

THE DELPHI TECHNIQUE: LESSONS LEARNED FROM A FIRST TIME RESEARCHER

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ABSTRACT

As a first time researcher, the thought of completing a Doctoral dissertation in a predetermined amount of time can be daunting. What methodology should be followed? Is the study being done the correct way? When can a researcher deviate from the given path in order to successfully complete the study? These are only a few of the questions that could populate the thinking of a first time researcher. This paper was written in order to help calm the nerves and minds of first time researchers, particularly Doctoral candidates. In order to do that, I will take the reader through a first person, step-by-step guide of my doctoral research methodology, the Delphi technique. This paper hopes to answer questions about the Delphi technique for a first time practitioner.

Keywords: Delphi, Dissertation, Research, Doctoral, First-Time, Lessons Learned

INTRODUCTION

The objective of this paper is to explain the Delphi technique through the eyes of a first time researcher. To accomplish this objective, this paper will be written from a first person point of view. The hope is to answer questions and concerns that could not be found as I was performing my research, as well as provide lessons learned in order to help future first time researchers employ the Delphi technique for their studies.

What is Delphi?

Norman Dalkey originated the Delphi technique at the RAND Corporation in the 1950s. The technique was developed to try and reduce bias due to group dynamics. It was believed by controlling the anonymity of the study participants, they would provide their true opinions, and not give into pressures brought about by group dynamics. The main objective was to garner a consensus from industry experts based on individual opinions (Dalkey, 1967, pp. 1-3). There is a particular structure to the Delphi technique that helps eliminate bias within the group.

Using the Delphi method, the researcher takes the panel of experts through multiple iterations of questionnaires. According to Dalkey (1967), these multiple iterations, or rounds, are used to elicit and refine the opinions of the panel. The multiple rounds are used to form a consensus amongst the group, while protecting the anonymity of the panel members, and eliminating bias generated by group dynamics (pp. 1-3). For the study, using the Delphi method allowed me to gather the opinions of industry experts, without gathering them as group in one location.

The purpose of my study was to rank the critical success factors for implementing an electronic health records system in the *cloud*. To accomplish this, a modified Delphi method developed by Roy C. Schmidt, specifically designed for ranking-type studies, was used. This version of Delphi uses three distinct phases of data collection and analysis. The first phase is issue discovery, where you gather the opinions of the expert panel using an open-ended question concerning the study's subject matter. In the second phase, the expert's initial opinions are combined into like statements and themes, and the panel is asked to select a specific number of top opinions from the list. The feedback from the experts is analyzed for consensus, and a new, smaller list is generated. In the third phase, the expert panel is asked to rank the remaining list in order of importance (Schmidt, 1997, pp. 768-770). This results in a final list of factors generated by the expert panel.

Why Delphi?

The purpose of the study was to find critical success factors for EHR implementations in a centralized computing services structure, or *the cloud*. There have been studies researching EHR implementations, but none of them encompassed EHR implementations in a *cloud-based* scenario. The study was designed to provide research to fill that void in the literature by establishing a ranked list of critical success factors for implementing an EHR in *the cloud*.

The study was conducted between August 2013 and January 2014. Participants in the study consisted of practice and office managers, hospital IT directors and IT staff, healthcare IT consultants, and EHR software vendors. Most of the participants were from organizations in Western Pennsylvania and Eastern Ohio. However, some panel members from EHR software vendors were based in Missouri, New Jersey, and Ohio.

Due to the nature of the medical industry during the dates of the study, and the potential for a limited number of participants, a methodology was needed that could accurately represent a larger sample size. In order to complete the study on time, a research methodology that required a smaller number of participants, but was still representative of the population being studied, was needed. Reading through other medical and IT studies, the Delphi technique quickly emerged as a viable option. One quote in particular from Julian de Meyrick caught my attention. He (2003) wrote,

“The Delphi research method is particularly suited to health issues. On many important health issues, there is a relatively small group of acknowledged experts whose knowledge and opinions are the only real guide to best practice in relation to the issue of concern; a large survey would not be appropriate” (p. 7)

Further evidence was provided by Kinney, Hasson, and McKenna (2011), who stated “In general, estimates of the use of the Delphi method in nursing and health-related services research are increasing...indicating that the technique has a firm and definite place in health-care development” (p. 41). Based upon this growing evidence of use, the possibility of limited expert participation, and potential geographic limitations, the Delphi method was chosen for the study.

THE RESEARCH STUDY

Selecting Participants

The study needed experts, or panel members, in the field of EHR implementations in *the cloud*. The first step was to determine how many experts were needed for a valid Delphi study. Delphi studies do not need large numbers of participants for validity. According to Okoli and Palowski (2004), the suggested size for a Delphi panel is between 10 and 18 participants (p. 19). Schmidt, Lyytinen, Keil, and Cule (2001) stated “The aim was to form panels that were large enough to allow diversity of opinion, but small enough to allow the panelists to handle the volume of feedback” (p. 11). This size for the expert panel was legitimized through a study conducted by Akins, Tolson, and Cole (2005) in which they generated computer samples of panels ranging from 1000 to 2000 participants based on a group of 23 participants. The study found that when responses from a small group focus on one specific knowledge area, they are similar to responses from a larger group (pp. 9-10). Based on these studies and suggestions, this study involved a total of 25 individual experts.

The expert panel was kept intentionally diverse in order to elicit expert opinions from multiple factions involved in the EHR implementation process, and to eliminate bias from the study. The selection philosophy in a study done by Schmidt et al. (2001), was similar. In the study done by Schmidt, they chose panels from three different countries in order to “lessen the effect of a single-culture bias and to broaden our view of risk factors and their ranking” (p.7). For my study, the panel consisted of Chief Information Officers in hospitals, healthcare IT consultants, hospital IT staff, physician practice staff, and EHR software vendors. The characteristic the expert panel had in common was

their extensive knowledge of EHR implementations in a *cloud-based* scenario. Due to this extensive knowledge, for the purposes of this study, they were considered experts.

What constitutes an expert, making the person eligible to participate in a Delphi study panel? For every study, the definition of expert will vary. For this study, to be considered an expert, the participant needed to fall within six unique categories: (1) The participant is an office manager, physician, or healthcare professional in a medical practice which is currently using a cloud-based EHR system; (2) The participant has installed an EHR in a cloud-based scenario; (3) Managed an EHR in a cloud-based scenario; (4) Designed an EHR implementation for a cloud-based scenario; (5) Helped integrate a cloud-based solution into a medical practice; or (6) Consulted with a medical practice to help determine which EHR to implement.

An initial group of existing professional acquaintances were contacted via phone and the particulars of the study were described. If they gave their verbal consent, a link to a website was provided. The website further explained the study and asked for the participant's written consent to continue. Whether they accepted, or declined, a process called volunteer sampling was used to solicit names of other potential study participants from this initial group, by allowing them to nominate other potential experts that may have been willing to participate in the study (Keeling, 2011, p. 3; O'Leary, 2010, p. 170). The nominees were then contacted to determine their interest in participating. For the study, the panel in the first round consisted of 24 participants, 22 participants in round two, and 22 participants in the round three. Participation for the entire study consisted of 25 unique participants, regardless of the round.

Selecting Participants: Lessons Learned

This was one of the most difficult parts of the Delphi process. First, I needed to determine what constitutes an expert in the field being researched. The literature review was very important to help determine the studies definition of "expert". Having the correct mix of participants on the panel was critical to the study.

Second, I needed to make sure to have a large list of potential experts to ask to join the study. Initially, 38 experts were asked to take part in the study panel. Of those 38, 24 responded to the first round survey, and of those 24, only 21 provided opinions on what critical success factors were needed for a *cloud-based* EHR implementation. There would also be attrition in subsequent rounds of the survey, so initial participation was key.

Round One

Traditionally, the first round of a Delphi study is an introduction to the study and a gathering of the initial expert opinions in order to create a list for the second round. This is done by asking the participants an open-ended question and allowing them to give opinions freely (Keeney et al., 2011, pp. 69-70). For this study, the first round lasted 29 days due to its critical nature in the study's success.

The first step in round one was to provide the instrumentation, or survey, to the panel. According to Grisham (2008), a platform was needed that can be easily accessed over the Internet, allowed the panel members the freedom to openly respond, kept track of the panel member's responses, and allowed the researcher to download those responses for external analysis (p. 120). For the study, it was decided to use an online survey format through a provider called Survey Monkey. This site provided all the necessities for completing a Delphi survey.

The first survey provided an introduction to the Delphi process and the study as described by Keeney et al. (2011), where it is stated "the researcher should send an information pack to each panel member which should include a cover letter and instructions on how to complete the round one questionnaire" (p. 70). It also provided a breakdown of how the Delphi process worked, following Grisham's (2008) advice that the researcher should "...introduce each potential panel member to the Delphi approach..." (p. 120). Once the potential panel members were informed about the study and the process, they were asked for their consent to continue.

Also part of the initial survey was the gathering of demographic information on the panel members, in order to allow me to run quantitative analysis if needed (Keeney et al., 2011, p. 70). Included in the demographic information

collected was age, gender, what type of organization the panel member is employed by, and the level of involvement each panel member had in the implementation or use of *cloud-based* EHR systems.

The main purpose of the first round is to ask the initial open-ended question to the panel. The main concern is determining how many factors, or opinions, to ask for from the panel members. Depending on the number of participants and the number of factors solicited, the list for the second round of the study could be large (Keeney, 2011, p. 71). It was determined, through pilot testing, that the panel members would be asked to provide between three and six critical success factors for implementing a *cloud-based* EHR, providing a potential pool of 144 factors. Based upon literature review, 144 was deemed to be a manageable number of factors to consolidate for round two.

A pilot was performed to make sure the survey instrument was valid, instructions and questions were understood, the completion of the survey did not take too long, and to determine the ideal number of factors to solicit. The pilot testers were technology professionals with EHR implementation experience that were not participating in the study so they were representative of the larger Delphi expert panel (Nardi, 2006, pp. 95-96). The pilot group consisted of a healthcare IT consulting firm salesperson, a healthcare IT consulting firm marketing professional, and a healthcare IT consulting firm general manager.

As stated previously, this round lasted 29 days. Due to the criticality of the first round, and to ensure response rate, reminders were sent to the panel twice in round one (Keeney et al., 2011, p. 71). Answers to the survey were provided by 21 of the initial panel members.

The next step was data analysis. In accordance with Keeney et.al (2011) the success factors provided were entered into Microsoft Word. This allowed for manipulation of the statements provided by the expert panel (p. 85). This also helped in providing a base for creating the round two survey. Once this was completed, the next step was to combine all like statements into themes using In Vivo and Descriptive coding methods (Saldana, 2013, pp. 262, 264). This allowed me to determine if there were duplicate or similar factors provided by the panel members. These could then be combined into one reflective statement, keeping as close to the original statements as possible, to include in the round two survey (Keeney, 2011, p. 85). There were 88 critical success factors after the data analysis was performed.

Round One: Lessons Learned

Round one was the most critical round of the study. If enough panel members did not respond to the survey, or enough success factors were not gathered, the remainder of the study could not be accomplished. This round was the basis for the whole research study.

The first lesson learned was to make sure my survey instrument was easily accessible, easy to follow, described the process correctly, and asked for the right number of opinions, or factors. This can be accomplished by running a pilot of the survey instrument. A pilot was not going to be performed at first because I did not see it as part of the literature for a Schmidt Ranking Delphi study. However, through further literature review, it was realized this would be critical to the study's success. Based upon the pilot study, the survey instrument could be fine-tuned, and the correct number of factors could be asked for from each panel member, allowing for a more manageable data analysis phase for round one.

Another lesson learned was to make sure your panel's provided answers are placed into correct themes. This will allow you to combine like statements effectively, giving your panel members more concise choices to choose from in round two. Unfortunately, I did not effectively combine my statements in round one, which led to extra data analysis in round two.

Round Two

In a Delphi study, the second round is used to further pare down the list of factors provided in round one. Traditionally, this is accomplished by having panel members rank the importance of each factor collected in round one (Keeney, 2011, p. 74). Since this study used Schmidt's Ranking Delphi method, round two was used to "...pare

the list of issues so that they can be meaningfully ranked”, with the goal being to get a list of 20 factors to be carried over to round three (Schmidt, 1997, pp. 769-770). Round two is critical for reducing the number of factors in order to get a manageable list of factors for round three of the study.

The round two survey presented to the expert panel consisted of 88 factors from the first round. The survey also contained instructions for the panel members to choose their top ten critical success factors for EHR implementations in *the cloud* from the list provided. Schmidt (1997) recommends that “...at least 10% (or more if the list contains less than 100 items)” be selected by the panel in round two (p. 769). The same group of pilot testers was used for round two. This was again done to make sure the survey tool was understood (Nardi, 2006, pp. 95-96). The list was presented to the panel using Survey Monkey.

Communications were made with the expert panel via e-mail. During round two, there were two email reminders sent to panel members for completion of the survey. This was done to make sure as many of the first round respondents participated in round two, and to keep the panel members engaged in the study (Keeney, 2011, p. 78). The second round lasted a total of 20 days.

At the end of round two, only 21 of the original panel members responded to the survey. However, an additional panel member that was originally invited, but did not participate in round one, participated in round two. This brought the total number of round two panel participants to 22.

Once all data was collected, a four column table was created to analyze the responses. At this point, according to Schmidt (1997) the panel members were split into healthcare IT, EHR software vendor, and healthcare IT consultant (p. 770). This allowed for response analysis based upon individual groups, as well as all panel members together. The four column table allowed me to track panel member responses and determine consensus amongst the panel members.

Round Two: Lessons Learned

There were two lessons learned from round two. The first was, do not get discouraged if there is panel member attrition. You will lose panel members throughout the study. The trick is to have the right size panel initially, so losing a few panel members along the way will not negatively affect the study.

The second lesson learned was make sure your initial factors in round one are put into correct themes and sufficiently combined. As I was analyzing the results from round two, there was very little consensus. This would lead to the original goal of round two to shorten the list of factors to 20 not being accomplished. After further investigation, I noticed that the initial list of critical success factors was not combined sufficiently. This led to the list of factors being too large in round two. Luckily, like statements were able to be combined into their correct themes and the list of factors for round three was shortened.

Round Three

As previously stated, the goal of round two to shorten the list of factors to 20 for round three was not achieved. In order to continue the survey process, the list needed to be pared by combining like statements into their correct themes. This is in accordance with the Schmidt Delphi method (Schmidt, 1997, p. 770). Criteria were established, and all data was analyzed. Any factors that did not gain any votes in the second round were eliminated from the study. This was based on a similar style study performed by Couger in 1988 (Schmidt, 1997, p. 770). If factors were combined, and gained the necessary consensus level, they were added to the round three survey.

In studies performed by Schmidt, consensus was considered 50% of the panel members choosing a factor as important (Schmidt et. al, 2001, pp. 11-13). For the purposes of moving on to round three, a consensus level of 50% was established for this study. This meant that 50% of the respondents needed to choose a particular critical success factor in round two in order for it to move on to round three. Two factors that did not gain 50% consensus were added to round three based upon the literature review.

The third round survey consisted of 37 factors from phase two. The instructions for round three were to choose the top 20 critical success factors for *cloud-based* EHR implementations from the list of 37 factors provided. Once they picked their top twenty, they were asked to rank from one to twenty, with one being the most important factor. The survey was once again put through a pilot test with the same group that pilot tested rounds one and two. Due to the pilot test, an explanation for how Survey Monkey would handle the ranking of factors was provided. Once again, email reminders were sent to all panel members concerning the completion of the round three survey. Once all data was received, it was analyzed to determine the top critical success factors for implementing an EHR system in *the cloud*.

Round Three: Lessons Learned

The main lesson learned was that the Delphi method is extremely flexible. Being a first time researcher, this was important. It allowed for mistakes through the study that could be corrected in future rounds. In this case, the mistake of not paring down the list in the round one analysis phase did not hurt the study. I was able to compensate in subsequent rounds. In fact, the compensation in the third round led to some interesting findings during the third round data analysis phase. It also led me to add a fourth round to my study.

Round Four

After phase three, there was consensus among the panel for what factors were selected within the top 20 critical success factors. However, there was very little consensus as to the rankings of these success factors. For validation purposes, and to investigate reasons for the lack of ranking consensus, three additional interviews were performed. As written by Skulmoski, Hartman, and Krahn (2007), "For PhD research conducted in our program, the Delphi results are often extended with a subsequent research phase such as interviews or surveys" (p. 5). A general manager of a Health IT consulting firm, a high-level executive from an EHR software vendor, and a practice manager for a sports medicine practice who had implemented both onsite and *cloud-based* EHR systems were interviewed during this round.

An interview template was created to ensure all three interviewees had an opportunity to answer the same questions. Once the interviews were completed and transcribed, they were loaded into an interview answer template, and analyzed for themes. These themes were used to validate the rankings tabulated in round three.

Round Four: Lessons Learned

The inclusion of interviews in the Delphi study once again showed the flexibility of this method. By including the interviews in the Delphi study, I was able to prove the validity of my survey results. This showed that even though changes were made to the base Delphi protocol, flexibility in the method allowed me as the researcher to complete the study in an effective manner.

CONCLUSION

During this study I learned many lessons concerning using the Delphi technique for research. They include the following: (1) having the right mix of experts on the study panel; (2) having the correct amount of experts on the study panel; (3) make a survey instrument that is easily accessible, easy to follow, describes the process, and asks for a manageable number of factors; (4) diligently add the panels answers into themes; (5) make sure to combine all like statements in round one into one representative factor for the round two survey; (6) do not worry if panel members drop out in rounds two or three, especially if you did a good job choosing panel members before round one; (7) the Delphi technique is extremely flexible, so don't worry if a small mistake is made along the way; (8) there is always potential to add rounds, or other techniques in order to improve the study.

The number one lesson learned was for a first time researcher, using the Delphi technique is a great choice. I feel this especially holds true for doctoral students trying to complete a dissertation in a predetermined amount of time. The Delphi technique allows for the possibility of multiple research methods, including qualitative and quantitative.

Researchers are exposed to multiple rounds of survey writing, qualitative data analysis, and potentially quantitative data analysis. In my case, I was also exposed to interviewing. The researcher also has the ability to work with a small group of experts, making communication and data analysis manageable.

REFERENCES

- Akins, R.B., Tolson, H., Cole, B.R. (2005). Stability of response characteristics of a Delphi panel: application of bootstrap data expansion. *BMC Medical Research Methodology*, 5(37), 1-12. Retrieved from <http://bmcmedresmethodol.biomedcentral.com/articles/10.1186/1471-2288-5-37>
- Dalkey, N. (1967). *Delphi*, 1-10. Retrieved from RAND Corporation website: <http://www.rand.org/pubs/papers/P3704.html>
- Grisham, T. (2009). The delphi technique: a method for testing complex and multifaceted topics. *International Journal of Managing Projects in Business*, 2(1), 112-130. doi: 10.1108/17538370910930545
- Keeney, S., Hasson, F., & McKenna, H. (2011). *The Delphi technique in nursing and health research*. West Sussex, United Kingdom: Wiley-Blackwell.
- de Meyrick, J. (2003). The Delphi method and health research. *Health Education*, 103(1), 7-16. doi: 10.1108/09654280310459112
- Nardi, P. M. (2006). *Doing survey research: a guide to quantitative methods*. United States of America: Pearson Education.
- Okoli, C., & Pawlowski, S. D. (2004). The delphi method as a research tool: an example, design considerations and applications. *Information and Management*, 42, 15-29. doi: 10.1016/j.im.2003.11.002
- Saldana, J. (2013). *The coding manual for qualitative researchers* (2nd ed.). Thousand Oaks, CA: Sage Publications Inc.
- Schmidt, R. C. (1997). Managing Delphi surveys using nonparametric statistical techniques. *Decision Sciences*, 28(3), 763-774. doi: 10.1111/j.1540-5915.1997.tb01330.x
- Schmidt, R., Lyytinen, K., Keil, M., & Cule, P. (2001). Identifying software project risks: an international delphi study. *Journal of Management Information Systems*, 17(4), 5-36. Retrieved from <http://reddog.rmu.edu:2056/docview/218924388/4D1BA57EA287410CPQ/1?accountid=28365>
- Skulmoski, G. J., Hartman, F. T., & Krahn, J. (2007). The delphi method for graduate research. *Journal of Information Technology Education*, 6, 1-21. Retrieved from <http://www.jite.org/documents/Vol6/JITEv6p001-021Skulmoski212.pdf>