate among the companies with contact to the business agencies. However, 24.3% is not satisfactory either. In order to improve the response rate we will have in the future to apply further "response facilitation techniques" (as collected in Rogelberg and Stanton (2007, p. 197)) in addition to those already applied in this survey.

While the passive nonresponse can be considered harmless to a survey the active nonresponse caused by missing interest in the subject area can lead to a bias that seriously damages the results. Research will seriously be obstructed in gaining insight into the causes of the missing interest. In the hindsight, we will propose using a two-stage technique where the first stage involves only a very small effort of information activity from the company. The limited information request will still make it possible for the researchers to obtain the same amount of information by additional application of mixed methods (e.g. phone & web) and thus ensuring answers and validity in terms of a reasonable response rate in the first stage. Those companies that are indeed interested in the subject area could be approached for further research of quantitative longer questionnaires. Both groups of respondents as well as groups of nonrespondents could be investigated though participation in qualitative interviews. This could be an avenue to pursuit also for the practical concerns of the development agencies in answering: "How is it possible to reach the hard-to-reach?"

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