INFORMATION LOSS: EXPLORING THE INFORMATION SYSTEMS MANAGEMENT'S NEGLECT AFFECTING SOFTCOPY REPRODUCTION OF HERITAGE-DATA

by

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ABSTRACT

This exploratory mixed methods study quantified and explored leadership interest in legacy-data conversion and information processing. Questionnaires were administered electronically to 92 individuals in design, manufacturing, and other professions from the manufacturing, processing, Internet, computing, software and technology divisions. Research decisions based on the analyses of the 69 selected responses from survey. Digital conversion problem for non-obsolete piece-part specifications from paper records to online databases were investigated. Leadership interest of 27.5% indicated combinations of time, money, and resources were primary reasons for voids in the online unconverted information. The 49% concurrence for all users benefiting from the Internet database accessing rendered caution for the information managements in data conversions. Triangulated decision on the leadership theme came from 49.28% agreements on the difficulties of finding valid information through paper search that led to increased costs in engineering endeavors. Null hypotheses were rejected based on the critical statistical significance of ($p = 0.01$) in goodness-of-fit test calculations through SPSS statistical evaluations. The interdependencies for variables in the survey instrument determined through statistical test of independence with ($p = 0.005$) significance.

DEDICATION

In God's name, I dedicate this dissertation to my father Moe and my brother Kamyar, who passed on long before this academic work started. Furthermore, I thank my wife Phyllis and children David, Michael, and Jonathan, for their patience while I was engaged in my doctoral program.

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CHAPTER 1: INTRODUCTION

This study explored the legacy-data conversion issues, an investigation for identifying reasons for the information loss and determining if the neglect or deliberate decision by the information systems management to circumvent the paper-based data conversions for the digital database archiving was the projecting reason. The study was based on presupposition that the information loss would be an inevitable outcome for the paper-based records, which would arise from the decision to dismiss electronic conversion and from the information systems managers' neglect to order such digital translation for the paper-based records. The submitted study for investigating the possibilities of the information loss was presented for gaining the opportunity to explore the initial assumption. Since an unsuccessful search for a topic could prompt increased recurrent heuristic attempts to conclude for the searching efforts (Bär & Huber, 2008), results from this research effort showed why such information absence dilemma had occurred for the online sources. Presentation of discoveries through exercising an empirical investigation on the pros and cons was helpful in determining the causality (Creswell, 2005; Neuman, 2003), when an anomaly had occurred. The concluding thought was that the validity of the claims made in this study could be verified by the supporting data collection in the planned study.

Research discoveries from this investigative work can be used by other researchers to initiate further investigations that relate to digital information availability concern and processing of the collected data from paper-based archives, which may broaden the collective knowledge by additional presentation. The need and evidence for investigating the problem of the management neglect (Maharaj, 2009) in relation to legacy-data conversion has been explained in the statement of the purpose section of this study with highlighting of the

possible benefits that can be gained from performing such a study. The supporting background evidences that corresponded to the intended outcome for this study were collected from the field surveys because literature from existing archives that pertained to the problem of the information loss as result of lacking digital conversion or the neglect were limited. The nature of the study, scope, limitations, definition of the terms used for the purpose of this study, and the theoretical frameworks were further enhancements to this investigational effort in the subsequent sections of this introduction chapter. The discussions on the assumptions made to conduct this research, pertinent reviews from related literatures, and the method used for arriving at the research results were discussed. The social influences that resulted from this research were presented.

Background of the Problem

Exhibiting indecision toward data conversion and digitized archiving by the information systems managers (Bär & Huber, 2008; de Acuñ & Agenjo, 2005) can hinder information accessibility, especially for the non-obsolete legacy-data, and can delay online availability through databases. The information seekers' inability to find data easily from online searches result in loss of interest for information because of the unavailability of the data, its obscurity, and absence. Throughout this study, heritage or legacy-data referred to historical information archived on paper-based media. Since archival methods affected information preservation and determined the availability of the data, additional to how accessibility factors in communicating the recorded contents effectively was viewed, Cohn (2004) concluded that the possibility of data obsolescence could increase with the emergence of new technologies that rendered some software products unattainable. The popularity in using Google, Yahoo, and other Internet-based search-engines ostensibly has been replacing

old methods for collecting, storing, and searching information from the paper-based media (Merat, Khatibzadeh, Mesgarpour, & Malekzadeh, 2009; Šauperl & Saye, 2009).

The trend toward using other online data repositories such as online encyclopedias suggested that digital databases were becoming the preferred method of archiving information. Rapidly and readily accessible information can often result in timely decision-making processes by management that could translate into business advantages because of earlier entrance into a competitive business market. Exasperatingly slow and tedious processes of accessing information through paper-based records, and the possibility that an online record could exist, apparently had resulted in the public's desire to change their information retrieval habits to search primarily the Internet. The cumbersome researching process of paper-based data was replaced by new and popular electronic-based practices through which obscured legacy-data should have translated for digitized archiving. The archival methods provided by the modern electronic databases, which were contributing to a changing paradigm in information seeking, were discovered gaining more momentum (Levin, 2009; Yu & Young, 2004; Quible, 1999) with the improvements in technology.

Increasing impetus to use the technologically advanced means seemed causing the complete abandoning of former models in data inquiry. Although technology had changed and advanced the archival methods for storing information, querying the data through different arrangements, and the frequency with which desired information was accessed from the online databases, some information remained unavailable through the online query. The unchanged non-obsolete data that was still useful to selective interested groups was one such paper-based information that still was not available from the online queries. Few records, such as engineering specifications, medical charts, or those of other scientific natures, which

had been previously available only as paper records like printed forms, charts, and tables shared with colleagues throughout the specialized fields appeared falling into problematic categories. To conceptualize a framework for doctoral study of the mentioned problem (Leshem, 2007), a researching candidate should conduct a comprehensive study that uses an appropriate method for approaching the critical issues and is capable of exploring the research problem.

Since information is the intricately vital component of an educated decision-making process, the strategies that the information technology (IT) departments devise to collect, store, and manage data as well as making vital information accessible becomes important (King, 2007). These strategies should consider the data source's authenticity while precluding possibilities for corrupted data to find its way into the database (Murray, 2005). The processing quality plays a major part in information finding, authentication, protection, preservation, and dissemination of valid and vital information in consequence (Laframboise & Reyes, 2007). Shehane (2006) elaborated on the development of a holistic approach to information gathering should include information reliability issues through documentation monitoring and a framework that can aid the decision support system (DSS) for vital and authenticated information. Successful information systems rely on effective database implementation in which the technical complexities are balanced with the interdependencies of the database creation process (Sherma & Yetton, 2007).

The goal from this investigation was to identify what was precisely the problem, investigate the root cause for the problem's manifestation, determine any advantages, determine who could benefit from the research findings, and reveal to which area the problem affected the most. Exposing the problem and bringing it into the open to increase

awareness may give reason to information technology leadership to take proper precautionary actions to rectify the existing issue and put in place a possible prevention system that can address and stop future recurrences (Brown-Boone, 2006). An important aspect of this study was the presentation and highlighting of the social tendency to adopt a new archiving approach, which promoted paperless communication. The particular goal from the planned research was to establish a new practical theory for researching methods with an emphasis on using the online databases. The online researching practices reduced the excessive time spent on finding information through paper-based archives because electronic query processes nearly have been instantaneous on the digital databases. The problem of legacy information conversion from paper archives into electronically stored records was reduced because of the investigations that were performed by the author in this research.

Statement of the Problem

The general problem was that not all of the human knowledge had been translated into digital archives (de Acuñ & Agenjo, 2005; Gauri, 2006, and; Guallar & Abadal, 2009). As a seeker's immediate choice for searching information shifted to using online databases more often (Chrzastowski, 2003; de Acuñ & Agenjo, 2005), this void in digitized information seeking led to greater problem (Erdogan, 2009). The probability for increasing implications and probable adverse effects of the missing information from online databases warranted an investigation. Data conversions to digital records had occurred only for a few paper-based information from the selective heritage-data while archival attempts continued to preserving quality of the converted information for modern electronically retentions. Authors de Acuñ and Agenjo (2005) discussed the difficulties of processing some paper-

based information to digital archives that were elevating the conversion attempts to new insurmountable level. Discovering none converted information, translating it from the original language and then converting that information into digital format can increase difficulties for the conversion process and further exacerbate the issue. Heterick (2002) explained that the academia scholars had begun converting important journals from the paper origins to digital archives since 1995 for the easier accessibility. Today's popular digital databases do not contain every type of human knowledge translation from the paper-based archives. A good practice in archiving suggested including digital conversions for all heritage-data from the original paper-based records (Guallar & Abadal, 2009).

The specific problem was that piece-part specifications for some spacecraft components were missing from the online databases, which both design and manufacturing engineers at the Jet Propulsion Laboratory (JPL) of the National Aeronautics Space Administration used. Searching for the data resulted in spending extra time on projects (Hoppmann, 2009). Arduously searching for a missing piece-part specification resulted in discovering a single paper-based record that was illegible because of partially faded print and nearly resulted in costly changing of the designs in which that specific piece-part initially was used. The online information inaccessibility and potential archival problem may not have been discovered if the piece-part specification was available quickly through the online query. Gauri (2006) mentioned the online database queries have shown some insufficiency in containing all the information known to people. The designing and manufacturing of few spacecraft components appeared to be on the threshold of suffering serious setbacks because of the inaccessible or missing specifications from the online databases.

Using the mixed methods investigational approach, the aim from the planned study was to seek and examine corroborating evidences that provided better understanding of the absence of some piece-parts specifications from the digital data retention records and possible effects of online inaccessibility on such information. The quantitative process was used for examining the correlations between data inaccessibility, obscurity, and its obsolescence from a user's perspective. The qualitative process was used for exploring if the trend in information inquiry indeed had changed to online searching, and the respondents' expressive thoughts would corroborate with quantitative data analysis favoring the online inquiry and probability for loss of information. The discoveries confirmed a paradigmatic shift in the information seeker's approach to data mining practices. The targeted population in this research plan was the members of the electronics engineering, subsystem designers, and manufacturing engineers groups from spacecraft industry such as the National Aeronautics Space Administration (NASA). An early discovery of missing piece-part specifications and the absence of the data from online records in 2008 had prompted planning of this investigation with the goal to understand the reasons for such occurrence.

Purpose of the Study

The purpose of this mixed methods study was to investigate the existing non-obsolete piece-part specifications data conversion problem for better understanding of the void in the online digital database repositories. The supplemented data from research on the online information inaccessibility problem affecting the paper-based records that the design and manufacturing engineers used at the spacecraft industries such as NASA divisions was considered improving data conversion. The corroborating data from collection of the opinions and quantified responses to survey from 50 individuals who primarily were the

stakeholders, and whose job performances diminished from online information unavailability or inaccessibility was investigated through this mixed methods study of the problem. The results of the planned study thought as a service to management awareness toward reduction or elimination of the impending digital data management problem and contributed to information accessibility that would save unnecessary costs on projects. This study led to concluding that the information losses could occur because of the absence of the legacy-data from online databases, hence it had become imperative to information management to order data conversion for every informational record. Creswell (2005) emphasized that the information losses because of the accessibility problems required substantive investigations to bring the focus and the complications to people's attention.

From a scientific and the business perspective, the problem with the probability of total loss or inaccessibility of specialized non-obsolete information required thorough investigation (Shiri & Revie, 2006). The designing and manufacturing engineers who depended on the availability and the ease of access to specific data were encountering hindrances in performing their duties because of the information obscurity problem that affected their job performances. The purpose from conducting qualitative research portion in this study was to collect opinions from engineers, who functioned as spacecraft electronics designers and manufacturers, for discovering thematic effects of online information unavailability that influenced individuals' decision to choose the information retrieval system that was conducive to their job performance. The quantitative aspect of this study presented opportunity for examining statistical data on probability of adverse effect when information was not available digitally or when it was absent from online inquiries through popular search engines, which could predict relationship between translation lacks for maintaining

paper-based information in digital archives. For example, the likelihood of the data being available online for quick retrieval was considered an independent variable, whereas the degree of the impact on the individual engineer's job performance constituted a dependent variable.

The distribution of a Likert-type survey was planned through communications network at a permitting firm for providing the opportunity for quantifying the survey responses for a goodness of fit evaluation and predicting popularity of selecting online search instead of the paper-based records. Fifty completely populated surveys among collected responses were to be used as the basis for performing this mixed methods study. The relationship between the difficulties of finding specification data for some specialized components and the engineer's tendency to abandon a particular design was the anticipating result from discovery through qualitative questions.

Variables.

The independent variables were the influencing factors that shaped the outcomes (Creswell, 2005). The popularly accessed and available online search engines, for example, were of such varieties of the variables or options to take into account for the quantitative studies in this research. Creswell (2005) emphasized that the dependent variables were those possible factors, which a researcher anticipated to explain through the investigative study. The dependent variables were the prelisted selections given specifically as choices to survey questions that related to absence of the component specifications for engineering design and manufacturing use. The independent and dependent variables will be tied to the surveys in Chapter 3 of this study.

The specialized part-specifications data that were not available from the online electronically translated digital archives, and were not investigated specifically through past researches, were the particular dependent factors to study for typical online queries in this evaluation. The influencing factors on the availability of the legacy-data in electronic forms (softcopies) and particularly the perceived accessibility of the converted legacy-data from online repositories included the independent variables. Obscurities of the legacy-data because of an inability to access the information in electronic archives and the data loss that could result were the two major dependent variables.

Significance of the Study

Creswell (2005) explained that the researchers approach a problem through mixed methods study when they intend to "incorporate a qualitative component into an otherwise quantitative study" (p. 510) for better understanding. The mixed methods research, which could increase the target groups' awareness through problem exposure, as inferred by Creswell, was unique approach when former researchers had not addressed the problem effectively. Leshem (2007) concluded that the raised awareness that follows a problem exposure through doctoral research could increase understanding and also encourage or motivate other researchers to continue conducting other (newer) investigations in the future that may discover similar problems. The benefactors in this study, who were primarily the engineering members from design and manufacturing fields in the spacecraft industries, benefited significantly from the outcome of this research when their online data accessibility increased. This study was an additional innovative contribution toward improving the data management scope (Blythe, 2007; Chandler, 2006; Chow & Chan, 2010, and; Erdogan, 2009) for the online information preservation.

The planned investigation initially provided a framework of awareness (Leshem, 2007) for the leadership to take initiatives and act promptly to ratify the identified problem, and then it resulted in setting the course for tertiary investigations that would follow for finding other related problems. Another major contribution of this study was an increased emphasis on the new trend in searching information and the seekers tendency to use electronic and online data retrieval options. If the results from planned research indicated stronger tendencies for using the online information retrieval, then perhaps efforts could have channeled to reducing the amount of paper used by the old archival approach. The lesser global paper consumption destined as an act of compliance to following the green initiative that could translate into more trees and forests, which should improve the Earth's atmosphere. As the discoveries from this study resulted in an expansion of knowledge (Leshem, 2007), other researchers would decide to conduct additional studies to contrast or confirm the discovered results from this study. Leaders in information management, who read proceedings of this investigation, will have another guiding model for knowledge safekeeping (Beazley, Boenisch, & Harden, 2003; Hong Cui & Heidorn, 2007; Hyun-Soo, Young-Il Chae, & Yung-Ho, 2004; King, 2007, and; Shehane, 2006) to adopt for managing information in the online data repository.

Significance of the Study to Information Management Leadership

This examination of discriminating exercise toward heritage-data conversion that stemmed from management neglect or decision not to preserve information in an online digitally stored media considered increasing awareness (Leshem, 2007) for leadership to change information-managing policies. The knowledge that an information manager would acquire through examination and disclosure of concerns with online heritage-data availability

should help that manager take prompt action toward finding a solution that averts data conversion and storage issues. The leadership may even establish processes (Beazley, Boenisch, & Harden, 2003) for identifying anticipated future anomalies with the digitization of the useful information, and prevent such incidents from happening. Studying the discoveries from this research on the concern about managers neglecting to order the heritage-data conversion and preservation in digital form (Hyun-Soo, Young-Il Chae, & Yung-Ho, 2004) may encourage leaders to improve their information management skills. Researchers also may conduct additional studies on the information conversion problem and discover newer methods (Hong Cui & Heidorn, 2007) for propagating usefulness of the electronic data storage and improvements for better accessibility.

The Social Effects

The social effects of this research plan were the heightened levels of awareness (Leshem, 2007) provided to both the information technology personnel and the archivists responsible for legacy-data preservation. A larger population outside of the focused group and the information management was thought to benefit from the outcome of the investigations and the influences of extended discoveries (Clemmons, 2005). The goal from planning to conduct contemporary study on the online information accessibility for the specialized legacy-data was to inform and ultimately assist with all forms of information processing into electronic archives for the universal access. The discoveries from this research resulted in changing readers' attitudes toward the online researching paradigm (Clemmons, 2005). Readers may discover additional interest for continuing studies of their own that pertain to data conversion and online information accessibility concerns.

Nature of the Study

The insufficiencies of the online databases (Gauri, 2006) yielded very few available studies to retrieve in which the focus was on addressing the question of what might happen to the expert-knowledge if the information becomes unavailable from the online inquiries. The curious nature for expounding the knowledge on this matter prompted reaching the experts to find how they would respond. To understand better if the corroborating data resulted from this study that yielded evidences on the availability of electronically preserved legacy-data encouraging the users of the information to favor the online searching, this study included both quantifiable examinations and qualified information on the discovered problem. The justifying data was obtained through surveys (Creswell, 2005) in which both statistical analysis and qualitative expressions were present. Deficiency of the available studies and insufficient prior supporting records (Gauri, 2006; Leshem, 2007) that could have enabled conducting a strictly quantitative research, and the deficit from qualitative investigation that could provide the explanation resulted in exercising the mixed methods research approach in this study. From a research perspective, a qualitative approach can provide a consensus on the perceived understanding of this unique problem, which could inspire future researches (Creswell, 2005).

To address the discovered problem effectively, this study included two-parts questionnaire to survey participants that enabled gathering personal opinions in a qualitative manner. Using the researching tool, Statistical Package for the Social Sciences (SPSS) made searching for specific words possible that established commonality in responses among the targeted research participants. The combination of collected information from both quantitative responses and qualitative expressions from questionnaires resulted in

corroborating evidences for mixed study outcome (Creswell, 2002, 2005) in this research. The quantitative study provided examination of the statistical data in favor of or against the hypothesis regardless of any bias. The qualitative study, on the other hand, reflected the individuals and test subjects' personal perceptions on the issues under the investigation and included their biases (Creswell, 2005; Neuman, 2003; Sproull, 2003). Each of the described research methods had merits that applied to specific investigating circumstances. When a large body of quantitatively acquired data was available, the quantitative study would have been the preferred method of choice, as Neuman and Sproull indicated. When the effects of change were more interesting to discover, a qualitative approach would have deemed more appropriate, as Creswell (2005) stated. When collections from chronological records were in short supply, and the general tendencies seemed to favor an unexplored practice, the mixed methods research was helpful in explaining a problem (Creswell, 2005) and suggesting its solution.

Research Questions and Hypotheses

The open-ended questions for qualitatively researching in this mixed-methods design were suitable for facilitating the interpretive questions result (Neuman, 2003). The approach enabled discovering the participating target group's perspectives through investigations and provided direction for making sense of what was a common perception. The qualitative part in this study was henceforth an explorative attempt to expand on the research questions. The quantitative research design was used for proving the null hypotheses (Creswell, 2002, 2005), and the approach would not have required research questions (Sproull, 1995, 2003). The hypotheses were drawn from the purpose statement for investigating the electronic archiving problem and predicting the outcome on the effects of information absence from

online sources. The mixed methods nature of the investigations in this study plan provided anticipating prediction for and description of the presented hypotheses through corroborating results from the field surveys in both quantitative and the qualitative parts.

Research Questions

The questions stated below were for obtaining qualitative investigation results in this research, as the focus from surveying the participants' opinions would lead to words why and how individual perceptions had developed, which enabled exploring for the qualitative research discoveries (Creswell, 2002, 2005). The research questions were designed specifically around qualitative study of the problem statement for interpretational objective to triangulate research outcome with the aid of the quantitative results. The hypotheses were devised as result of the research question however. The alignments between research questions and hypotheses were as follows: research question one resulted in developing first hypothesis, research questions two and four resulted in third hypothesis development, and the second hypothesis was based on third research question. The qualitatively explored opinions and the obtained results from this study provided answers that stipulated explanations for the following questions:

1. Why do the information conversions from paper-based records to electronic databases become difficult and costly efforts?
2. How can electronically archived data for part-specifications benefit the engineering community?
3. Why do the archived data from popular search engines and databases lack some part-specifications?

4. How can conversion of information from paper-based record to electronic database guarantee preservation for uncommon, non-obsolete, but useful information best with the accessibility?

Hypotheses

The aim from the current study on electronic translation and archiving of data, heritage or otherwise, was to examine the following hypotheses and to arrive at conclusions that either proved or rejected the claims made in the title. The null hypotheses addressed and included the dependent variables that made up the special interest in this study plan. The rationale in proposing the quantitative research segment for this study was to enable statistical evaluations for the following hypotheses:

$H_0$1: There is no significant direct relationship between the perceived information obsolescence, loss or deficient use, and inaccessibility of the data from online databases resulting from conversion neglect or management's decision to circumvent digitization of the paper-based record.

H_a1: There is a significant direct relationship between the perceived information obsolescence, loss or deficient use, and inaccessibility of the data from online databases resulting from conversion neglect or management's decision to circumvent digitization of the paper-based record.

$H_0$2: There is no significant direct relationship between the popularity of inquiring information online because of instantaneous availability of the data and threatening imposition to boycott the data repositories that remain on paper media.

H_a2: There is a significant direct relationship between the popularity of inquiring information online because of instantaneous availability of the data and threatening imposition to boycott the data repositories that remain on paper media.

$H_0 3$: There is no significant direct relationship between the perceived online frequencies of use for non-obsolete specialized data, guaranteed availability and preservation of such information, and conversion of the paper-based records to digital archives.

$H_a 3$: There is a significant direct relationship between the perceived online frequencies of use for non-obsolete specialized data, guaranteed availability and preservation of such information, and conversion of the paper-based records to digital archives.

Theoretical Frameworks

In this study, the transcending theoretical framework for the research encompassed the arguments regarding today's information users favoring the convenience of accessing data through the Web searches (Keston, 2009), and the difficulties in the data conversion process for electronic storage (Sarin, 2005). Authors de Acuñ and Agenjo (2005) analyzed problem and solution for digitally archiving information in the electronic resources. Guallar and Abadal (2009) evaluated digital archiving of newspapers and suggested suitable practice for producing such records. Bär and Huber (2008) examined the effects of successful searching on decision-making and possible risk of unsuccessful search on the behavior. Hoppmann (2009) explored opinions about what may be irritating experiences resulting from the online searching. The question of what might happen to the information as result of online unavailability or inaccessibility was not explored in these studies. The Internet and searching applications that online web-based databases offer to users have increased the potential for information searching convenience. The availability of the Internet has enabled

the management of e-marketing through e-Market Metadata (eMaM) directory services (Manouselis, & Costopoulou, 2005) for many businesses and has provided secure information transmissions for many legal data exchanges and governmental online transactions (Chandler, 2006). With the ease of use and the availability of the Internet, today's information seekers seemed to prefer the convenience of easily accessing and retrieving data online. If the trend for information searching was leaning toward the new paradigm of online data inquiry, as was the case in locating academic and scholarly reviewed information for social sciences (Berkman, 2008), then the negligence in data conversion from paper-based media into an electronic form could not be favorable to the user.

The exposure of the neglect in preserving specific heritage information in a digitized version was relevant to the information management studies. Creswell (2005) explained that a researcher anticipates explaining a problematic phenomenon through an investigative study. The types of non-translated specialized data that were absent from digitized media were the problematic factors for the online inquiries in this planned investigative instance. Liu and Tuzhilin (2008, p. 86) described the identification of "the main issues and problems" can bring attention to unexplored possibilities. Though efforts in data translations and digitization of many records had already begun, the translation of specific parts specifications for enhancing the engineering databases remained an important issue for information management to explore.

Although few studies on the subject of electronic information storing could have addressed the problem of the data conversion in the past, the information conversion problem and electronic storage concerns (Burns & Peterson, 2010) continued. Despite the limited studies on the difficulties of information transfer and the lack of adequate researched

explanation of data conversion issue, the probability for loss of information because of neglect in translation of data into electronic media had never been so obvious. New technology for storing large volumes of data currently existed. The provider of the popular online search engine, Google Incorporated and Google Scholar, used the new MapReduce technology for storing vast quantities of information (Dean & Ghemawat, 2010). The MapReduce electronic stores offered technology with the expectation of replacing traditional database management systems (Stonebraker et al., 2010).

Technology leaders in advanced electronics manufacturing, with the cooperation of the distribution industries, had produced pertinent parts specifications for most of their products. Finding reliable information from the online parts specifications that most major distributors provided was relatively easy. Nonetheless, and especially for rarely used products, not every parts specification was available in an electronic format online. The lack of finding such specific information online inconveniences the engineers who need to use the rare parts specifications while expecting to find information through search engine databases for their design or manufacturing. The result appeared forcing few who had limited research time for parts specifications to abandon their inclusion of such parts from the design or manufacturing, and changed their initial efforts.

The unavailability of online parts specification for some specific components that the space industries used or that engineers required for inclusion in their designs and for manufacturing endeavors prompted the desire to plan and conduct this investigation for understanding the online information unavailability phenomenon. The theory in this study was that by surveying the opinions of the engineers who worked in the space industries, specifically the design and manufacturing engineers working at the National Aeronautical

and Space Administration (NASA), the relevant data would surface. The analysis of the data then should have provided necessary understanding. Pertinent research data from this study then could add value to the body of prior research endeavors regarding efforts in data conversion and management ideas about legacy-data preservation. The information managers and their leaders should become henceforth more vigilant about preventing any possible neglect that could lead to later information obscurity.

Definitions

For describing some specific ideas and representing special meanings in this study, certain words were used to emphasize particular objectives in sentences. Some encountered terminologies throughout this research were as the follows.

e-marketing [emphasis added] is the adaptive abbreviation for electronic marketing practice through the Web. The online referencing source described e-marketing the same online marketing practice through the Internet ("eMarketing," 2010).

Heritage-data [emphasis added] refers to parts specifications or information with taxonomic descriptions for a legacy-data conversion to "extensible markup language (XML) format" (Hong Cui & Heidorn, 2007, p. 133).

MapReduce [emphasis added] is the "programming model which provides a convenient framework for organizing such computations" (Lin, 2009, p. 15) that appreciably minimizes cluster searching for lengthy textual inquiry.

Softcopy [emphasis added] refers to digitized information from electronically available repositories or "archiving of image information" (Obenauer et al., 2003, p. 341) that one can access through computer database inquiries and information availability that does not require the use of paper.

The Oxford English Dictionary online provided following description for the softcopy in its separated words form: “soft copy, a legible but transient presentation of information, as on a VDU screen” (“Soft copy,” 2010, para. 1). Softcopy is in contrast to hardcopy in this study.

Another online dictionary, Merriam Webster, contained following definition for *hardcopy* [emphasis added] in separated words, as in hard copy: “a copy of textual or graphic information (as from microfilm or computer storage) produced on paper in normal size” (“Hard copy,” 2010, para. 1).

Paper-based [emphasis added] refers to hardcopy or the printed form of information repository in this research. The term, paper-based, has become popular since 2006 when the initial research idea was incepted by this author. Other authors have used this compound word in comparison to electronic or computerized information (Ardalan, Ardalan, Coppage, & Crouch, 2007; Erdogan, 2009; Hardré, Crowson, & Kui Xie, 2010).

Assumptions

For conducting this planned study, the assumption was made that most engineering people used, or preferred strongly to use, online databases when they were searching to find data on parts specifications. The next assumption in this study process was to accept that the online databases were replacing the libraries that mostly held paper-based archives (Chrzastowski, 2003; Kousha, & Thelwall, 2007). The recorded information on paper-based media was assumed to fade away or become inaccessible and obsolete. The precipitous idea furthermore was that the electronically preserved information offered important advantages and was preferable over the information stored on paper-based media. Another assumption was that the information seekers could find and accessed data more conveniently through

online databases. It was also assumed when information system managers neglected to convert paper-based information to digital archives, researchers who sought such information would lose interest in pursuing it (Kim, Bartlett, & Lehmann, 2005) because of the difficulties of obtaining paper-based records. The unavailability of information was assumed to result in the loss of the information in the cases of unconverted data. Tailoring the discoveries of this investigation to a randomly pertinent group of parts specification meant that managers could represent a better deduction for the affected information and its users. The preference of searching the online records to find any information ("Americans Prefer Electronic Health Records," 2007) was another assumption precluding the engineers' attempts to look for parts specifications elsewhere other than online databases (Montgomery, 1999).

Scope, Limitations, and Delimitations of the Study

This study was in reference to the electronic conversion and archiving of legacy-data, discovery of a related anomaly in the legacy-data archiving, and pertained to an identifiable group of users. The scope of the investigation encompassed an absence of electronic information available for some component specifications. The electronically unavailable component specifications related to electrical and mechanical parts used in some subsystems or devices on the spacecraft. The objective focus in this research remained on obtaining research data from particular engineers at designing and manufacturing groups in the spacecraft subsystems activities.

Limitations.

The research limitations pertained to whether the depth and quality of the surveyed responses, or responders' willingness to participate in the study and released their rights to

information from collected responses through survey instruments, produced measurable constraints. The scope of the study was thought could be limited further if participants resisted giving authority to the researcher to publish the results. Whether the participants gave their consent to using information from the surveys, or the limitation of the time set for the completion of the research was considered producing additional problems that externally could hinder this study. In addition, the investigations were limited to only the members from a study group who worked with the spacecraft subsystems design and manufacturing.

Delimitations.

The delimitations included primarily an investigational approach and focus on NASA-specific standards in this study for using the select parts or components in design and manufacturing of the spacecraft subsystems. Users for the parts specification (e.g., electronics designers) were among those who delineated further this research plan. Randomly selection of 50 completed survey questionnaires for both statistical analyses that enabled evaluation of the hypotheses and discovery of the survey participants' perceptions for the qualitative study further delimited this study. Choices of surveying only the electronics design engineers and the manufacturing engineers from spacecraft industries were additional delimitations.

Summary

The purpose of this mixed methods investigation was to explore the problem of the non-obsolete parts specifications used in spacecraft design and manufacturing that could not be found in digital databases but that engineers in the industries (e.g., NASA divisions) regularly used in their designs and manufacturing. The first key point in this study was to investigate the claimed assumption that information loss could occur because of the neglect

to produce and maintain electronic records. The assumption of a public searching preference to find records online ("Americans Prefer Electronic Health Records," 2007) could have precluded engineers' attempts to look for parts specifications elsewhere other than through online databases (Montgomery, 1999). The deduction was that the softcopy records and electronically acquired information describing such specifications would be easily attainable and preferable from the online sources in comparison to paper records. The next key point to investigate through this study was whether the information was rendered obsolete when users could not find data easily through commonly accessed online sources, or when minimal data was available and searching became cumbersome (Kondro, 2005).

The main key point of this study was to obtain data through mixed methods research design for validating the first and second key points by investigating the user behavior in searching preference (Kwan Yi, Beheshti, Cole, Leide, & Large, 2006). Whether the inaccessible information became obsolete eventually when the online record was not available, was of concern. Focus on the online searching phenomenon to determine if the shift in the information-seeking paradigm had occurred (Göritz, 2009; Hoppmann, 2009) was considered to reveal answers for the key points in this study. Telecommunications had improved information exchanges through technological advances. With the speed of electronic data processing and the reductions in cost of acquiring electronic databases, the conversion of the legacy-data for electronically archiving thought to have become the more relevant approach.

The primary goal and subsequent suggestion for exercising this study was to realize that if perhaps the conversion of all legacy-data from paper records to the electronic databases was the next logical step for information archiving. The presented referenced

literatures in the next chapter included accessible supportive articles online for this research and were direct arguments for the key points made in this study and represented scholars' corroborating assertions. The supporting evidence was given through the discussions of the literature in chapter 2 for this study plan.

CHAPTER 2: LITRATURE REVIEW

The purpose of this mixed methods study is to investigate the existing non-obsolete piece-part specifications data conversion problem for better understanding of the void in online digital database repositories through quantitative and qualitative processes of the phenomenon (Creswell, 2002). The problem is that piece-part specifications for some spacecraft components are missing from the online databases, which the mixed methods research design is thought to result in better understanding of the reasons (Creswell, 2005). Heritage-data, specifically in this research, refers to desired piece-part specifications for use in engineering. The information that cannot be found online may not be sought, and perhaps will be considered obsolete (Kim, Bartlett, & Lehmann, 2005). Difficulty in accessing information, particularly of legacy-data, and perception of the obsolescence of such information may lead to a complete loss of valuable knowledge as people become discouraged in their attempts to find the data. The problem of-legacy-data conversion requires investigating its cause and the circumstances that result in it.

One potential value of this investigative discussion and its results may be that it could expand the scope of activities for information technology leadership and emphasize the importance of data digitization (Balnaves & Chehade, 2009). Chapter 2 includes presentation of supporting researched literatures in conceptual areas pertaining to technology affecting the leadership, data conversion for electronic storage, search preference for technology users, tendency to use electronic databases, and the nature of the electronic media. Five main topic areas: effects from information systems on the leadership, legacy-data conversion for electronic storage, users of information systems, popular information databases, and electronic archiving environment will be addressed before concluding the

discussion of the supporting research. Title searches, researched articles and documents, historical overviews, researched journals, and currently available peer reviewed materials from the online databases follow.

Information Systems and Technology Leadership's Impact

Technology continues to change and advance archival methods, data retrieval trends, and the frequency with which specialized information searching takes place. Changes can introduce problems for data archiving that may lead to information losses beyond the recovery attempts that try rescuing paper-based data from destruction. An individual in the leadership position who works with the information processing should become aware of such possibilities. This researcher's hope is that the outcome of this comprehensive study will help develop new strategies that ensure legacy-data preservation. Moreover, the results may lead to developing better mechanisms for data collection, storage, management of information, and accessibility (King, 2007).

Evidence of the obscurity of some information may have led leaders, in such specific knowledge areas, to consider the prevailing trends in general data inquiry habits. Finding the new public trend in information inquiry may require an extensive survey of the opinions of information users. Scientifically obtained surveys often lead researchers to conduct some form of scholarly exploration. The result of such scientific explorations may yield additional explanatory and predictive outcomes that ground in theory and creates better answers for the question of how and why problems exist (Cooper & Schindler, 2003). Although the theory behind the research for this study is based on the assumption that the loss of information may happen because of data conversion problems, the research cannot be based on the theoretical analysis alone.

Conventional thought from scholars suggests that the perceptions of surveyed individuals may play an equally strong role in predicting the trend with which data inquiries are exercised among information users. Leadership affects the organizational process (Gilkey, 1999; Wren, 2005), and information system technology (IST) leaders are influential individuals, as Luftman (2004) alluded, who can help preserve knowledge for future generations. The IST management neglect to preserve the knowledge can lead to intellectual property loss. Henceforth, the IST leadership's agenda should include data preservation strategies within the risk management plan. The control and the flow of the data should be part of the information technology leadership's efforts.

Recent studies on the use of the Web for conducting health-related surveys resulted in the discovery of online health information users' satisfaction with an electronic communication method that superseded a traditional approach (Wood et al., 2008). Wood et al. (2008) explained these studies initiated an online surveying process known as "the American Customer Satisfaction Index (ACSI)" (p. 5) in which the supporting role of the management leadership was found to be the agent of change. The management teams' commitment to ensuring online access to interesting data for the survey resulted in improved use of the Web and an increase in the approval of electronic communication from participating citizens. Changes brought by the technology advancements have altered the leadership approach for information archival. They have brought more attention to the need for prioritizing online accessibilities of the information as Barsh and Lisewski (2008), Fitsimmons (2007), Loddington, Pond, Wilkinson, and Willmot (2009), Schmetzke (2008), and Teli, Pisanu, and Hakken (2007) have discussed in their articles.

Management's Role

The consequential effects of workforce downsizing, a worldwide practice, which many businesses were forced to endured as result of the economic depression, have left many companies with lower management skills and awareness (Munkeby, 2007), because the more experienced senior managers were unavailable for training. A high priority should have been to train middle managers and improve their technical skills in processing information along with improving their personal skills (Munkeby, 2007), which could have brought up their competency levels. Higher competencies contribute to personal intelligence, which can enhance leadership's awareness of problems and can result in mitigating the legacy information archiving problem. The scarceness of studies that discuss the subject of information obscurity with an emphasis on the resulting effects of non-electronic archiving, the possibility of obsolescence or loss of data, and user's preferred methods for searching for information, are perhaps indications of this failure in training.

The information technology management's responsibility should include continual practices that emphasize an increasing awareness (Brown-Boone, 2006) for the need to preserve every form of data for globally accessed practice (Palmer & Eriksen, 2000) as the former information archiving systems become outdated (Kingsley, 2007). Information technology managers must be vigilant in their efforts to translate the paper-based data for electronic conversion processes and consider electronic archiving. Management's role should include ordering the data translation and transferring of many sorts of information into electronic archives that currently cannot be found in digitized form. The higher responsibility lies in the information technology leadership role to archive the legacy-data.

Nevertheless, middle management should also become aware and skillful in a similar fashion.

Another aspect of the leadership influence on organizational change is the emotional intelligence. Momeni (2009) stated that the leadership's emotional intelligence sets the culture for the organization. Momeni discovered that the emotional intelligences of the subject managers from the study were the primary reasons for their organizational climate, in addition to their social and self-awareness. Based on such observations, information technology leaders had better become aware of their impact on the preservation of knowledge and exhibit a proactive stance toward information safekeeping that guarantees both permanent and accessible data.

Management Neglect or Decision

The information technology managements' neglect to make various forms of information electronically available could lead to information obscurity or loss for some records. Wren (2005) described management as integral to organized endeavors; an essential activity that attempts to ensure successful process flows for favorable outcomes. Governance is a formidable power that management possesses (Wren, 2005) with which the changes can be brought forth (Scott, 2007) to affect responsive aptitudes (Momeni, 2009). As the leading individual for information archiving, the IST manager has the responsibility to preserve human intelligence in the form of accessible repositories of knowledge. A neglect to act accordingly may result consequently in the loss of the intellectual property.

Inefficiencies in planning to store the information in the right place could result in a breakdown of the intelligence gathering required for prompt decision-making, as Beazley, Boenisch, and Harden (2003) have alluded. Most important, the archivist manager's neglect

would exacerbate existing data conversion problems. Hence, the IST managers will need better plans or preservation methods for safekeeping knowledge and will need to find the right storage facility for intellectual capital. Online libraries for public use may provide an answer to paper-based archival problems. An extensive study on the circulation effects of the "online public access catalog (OPAC)" (Bennett, 2007, p. 36) for information accessibility indicated that the patronage for online inquiries had increased appreciably after the implementation of an online database.

An inference from the OPAC circulation effects study would suggest that perhaps information management should consider translating any paper-based information into an electronic database and not neglect data conversion for any records. Hence, creating a standard based on the use of electronic archiving may result in better information processing and dissemination of legacy-data (Mugan, Boe, & Edland, 2004). The decision to convert paper-based data into electronic information for online access depends on the proactive effort of the information management team, and relies on their vigilance in envisioning future trends for information acquisition. The ability to see the changing movement in the users information inquiry process may keep the obscure legacy-data from becoming obsolete because of an inaccessibility problem.

Data Obscurity

Data obscurity can result from information inaccessibility. When researchers cannot find data on the matters that they are investigating while knowing that the legacy records exist, the obscurity can be the reason. Often hard-to-find data is subject to obscurity, especially when the search for the information leads to no record. No comprehensive prior studies have discussed the problem of hard-to-find data or data obscurity that the researcher

could extrapolate from or locate supporting data that could relate to the problem at hand. The referenced conventional wisdom (Albrecht, 2007) supports the idea that making the information easily accessible may prevent obscurity of the data.

Obscurity of sensitive information does not necessarily guarantee its security either (Bono, Aviel, Stubblefield, & Green, 2006), as misleading accounts have suggested. On the other hand, technology improvements have led to safer electronic archiving through enhanced data encryption methods (Yahya & Abdalla, 2008). For instance, recent technological advancements in electronic data encryption and procedures that allow deploying secured applications (Luftman, 2004) can account for one such developmental effort toward improving information security measures. Contributors to cryptographic science, such as Charles Peirce (Beaulieu, 2008), have provided tools to ensure data security. With the advanced technological capabilities and introductions to more data encryptions and the increased use of the Internet, new data security issues have been raised (Kayem, Akl, & Martin, 2008; Hilley, 2008; Betts, 2008).

Gilkey (1999) stated that most of the attempts to gain access to knowledge through "reading journals and going to conferences" (p. 34) have been deemed traditionally cumbersome and have fallen short in educating practitioners. The information-gathering systems that have used the Internet as their vehicle for expert knowledge enhancement consequently have proven to be successful. The suggested logical conclusion is to use new information processing and archiving concept as better method for human knowledge exchanging. The Internet has opened extensive opportunities for networking through which viable information exchanges are taking place. More people are using the Internet for

searching for information than ever before. With such habitual use, the public inclination for seeking information and accessing data has begun to shift.

Information Loss

The loss of information may be the result of inaccessibility of data from popular media. When knowledge repositories no longer can archive information, or when information from prior recorded knowledge is not available, the result is information obscurity and the data loss that may have occurred already. Additionally, if the system or the knowledge holding facility receives poor maintenance, the information archiving can suffer losses because of media degradation (Seneca, 2009). The probability of information's obsolescence can increase with the emergence of the new technologies that render some products outdated; hence, the information about such products is then deemed unattainable perhaps because of missing electronically archived data (Cohn, 2004).

Information losses because of inaccessibility necessitate investigating the cause and planning preventive measures to protect against future losses by bringing focus to the problem of inadequately preserved data archives (Creswell, 2005). Raising people's awareness of the existing problem can entice others to seek additional information on the problem and can motivate future research through which discoveries of new preventive measures may result (Leshem, 2007). Liu and Tuzhilin (2008) stated that the identification of "the main issues and problems" (p. 86) could bring attention to unexplored possibilities. By exposing the problem to bring forth awareness, leadership can take the proper actions to rectify the existing issue and put in place a possible prevention system to address future issues (Brown-Boone, 2006).

Obscure information may never return to use if records maintenance does not plan for future use of such information. Seneca (2009) described a multi-year project for risk management of Web data archiving that required building an infrastructure for preservation of library materials. In the article, Seneca noted the major benefit of such archival attempts was the development of the "Web Archiving Service (WAS)" (p. 427) with which curatorial efforts are possible. The California Digital Library developed the WAS tool for collecting a variety of library records. The tool was accessible for library patrons and could help researchers with information searching.

Information Repositories

Since information is an intricately vital component of the decision-making process, the strategies that the leaders develop for collecting data, storing, managing, and making data accessible in information technology departments becomes very important (King, 2007). The information technology strategists should consider the data source's authenticity while eliminating possibilities for corrupted data to find its way into the database (Murray, 2005). The authenticity of data is very important and its integrity adds to the information's value. The quality of processing the data conversion can play a major role in information finding, authentication, protection, preservation, and subsequently for dissemination of the valid and vital information (Laframboise & Reyes, 2007). Electronic communication technology has provided capabilities in online databases for creating secure and reliable electronic archival systems for a user's rapid access.

Shehane (2006) explained the development of a holistic approach to information gathering should include information reliability issues through documentation monitoring and a framework that can aid the decision support system (DSS) for vital and authenticated

information. Particularly, the archiving of scientific data (Buneman, Khanna, Tajima, & Tan, 2004) can fall under scrutiny because of the importance of validation of information within database records. Successful information systems rely on effective database implementation in which the technical complexities balance with the interdependencies of the database creation process (Sherma & Yetton, 2007). For an information repository to validate its content, the database management must exercise security precautions that will ensure data integrity. Buneman et al. (2004) recommended archiving techniques for scientific data archiving in which both the efficiency for using storage space and the continuity of the information through numerous versions can be controlled and protected.

Information repositories can expand to encompass other forms, including non-scientifically oriented communications such as newspapers, and journals. Many e-journals (Balnaves & Chehade, 2009) have been in practical use with countless clientele already subscribing to such online information sources. Online subscriptions to information have begun to establish a new trend for the information communication needs, and the increased potential for a complete turnover from print to online may come to fruition as telecommunication technologies advance. The e-journal subscriptions of special libraries may count toward a growing pattern for online electronic information exchanges. As more users find electronic information searches a trustable, convenient, and cost-effective approach to explore, the more an emphasis on data conversion and translation of paper-based data into electronic databases become important for every form of information.

Current research variables.

Creswell (2005) explains the independent variables are the influencing factors that shape the outcomes in quantitative studies. The online search engines are considered

independent variables affecting the outcome of this study because online information repositories are the focus of changing trend for legacy-data inquiries and retrievals. The influencing factors on the legacy-data availability in its electronic form (softcopies) and particularly the perceived accessibility of the converted legacy-data from online repositories are the other independent variables. Creswell (2005) also defined the dependent variables as those possible factors that a researcher anticipates to explain through the investigative study. The deposited legacy-data on the specifications are considered dependent variables in this study because part-specifications for manufacturing specialized components in the design and development of spacecraft have been missing from online engineering databases and require explanation. Obscurities of the legacy-data because of an inability to access the information in electronic archives and the data loss that may result are two major dependent variables.

Legacy patterns.

Preservation of human knowledge has evolved through the ages because of the changes in information processing patterns. Before the discovery and ultimately the invention of paper, people had used various means for preserving information from the spoken words of teachers to pupils to using clay and animal skins to inscribe written words on for passing knowledge to future generations. The pattern for archiving human knowledge has remained constant nonetheless for decades after the invention of paper. Paper-based archiving has proven to be a viable method for preserving information for its future use. Nonetheless, increased volume of information through the ages has required the use of paper as media of choice to an exhaustive level.

Traditional systems for archiving information for scholarly research are gradually becoming outdated, by Kingsley (2007) description. More scholars are turning to the Internet for viable and easer information accessing. The continually gaining popularity of the Internet use and the new searching trend suggest that the paradigmatic shift may have already begun. Authors Palmer and Eriksen (2000) acknowledged the possibilities of global distribution of information through the Internet. The movement toward using less paper to preserve the forests, and the notion of going paperless, is another push to change the old habits of information archiving.

This new mechanism of information distribution is gaining popularity among seekers of information and is further grounds for changing the traditional approaches forever. Workers in the information technology field will have to make conscious efforts to notice gains in popularity and changing habits. Promptly preparing an information archiving practice that is in accordance with this new trend of processing information electronically ultimately should become the priority of IST leadership to augment their new roles as archivists. Past ways of archiving human knowledge appear to have given way to today's modern approach.

Modern approach.

Until the popularity of the Internet and an overwhelming growth in computer use, the majority of the written archives consisted of books printed on paper. Even though paper-based records are still in use, much information is available from electronic archives. Converting data so it can be stored in a digitized format can save searching time, especially if data is available from a centrally located organized database ("How Going Paperless," 2008). Searching for information online is faster and more convenient, especially when information

seekers can electronically query the data from a known Web address (location) in which data is kept.

Even rarely used information can benefit from the availability and the quick access that results from the electronic process, even if information does not fall under the legacy umbrella. Allowing the users readily find whatever information they are seeking from a conveniently located and known online repository can improve their productivity. More rapidly searched and easier to find information allows users to find results conveniently for their electronic inquiries with less time wasted in the searching process. Hence, the process of information researching information online can be a satisfying experience and the preferred method of researchers (Chow & Chan, 2010).

The transfer of information from paper-based records into electronic archives has proven to promote ease of accessibility and usability for the data (Balnaves & Chehade, 2009; Broom, Cheshire, & Emmison, 2009; Chow & Chan, 2010; Vilar, 2008). Literature related to user satisfaction with online inquiry suggests that the conversion of legacy and specialized data would benefit from promoting the archival process of electronic storage. A consequential benefit from converting the legacy-data into the electronic repository can be the leadership's heightened awareness for translating other forms of human knowledge to the electronic archives. Using the modern approaches to store the legacy-data in electronic form may lead to positive experience that can interest the information users to seek and acquiring their interested information through the online databases.

Mitigation of the risk in information processing will require changes. Pratt (2007) warned that several areas of information technology misalignments could benefit from operational processes changes that mitigate the information problem. Areas in which

information technology misalignments may occur are those of the organizational culture, mission, purpose of archiving the intellectual asset, and the supporting resources. A misalignment also can occur because of the operator mistake that is responsible for preserving the human knowledge. The awareness of risk managers of such misalignments may prompt information technology leadership to take steps in preventing the misalignments. Technology advances for the modernization of electronic repository methods may approach to a matured stage in which every byte of human knowledge receives its transformation to a modern digitized archival form.

Paper-based.

A vast pool of human knowledge is in books, newspaper articles, and other paper-based media. With the invention of paper, humans had found their reliable ancient source for data storage. The ancient Chinese were among the human populations who contributed to the art of papermaking. Some sources have stated that the Tsai Lun of the Han Dynasty was the first individual who knew how to make paper from mulberry fibers. The Oxford English Dictionary describes paper as thin flexible material made of bleached wood pulp byproduct that is available in sheet forms for writing, drawing, or wrapping purposes ("Paper," 2010). The transcribed information on this flexible sheet form that helps extending the preservation of the data is the paper-based term used in this study. From the time when paper became available, archivists have tried to preserve human knowledge in this form by writing scores of the information down.

Access to paper-based records however, such as books available at libraries, especially for researching purposes by people in the academia (Jacobs, 1996), can be restrictive because of the limited number of printed copies. In contrast, access to electronic

records can eliminate the need for physical possession of limited copies. The information technology leaders who work in the knowledge curators' capacity can lead the legacy-data conversion efforts to make the books more available from the online sources. Translating knowledge from paper-based records into electronically accessible information repositories preserves the knowledge longer and can make the information more readily available through replication.

Electronic form.

The paperless record-keeping practice already has become the mode of operation for some health care providing organizations, as Hawn (2009) discovered. In her primary example, the author described how a Brooklyn primary care clinic regularly used instant messaging and other social networking systems to enable fast communication between patients and the physician partners in the clinic. Eliminating the majority of non-emergency visits cut the traveling times and allowed more freedom to both patients and doctors to go on with their regular daily activities.

In another example in which the health information managers (Wollersheim, Sari, & Rahayu, 2009) had to rely on archetype electronic health records, they concluded that electronic records were more suitable for health information repositories. The convenience of acquiring instantaneous access to records, the speed in keyword searching, and easy retrieval of the desired information have made electronic conversion and electronic storage capabilities the preferred data archiving method. Moreover, the convenience of online access both expedites the information search and its retrievals as well as reduces the cost involved in labor-intensive data searching through paper-based archives.

The most widely used data archiving approach uses multiple tabulations of information in a relational database management system (RDBMS) model. Dr. Edgar Frank Codd introduced the RDBMS in 1970 while working at the International Business Machines (IBM) Corporation. The RDBMS has received many augmentations through the years after its initial inception date to what its current application capability can provide now. The system can store varieties of data formats within interrelated tables. In the RDBMS, the relations (tables) consist of records of tuples (rows of data) that share many common attributes (fields in columns) and are identifiable through their reference keys. Every data record is identifiable through its unique reference number, which is the primary key for that record.

Tables of records will relate to one another through the common foreign key entries in tables. Managers in the IT fields can collect vast amounts of information as the new curators of the knowledge, archive using databases and the relational structure, and preserve those data for future access. Most of the popular online search engines such as Google and Yahoo can provide access for more than a terabyte (a million-millions, or 1000 gigabytes) of information. Although some relational database systems have limited capability for storing large data volumes, new data archiving concepts have been emerging through which suggested data storage capacities can be many times greater than a petabyte (10^{15}, or 1000 terabytes) for holding collections of records.

Chisholm (2009, October) described the approach to data storing practices that have gone through yet another paradigm change in which information management based on Google's "BigTable" concept has become the new preferred approach (p. 45). Although technology improves infrastructure for storing and processing data, leadership in IT

management should take advantage of the new capabilities to ensure electronic preservation for every type of information. Selectively leaving out an obscured and less desired information (for example, the rare legacy-data on piece-part specification) can be detrimental to the availability of knowledge online for future generations. Expectations for quality of data from electronic repositories depends on systematic archiving (Broom, Cheshire, & Emmison, 2009) of quality information for guaranteed future researching and use.

Legacy-Data Conversion for Electronic Media Storage

The electronic version of legacy-data includes any captured images, translated writings, or the combination of both data types. The conversion process for translating paper-based information is perhaps more cumbersome in comparison with snapping just photographic images of the artifacts. Nonetheless, both processes will incur costs to produce and labor to achieve. As the data conversion will require thorough understanding of the original languages and prompt translation of the written manuscripts for credible electronic archiving, the conversion effort may seem a difficult task. Practical applicability of archiving through websites (Vilar, 2008) may give an incentive nevertheless for information management professionals to steer their electronic archiving efforts in that direction.

Data Conversion Difficulties

The difficulties of involved steps in the process of translating and converting legacy-data from its original paper-based format into an electronic archive database may stem from multiple factors. Lack of familiarity with the original language that the legacy-data producer had used, the suggested method for the data conversion, the issues in procuring the database infrastructure, allocation of expenses to cover the costs, and the archivist manager's proactive desire to pursue the conversion effort are among the primary concerns. Other constraints that

can lead to experiencing more difficulties with the reproduction of a viable legacy library (Quintana-Ortí, Quintana-Ortí, Van De Geijn, Van Zee, & Chan, 2009) may force further changes in archival routines that require using alternative approaches that facilitate better information accessing for the benefit of the users.

Data conversion may require integrating information from the legacy data for storage at database systems that contain composite information environment (Madnick & Wang, 1988) in which the full integration is difficult, time-consuming, and expensive process. The conversion and the integration processes may require separating data from the processing environment, use of specific tools that provide flexibility for the data translation, specialized data conversion interfaces for communications purposes, and the precise identification of the database environment. Difficulties of achieving these steps precisely can increase both the cost of legacy data conversion and extend the anticipated time for completing the data conversion. For digitization and conversion processes of the non-digital information (MacPherson, 2006), the leaders of the information technology will have to strategize the legacy data conversions.

Cost Effectiveness

The cost of converting legacy or specialized information from paper-based records into electronically stored data archives should level out with the benefits gained from the information's accessibility and the lasting preservation of the human knowledge. Electronic records are the most convenient forms of archival repositories. Moreover, when the electronically preserved information receives verification by scholarly reviews that guarantee its authenticity, the value of its content rises.

The conversion of legacy-data into a digitized repository can be a considerably inexpensive process. Taking photographic images of the legacy-data and the ancient artifacts is currently possible through electronic scanning, or even with digital cameras. The obtained images can then be easily imported into a computer via embedded software that is part of the graphic programming component in most of today's popular computer operating systems. This results in low costs of operations for converting non-electronic legacy-data to electronically stored information.

Electronic Information Availability/Accessibility

The availability of legible data and the accessibility of necessary information make the passing of knowledge to others more convenient. Conversion of legacy-data from paper-based repositories into their equivalent electronic form can provide such convenience and can preserve information longer while providing instantaneous availability. Moreover, the converted data may become electronically attainable online through the Internet. Providing accessibility for information through the Internet encourages information users to seek the preserved knowledge (Lopez-Sisniega, 2009).

Study conducted by Carlos Lopez-Sisniega (2009) on the "eGovernment" patronage had shown the strongest factor for use of the online facility was the users' access to the Internet (p. 53). Providing easier access to information through electronically preserved knowledge databases consequently can encourage the acquisition of knowledge for use. IT leadership should make deliberate attempts to become more familiar with the discoveries of such studies, and respond accordingly to convert legacy-data for electronic archiving.

Through many enterprise-networking facilities, the information archivists can collect and manage fractal information for an extended lifecycle using the branch independent

research method (Koutsakas, Hatzaras, Vontas, & Koumpis, 2002). The Koutsakas et al. (2002) discoveries explained the flow of information through the information supply chain (ISC) providing better access to knowledge, and making the information processing network more reliable. They alluded that with the new data processing architectures, IT managers should be able to provide cost-effective networking systems that harmonically operate to acquire and disseminate information.

The notion behind the promotion of digital translation of every type of information for archival safekeeping, whether be it legacy or new knowledge, stems from a belief that the digital database archives are more accessible. An example for such a conjecture may come from the new recording procedures that the medical group known as Kaiser Permanente in the state of California has adopted. The health care services provider has changed its paper-based patient data recording method to an electronic data processing system, which can allow patients and physicians to access a variety of information about health matters online ("Kaiser Permanente," 2009). The changeover of the archival methods also has made it easier for a member to switch his or her health record to a new residence if the work requires his or her relocation.

Electronic Information Dissemination

Collection, storage, and dissemination of electronically converted information through many available software tools such as content management systems (CMS) can optimize the information organization process (Benevolo & Negri, 2007). As a result, the knowledge workers and the researchers as the users of such systems will have freedom and wider access to the knowledge in a shorter time. The important matter is that information

conversion of the data takes place at every level so that any interesting information is electronically accessible to the user.

Changes in the modes, and archiving methods from the formerly paper-based media to electronic forms can in turn, cause changes in the organization's processes for managed information dissemination. Scott (2007) described organizational needs for information can fuel innovative growth, and as the new technologies emerge, the organizations can change to fit their information management processes to the new model's added functionality. This process shifting would require the abandonment of the old methods while demanding the conversion exercise cover the information translation unilaterally for every form of data.

Evidence may show that when changes in information documentation and accessing occur, the old ways of knowledge preservation may no longer be effective approaches or the methods that continue to hold popularity among users. The changing trend, which usually alters the behavior regarding the work of knowledge preservation and acquisition in a person can affect the human "multiple intelligence paradigm," a term coined by psychologist, Howard Gardner. A user's adaptation to the changing trend can result in new prevailing practical intelligence, as discussed by Karl Albrecht (2007), and become the new practical approach as a result.

Electronic Information Validity/Reliability

Ensuring the integrity and the correctness of electronically converted and stored information is an important aspect of the electronic information repository. Archivists have exerted continually their best efforts to preserve the integrity of the information in the collected records because preservation and propagation of information kept on shifting from the oral transfer method of the past to that of the written artifact forms (Robertson &

Cunningham, 2000). Despite many archivists' arduous efforts, few ancient records have survived in comparison to the enormous volumes that should have existed.

Creswell (2005) has accentuated problems arising from the experimental procedures or participants' understandings in a study as threatening researchers ability to extrapolate cause-and-effect correctly that coerces both the internal validity and the outcome of the experiment. When researchers misinterpret survey responses from the participating panelists, then the concluding results of the research are questionable. In reference to experimental design and the internal threats for such designs, Creswell (2005) suggested literature from Cook and Campbell (1979), Reichardt and Mark (1998), and Tuckman (1999). A rather long time passing between the start and the end of a study, for example, with the changes occurring during such time that may have altered the participants' perceptions, is one such internal threat to validity of the research results.

Generalization in a study is the threat to external validity. Researchers presumption of the study outcome as a treatment and applicable to the future recurrent investigations is a generalization after the extraneous causes haven been ruled out. Assumptions are external validity threats that can affect the study results, according to Creswell (2005). The diverging problems resulting from research participants' misunderstandings or the experimental procedures in the study affect researchers judgment to draw correct inferences for the cause-and-effect and threaten the validity of the research as Creswell (2005) alluded. The three types of external threats to research validity that can lead to generalization problems are (a) interaction of selection and treatment, (b) interaction of setting and treatment, and (c) interaction of history and treatment (Cook & Campbell, 1979 cited in Creswell, 2005, pp. 293-294).

Wang, Chang, Hsiao, and Teng (2006) referred to some ancient Chinese scores that suffered from environmental corrosion, leaving the artifacts fading presently. Preserving legacy information for extended future would require implementing strict environmental controls that affect the storage climate. During the April 2007 meeting on sustainable climate control strategies ("Newsletter 22.2 Spring," 2007), experts from various scientific disciplines participated. The representatives discussed possible alternatives to the conventional air conditioned systems and noted that the preservation of many historical artifacts (including scrolls, and paper records) required tailored stringent environmental controls to conserve different materials.

Information Systems and Technology Users

The users of information come from all occupations. Based on the individual's needs and the literacy standing, the type of sought information can vary vastly. Before the global availability of the Internet databases and the popularization of various online searching tools, people used to commute to local libraries to conduct research for the information they wanted. As the online databases became more available, and the database administrators enhanced the information contents in those databases, by adding more information with factual evidences and verified accuracy, more people began trusting the information available from the online sources, and they started searching regularly through various search engines.

Today's business professionals as well as distant learners from virtual classrooms are using authenticated information from many online peer-reviewed sources. Brooks (2001) elaborated on the use of online libraries through which members of the academia can access peer-reviewed full-text articles from databases. Authenticated information from the online sources is not exclusive to the academia and businesses. Average users can access verified

critical information when the needs arise. For example, anyone with a personal computer who can connect to the Internet is capable of accessing the Google Map and finding exact routes and distances for a driving trip. Such trusted information is measured physically, its data converted and stored digitally, and available from the well-known online database.

Stakeholders/Beneficiaries

In general, the public benefits from the availability of information that is readily accessible through many online databases. The sought out specialized information is a particular concern for specific groups, as rare reports are normally not of general interest. Specifications that may be interesting only to a select user group and the protected records that must remain obscured from the public view without the proper authority to access such data fall into this category. Many types of information can benefit particular users if the data is easily retrievable online. Anyone who can access information from the online database is the potential beneficiary because the online information accessing saves travelling time to the local library for the average user.

Many members from special groups, such as professionals in the health-care systems, are depending on the availability and the use of information from secured private online sources. Hirji (2004) discovered that the Canadian health-care personnel were among the stakeholders who greatly depended on digitized information and benefited from the online provisions for information accessing. Practically, everyone can benefit from accessing the information online from trusted databases.

General user (public).

The general user labels the users in public and denotes all who have access to the Internet and are cognizant of how using various features in the online search engines that

facilitate the searching for desired information. Although the average person may not find specialized data interesting, accessing of information through online facilities has become favorable in comparison with the troubles of driving to a local library. One of the goals from this study is to ascertain if the preferred information-seeking method has changed in the public's perception. Evidence of the increased use of the Internet for searching information (Bar-Ilan & Peritz, 2009; Harris-Bowlsbey & Sampson, 2005) is perhaps an attribute to the changing public attitude toward inquiring.

Special groups.

Some members of society will fall under special groups or circumstances that require protection of the law for their personal rights. A signed consent from a legal guardian would be needed for such cases if the survey is dealing with minors, pregnant women, and other individuals protected by the Health Insurance Portability and Accountability Act (HIPPA) of 1996 (CITI, 2006). The purpose of obtaining informed consent is to ensure participants' privacy, state how the survey will be administered, and fully disclose the purpose of the study. Informed consent is an integral component of ethical research (Creswell, 2002 cited in Psalmonds, 2008).

Academic researchers from various fields, physicians, other health-care providers, and engineers, are some members of the public who would fall under the special groups label. Many such professionals, for instance the medical doctors or health-care providers, deal with patient records and other sensitive personal information that involves an individual's privacy, which needs protection. Engineers may need access to highly technical data interesting to their job or performance. Educators, who use "MERLOT (Multimedia Educational Resource for Learning and Online Teaching)" (Smith, Smith, & Melder, 2007, p.

147), would encompass the specific knowledge workers among the researchers group. The engineering group is the specific study group that this author will be focusing on throughout this investigation.

The goal of a qualitative investigation is to describe and add to existing knowledge (Morse, 2006) for which validity has a different function. The rigor in collecting qualitative data will rely on a validation process that conventionally accepts the participants' responses in the survey as unconditionally permissible facts. Validity in the study associates the research questions with the research design appropriateness through which the repeatability of results from the investigations is possible to prove the reliability of the research (Creswell, 2002 cited in Psalmonds, 2008).

Gender relevancies.

Regarding the relationship of gender to the use of the Internet, Johnson (2003) found that no significant differences existed at the university students level. Both sexes, men and women alike, accessed online government services equally, as Lopez-Sisniega (2009) determined through his research findings. The most prevalent problem for accessing Mexican government services through the Internet was the connectivity issues, not gender (Lopez-Sisniega, 2009).

Nature of the Information (Specificity in Contrast to Popularity of Use)

People's habits and changes in their preferences can lead to shifting of what was previously considered normal practice. A change in user behavior may be the result of influence from changes in the organizational structure toward the operating culture that has changed to fit organizational searching pattern to the new model of information accessing, as Clemmons (2005) has implied. As new data archiving and retrieval methods become the

favored public pattern for information accessing, a paradigmatic shift in legacy-data processing may take place. The validity of the information must remain unchanged regardless of the exercise.

Nature of Electronic Media and the Archived Repository

The electronic media comprises of the online databases that are accessible through the Internet connection, where the information exchanges take place. The following subsections contain additional explanations on the electronic media environment.

Media Durability.

Media for recording and archiving information varies. From stone and woodcarvings, to ancient scrolls on animal skin, to paper-based records, different materials thought to be best suited for archiving information have been used over the years. Written data on paper media can be more susceptible to damages caused by environmental changes in comparison to records stored electronically in a more durable media format, such as compact disks. New forms of electronic media storage, such as images from radiographic collections (Dandu, 2008), can also hold large volumes of information in relatively small areas.

Large storage capacities for holding considerable volumes of data in small spaces and material durability in the new electronic storage media, such as compact disks or other flash memory-type devices, make the selection advantageous over former information archiving materials such as books and parts-specification pamphlets. Rose and Wright (2004) explain that electronically inscribed records of today are more efficient and have longer lasting forms of archiving. Collecting, storing, and making the information readily available to users in a convenient and easily portable media has proven to be a favored method for many information users.

Media Security.

Scholars and researchers have questioned the integrity of much electronically stored information. Circumstances surrounding the integrity of the online information, especially when the possibilities for manipulating facts in electronic records exist, have prompted some users to mistrust the electronically stored information as the viable data. The security of information, which can show its originality, is hence a very important matter. Controlled access through authentications for data editing can ensure some level of data validity henceforth.

Maintenance.

Protecting the originality of information along with its value and integrity requires planning and routine maintenance on the database. Regular backups, information updating, and security provisions that allow only authorized individuals to access or change the contents of electronic information repositories can ensure the authenticity of data and maintain its value. Database maintenance planning may include provisions that not only safeguard the integrity of electronically preserved information but also elevate the validity of such documents to the status of legally recognized and binding records (Blythe, 2007).

Maintaining the validity of electronic records may require authentication of the data through a verification process that involves peer-review checks by scholars in the fields that such information records pertain. Routine backups of the databases can provide identical records for replicating authentic information. Multiple backups from the same database may prevent record loss by mitigating the risk of losing information because of an unexpected accident. Moreover, a replicated database can easily be transferred to a different database

server if the main computer suffers damage while keeping the original information still inside.

Management.

Converting useful information into electronic records, maintaining the integrity of the data during conversion, and archiving the converted knowledge in electronic storage facilities for the purpose of future reference is the responsibility of information systems technology management and personnel. The leadership of IST management facilities will have the primary responsibility for any data that their IST department is tasked to store and preserve. Activities surrounding information processing can vary depending on the type of data that requires archiving. Not all data is the same. Chisholm (2009, April) describes three distinctively different forms exist for data communication. Chisholm has differentiated the three types of data to be that of the reference, the master-form, and the event type data; each form needs a separate management technique.

The information technology leadership must react accordingly. Hesitation in translating legacy-data for electronic archiving because of its cost or any other factor could cause failure to preserving the knowledge in this new electronic era. As a result, it may be hindering the information access that can aid the growth of multiple intelligences in people. The relationship between the leadership and the domains where human multiple intelligences are functioning contributes to the leadership's failure or their success (Wilson, 2004). A better knowledge of personal intelligence that encompasses both interpersonal and intrapersonal environments, Wilson (2004) explains, could bring forth awareness necessary for one's leadership efforts to prevail.

Comparative Costs.

With technological improvements in telecommunication and falling prices for infrastructure acquisitioning, electronic data archiving has become the more economically feasible route to take. Virtual access to information is the most efficient way of training military personnel, and it can be cost-effective by the Mordvinov (2007) explanation. Moreover, the authors Rockwell and Abeles (1998) indicated that the emphasis on data archiving would eliminate future information obscurity and encourage future research. The expenses incurred to preserve legacy-data in a more accessible form is not only justifiable when compared to expenses for a paper-based information archiving method, the cost may even become less as technology advances.

Conclusion

The analysis of existing research literature showed that electronic data storage provides more efficient information archives (Palmer & Eriksen, 2000; Koutsakas et al., 2002; Rose & Wright, 2004; Benevolo & Negri, 2007; Smith et al., 2007; Mordvinov, 2007; Lopez-Sisniega, 2009; Wollersheim et al., 2009). The electronic archives are available to all information users for more rapid access and a more effective learning experience. Hence, sufficient research evidence may be found to support the claim that this study will investigate. Another claim that the author of this study has been suggesting contends that the new trend in information seeking is in the process of changing the legacy knowledge base paradigm.

The supporting literature for the latter claim has indicated that people usually prefer to use of an electronic information facility when they have the means to access the Internet ("Kaiser Permanente," 2009; Lopez-Sisniega, 2009; Quintana-Ortí et al., 2009) and when the

information is available in an electronic form. Moreover, and as result of further supportive indications given by Chisholm (2009, October) and Hawn's (2009) studies on the popularity of the electronic information access, the investigating author in this study intends to ascertain survey proof for the paradigmatic shift. The research literature revealed that the tendency of today's information seekers is to go to online sources immediately. This new information-searching trend seems to continue growing as more people gain access to online methods.

To undergo investigational attempts for this study, the researcher will need to acquire analytical knowledge for carrying out statistical tests (e.g., t-test, ANOVA, regression, chi-square) on numerical results from the quantitatively obtained portion of the research (Burton, 2003; McMullin, 2003). Neuman, Plano-Clark, Lane, and Roberts (2004) presented four study cases that illustrated such proceedings. The chi-square analysis is the popular analytical approach in which researchers can determine if goodness of fit between results of the collected data to the null hypothesis exists, or determine for independence or the dependency between two variables (Jaisingh, 2000; Thorne & Giesen, 2000; Kuzma, 1998).

The information technology managers as the new data archivists should warn information users to seek out every opportunity to safeguard data in an electronic form and proactively proceed with legacy-data conversions. Effective planning for legacy-data conversion and choosing of the proper archive (Beazley et al., 2003) can ensure the availability of the information. Data accessibility through improved mechanisms, as King (2007) alluded can improve research time because results of the information searches are available rapidly.

Summary

The key goal of this literature review was to discover whether earlier studies had dealt with information loss because of the lack of electronic conversions of legacy-data or if investigation of the problem was warranted and required a gap study. The research discoveries corroborate the need to investigate this problem. Supporting evidence has confirmed the notion of paradigm changes for information accessing. The researcher presented the importance of data conversion through discussions and highlighted the need to include any record no matter how little sought out the information may be.

The electronic conversion of legacy-data improves researcher's productivity ("How Going Paperless," 2008), whereas rapidly accessing information provides more efficient searching in a cost-effective alternative method of preserving information. The key point for information technology leadership is that such managers exert primary influential changes in organizations (Gilkey, 1999; Luftman, 2004; Wren, 2005; Munkeby, 2007), which continue to set standards for how organizations operate. The IT management must not willingly or unintentionally abandon any non-electronic human knowledge solely on the presumption that the conversion is difficult.

Traditionally, most research studies were quantitative because of the types of research questions such studies contained (Bhagan, 2008; Patten, 2004), whereas qualitative studies were much less practiced. Although the objective is to either confirm or reject a hypothesis in the quantitative research, the main objective from a qualitative study is to explore a phenomenon for a better understanding of it. The mixed methods approach to researching additionally requires the researcher to investigate a phenomenon by combining the two traditional approaches for more comprehensive knowledge attainment.

In chapter 3, the author of this study will be presenting appropriate research methods for investigating the key claims made in the statement of the purpose for the proposed research. The first key point this study will investigate is the researcher's claim that information loss occurs because of neglect in producing and maintaining electronic records. The second key point that the researcher has considered for study is the assumption that information is rendered obsolete when users cannot find data easily through online sources or when minimal data is available, which creates a cumbersome search process (Kondro, 2005). The third key point in the study is to obtain quantifiable data that validates the first and second key points through user behavior in searching (Kwan Yi et al., 2006). Statistical results from the obtained answers through the survey questionnaires should either support or reject the claim made by this study.

The examination of the qualitative survey results should provide a wider evaluation of the problem that the researching author has planned to discover. The outcome of triangulating the problem of absent data's effects (Creswell, 2005) on database inquiries may encourage information managers to design strategies that prevent future online data accessing problems by ensuring heritage-data conversion, storage, and online availability. Moreover, informed managers of online database archives may seek out valid legacy-data for online conversion (Den Besten & Dalle, 2008). Presented materials in chapter three include answers for the appropriateness of the design in this research, include research questions with hypotheses, contain explanation of population, sampling, obtaining informed consents, and rationale for data collection and procedures as well as instrumentation, validity and reliability, data analysis, and summaries. The proposed research method for this study is given in the following chapter.

CHAPTER 3: METHOD

The purpose of this mixed methods study was to investigate the existing non-obsolete piece-part specifications data conversion problem for better understanding of the void in online digital database repositories. The presentation of corroborating evidence on the conversion problem of the non-obsolete piece-part specifications that were unavailable from online databases and the engineers at NASA divisions still used was considered providing awareness for improving the online inquiries at NASA. To understand better about influencing factors that may have contributed to the information void phenomenon, both quantitative and qualitative investigations were proposed simultaneously. The survey instrument included both open-ended and closed-ended questions that related to the legacy-data conversion problem for triangulating the resulting surveyed data through this research for successive interpretation. The survey instrument was presented as Likert-type questionnaire and was distributed through communications network of the permitting firm where engineers could access. To obtain corroborating data for the interpretation, from both quantitative analysis and qualitative discoveries, 50 randomly selected responses from completely answered questionnaires were to be chosen.

The anticipated knowledge gaining was to assist understanding the problem of the legacy-data conversion better for online archives and inquiries based on collecting the survey answers. The assumption was that the online databases were trusted generally and were the preferred way of gathering information (Kim, Bartlett, & Lehmann, 2005) in practical and empirical inquiries. The outcome of triangulating absent data's effects (Creswell, 2005) on database inquiries was considered encouraging information managers to design strategies that prevented future online data accessing problems by ensuring heritage-data conversion,

storage, and online availability. Informing data managers of the probable preference for using the online database archives for seeking out valid legacy-data was determined prompting them to favor the online conversion (Den Besten & Dalle, 2008). The presented materials in chapter 3 included answers on appropriateness of the design in this research, contained research questions with hypotheses, and included explanation of the population, sampling, obtaining informed consents, rationale on data collection, instrumentation process, validity and reliability, data analysis, clarity of organization, and information to explain the study plan.

Research Design

The design of this study was based on the triangulation mixed methods approach as depicted in the following Figure 1. Researchers, who use the triangulation mixed methods design, simultaneously conduct the quantitative and the qualitative research techniques together and compare the analyzed results obtained from both studies to determine if both databases have produced similar or dissimilar results (Creswell, 2005). Researchers traditionally have used either quantitative or qualitative approaches to conduct researches, as Creswell (2005) exclaimed. In the quantitative method for researching, a researcher must first identify variables (independent and dependent) that relate or pertain to the problem under investigation. The survey questions two through 12 and corresponding possible choices given to participants for answers were the independent and the dependent variables respectively for this study. The study of the conditions that affect mostly the independent variables included statistical analysis of the quantitative results, which the qualitatively obtained responses could corroborate with, for concluding about this study's findings.

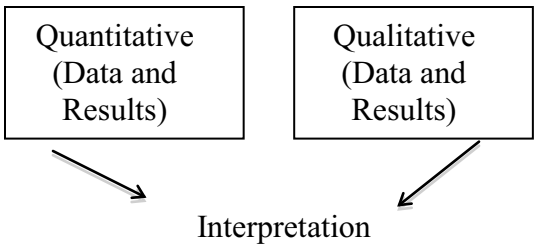

Figure 1. Triangulation mixed-method design process adapted from Creswell, 2005.

The quantitative process provided an unbiased conclusion and the researcher presented the facts without personal influence. The quantitative approach primarily would produce "educational research in which the researcher decides what to study, asks specific, narrow questions, collects numeric (numbered) data from participants, analyzes these numbers using statistics, and conducts the inquiry in an unbiased, objective manner" (Creswell, 2005, p. 39). In a qualitative research approach, researchers study opinions and personal understandings that pertain to or can associate with the problem under study. For a qualitative study, a researcher normally asks open-ended questions to discover deeper understanding of the phenomenological anomaly or explore the problem. Problem explorations then would yield explanations that aid in understanding the problem.

Cooper and Schindler (2003) had attested that explanatory and predictive studies "are grounded in theory, and theory is created to answer why and how questions" (p. 11). Although the theory for the research in this study was based on an assumption of the loss of information because of a data conversion problem, the research could not base solely on the theoretical analysis. The information user's perception played an equally strong role in the way of data inquiry and required a qualitative investigation. For a purely qualitative study, a researcher "relies on the views of participants, asks broad, general questions, collects data consisting largely of words (or text) from participants, describes and analyzes these words for

themes, and conducts the inquiry in a subjective, biased manner" (Creswell, 2005, p. 39). The qualitative research method alone would discount the quantitative effects that this study had predicted. For a better understanding of the legacy-data conversion phenomenon and the problem with information availability online for some part-specifications this mixed methods design had been proposed in anticipation of triangulating the research findings (Creswell, 2005) for an interpretive conclusion.

Appropriateness of Design

In his dissertation, Bhagan (2008) had quoted Patten (2004) by stating, "Some research questions inherently lend themselves more to a quantitative than the qualitative approach" (p. 21), whereas some could lead other researchers to pursue a qualitative study (p. 54). Although the objective of quantitative research is to either confirm or reject a hypothesis, the main objective from a qualitative study is to explore a phenomenon for better understanding. In the mixed methods approach to researching, the researcher's goal from investigating a phenomenon combines the two traditional approaches for a more comprehensive knowledge gain.

The mixed methods design in research would enable a researcher to understand, explore, and explain the problem through interpretations of collected data. Researchers, who use the mixed methods design can benefit from the advantages of each of the quantitative and qualitative investigational styles by combining the results of both methods to produce a better understanding of the problem (Creswell, 2005). Three types of mixed methods designs existed for researching, and they were (a) triangulation, (b) exploratory, and (c) explanatory (Creswell, 2005, p. 514). The favored approach was to use the triangulation process in which researcher conducted simultaneous quantitative and qualitative studies. This research plan

included both open-ended and closed-ended questions for collecting qualitative and quantitative data simultaneously for the purpose of triangulating toward an interpretative decision in a mixed methods design approach. The research questions were available through survey instrument (see Appendix A, Table A1). Merging results from both sets of data (quantitative and qualitative) that were obtained through questionnaires for discovering if corroborating evidences would lead to clearer understandings (Creswell, 2005) of the problem with legacy-data conversion and online part-specification availability was the intent from survey at the end of the study.

The rationale for using the mixed methods research design was that weaknesses of collected data from one set, either quantitatively or qualitatively could be offset by the strength of data from the other (Creswell, 2005). If the information loss occurred for the legacy records because of the unavailability of the electronically preserved records, and because very few focused studies were available to address the problem, then the mixed methods design was the best fitting approach to study. To evaluate if the availability of legacy-data online correlated to the frequency of the use for information, the study included quantifiable survey score examination with simultaneously complimenting obtained qualitative expressions from the research subjects. Understanding the legacy-data conversion problem better led to identifying the user preference or pattern of information inquiry, which increased management efforts for converting legacy-data for the online access. Through a triangulation mixed methods design a researcher nonetheless would be able to explain the legacy-data conversion problem better and subsequently add to the understanding of its problem.

Population

Consistent with the Cooper and Schindler's (2003) explanation, population referred to the sum of essential data collections in a study with which the researcher desired to make an inference at the end of the study. The population affected by this mixed methods design triangulation study combined the spacecraft industry engineers from electronics and manufacturing (mechanical) fields, who received Likert-type questionnaires and were asked to sign a letter of informed consent prior to answering the questions. These groups of engineers handled electronic subsystems that required accessing and knowing piece-part specifications that helped them in completing circuit designs and documentation. The effects of the outcomes in this investigation then extended to benefit a larger population of the professionals outside the focused group.

The specific targeted population for conducting interviews with or collecting survey results from through questionnaires was chosen to be members of the engineering from electronics and manufacturing fields found in spacecraft industries such as the NASA for the purpose of this research. These classes of engineers need the access to technical specifications on the hardware components that they use in their designs, manufacturing, or testability factors for incorporating the information into their reports and final documentation of the product.

Sampling

The sampling consisted of subset of the targeted population who participated in the survey and completed all survey questions. The maximum number for the selection process was set initially to 50 individuals. For evaluation of the research results through triangulation mixed methods design in this investigational study, the participants' completed

survey questionnaires were selected at random and coded for protection of the participants anonymity in the process. The aggregate coding of the collected data for quantitative evaluations preserved the anonymity of the surveyed subjects and allowed the collected data to remain unaltered and unbiased. The aggregated scores of selected responses and pre-coded collections were used then to accommodate for matching the corroborating data between quantitative data analysis and the qualitative expressions from the targeted survey participants. Through such evaluative approach, the enabling of the translation of one form of data from the study for integration with the other form for comparison (Creswell, 2005) was possible. The coding process additionally ensured the privacy of the surveyed subjects regardless of their answer choices and kept the collected data unaltered and unbiased by the opinion and the assumptions made in the study.

Selection

The selection process for the collected field data from responded questionnaires included only the fully answered surveys. Every retrieved survey response was labeled sequentially with a unique number arrangement, for example the Internet Protocol (IP) address and membership listing, which indicated anonymity of the participant's name and gender. The engineering need for parts specifications was considered same between the sexes. The commissioned internet-based company, Survey Monkey, arranged the online solicitations for collecting the survey participants and distributed the instrument.

Validation and Reliability Instrument

Selecting 50 fully answered questionnaires from the engineering groups provided the scaling validity (Topcu, 2010) for the research findings. The generalization of the obtained survey results for conclusive treatment of the variables (Sproull, 2003 cited in Lopez-

Sisniega, 2009) in this study led to inconclusive inferences about the problem of the legacy-data conversion.

Data Types for Measurement

The enumerated possible answers were provided for the survey participants through a Likert-type questioning system. The individuals' selected an answer for each of the quantitative questions on the survey questionnaire, which was the number that corresponded to a particular answer. The circled number then gave one numerical predictor for the possible data level measurement.

Collection procedure.

Quantitative data was collected through Likert-type questionnaires that brought focus onto the probability of online data searching patterns and the notion that online search capabilities were setting the new trend for information inquiries. Whether a paradigmatic shift in informational archiving and its inquiry had occurred already or that the change was inevitable, the focus on concluding qualitatively with the same results remained unchanged. Data entry and collection of the survey participants' responses to online survey questions followed the specific process flow that is shown at the appendixes section of this research manuscript.

Organizing procedure.

Responses given to the questions on the Likert-type surveys were organized into numerical scores for statistical analysis. The participants' responses to the qualitative questions were sorted furthermore by the patterns to provide for discovering a majority concurrence, which then supported the idea of a strong and popular new emerging trend (the paradigmatic shift) for seeking information from electronic archiving facilities.

Analyzing procedure.

The mathematical analyses for the quantitative conclusions were accomplished through the chi-square methods. The null hypotheses were tested using the Pearson's chi-square formula for the goodness of fit. Additional numerical results were evaluated using basic statistical evaluations such as mean values for picking responses or modes in selecting particular answers for each category of the surveyed questions.

Interpreting procedure.

The mode for particular answers from the surveyed questions indicated a tendency among survey participants that favored certain assumptions made by the researcher or the state of the hypothesis for that concern. The goodness of fit results had indications to either favor the null hypotheses or reject them and supported the research assumptions made by researcher.

Prediction.

The predictability of the results obtained from the answered questions on the questionnaires included either rejection of the claims made in this study or indicated favorably for the assumptions about heritage-data conversion anomaly.

Interviews.

The primary form of collecting opinions from the individual participants was through online questionnaire distributions. If the process of remotely interviewing and collecting responses was impossible, then a face-to-face session could have been arranged in which the interviewer would have asked the same questions from the mailed out questionnaires.

Research Questions and Hypotheses

The research questions and hypotheses appropriately were tailored. Open-ended questions for qualitatively researching in this mixed-methods design were suitable for facilitating the interpretive question results (Neuman, 2003). The approach enabled discovering the participating target-group's perspectives through investigations and provided direction for making sense of what was the common perception. The qualitative part in this study was henceforth an explorative attempt to expand on the research questions. The quantitative research design was used for proving the null hypotheses (Creswell, 2002, 2005), and the approach did not require designing research questions (Sproull, 1995, 2003). As the mixed methods nature of the investigations in this study indicated, the corroborating results of the field surveys from the qualitative part were anticipated to include favorable prediction of the quantitative results and revealed better descriptions for explaining the hypotheses. Research questions and the hypotheses in this study for examining for both quantitative and qualitative parts were as the following.

Research Questions

The questions stated below were for obtaining qualitative investigation results in this research plan, as the focus from surveying the participants' opinions was considered to lead to words why and how individual perceptions may have developed, which enabled exploring the qualitative research discoveries further (Creswell, 2002, 2005). The qualitatively explored opinions and the obtained results from this study provided answers that stipulated explanations for the following questions:

1. Why do the information conversions from paper-based records to electronic databases become difficult and costly efforts?

2. How can electronically archived data for part-specifications benefit the engineering community?
3. Why do the archived data from popular search engines and databases lack some part-specifications?
4. How can conversion of information from paper-based record to electronic database guarantee preservation for uncommon, non-obsolete, but useful information best with the accessibility?

The questionnaire in survey instrument, which is shown in Table A1, contained questions that required from the individual participants to choose an answer from listed responses on the Likert scale to which the correlating research questions were indicated on Table B1 subsequently. The information on independent and dependent variables was collected additionally on the surveys appropriate questions or the group of items (see Appendix B) and variables were limited to survey questions Q2 through Q12.

Hypotheses

$H_0$1: There is no significant direct relationship between the perceived information obsolescence, loss or deficient use, and inaccessibility of the data from online databases resulting from conversion neglect or management's decision to circumvent digitization of the paper-based record.

H_a1: There is a significant direct relationship between the perceived information obsolescence, loss or deficient use, and inaccessibility of the data from online databases resulting from conversion neglect or management's decision to circumvent digitization of the paper-based record.

$H_0$2: There is no significant direct relationship between the popularity of inquiring information online because of instantaneous availability of the data and threatening imposition to boycott the data repositories that remain on paper media.

H_a2: There is a significant direct relationship between the popularity of inquiring information online because of instantaneous availability of the data and threatening imposition to boycott the data repositories that remain on paper media.

$H_0$3: There is no significant direct relationship between the perceived online frequencies of use for non-obsolete specialized data, guaranteed availability and preservation of such information, and conversion of the paper-based records to digital archives.

H_a3: There is a significant direct relationship between the perceived online frequencies of use for non-obsolete specialized data, guaranteed availability and preservation of such information, and conversion of the paper-based records to digital archives.

Informed Consent

The survey participants expectedly received and studied the informed consent forms through online survey instrument for obtaining their free will to participate and permit to collect and use their responses with the guarantee to secure their confidentiality before starting the surveys (Cooper & Schindler, 2003). Securing the informed consents before allowing participants to continue with the survey furthermore provided the legal rights and protections for both the participating individuals and the researcher. A signed consent would have been needed if the survey had dealt with minors, pregnant women, and other individuals protected by the Health Insurance Portability and Accountability Act (HIPPA) of 1996 (CITI, 2006). The purpose of obtaining informed consent was to ensure participant's privacy, state

how the survey was administered, and fully disclose the purpose of the study. Informed consent was an integral component of ethical research (Creswell, 2002 cited in Psalmonds, 2008). Informing the engineers, who were participating in the survey by taking the questionnaire tests, of their anonymity and guaranteed protection for their personal identity alleviated the concerns they might have had in taking the tests. The participants were free to choose to either respond to survey questions or not participate. The informed consent statement furthermore included explanation of the purpose of this research clearly, which was to collect data for better understanding of the problem of legacy-data conversion and how the results affected online accessibility of the information (see Appendices C & D).

Data Collection

The collection of data was determined to be limited to surveying engineers who worked at the spacecraft industries such as NASA facilities, and only to the designers and the manufacturers in that organization. The individuals from the targeted groups were to access and respond to the questions on questionnaires that the researcher had placed on the computational network facilities at the targeted organization. Minimums of 50 randomly selected responses to completely filled-out questions on questionnaires from the focus group's population were providing the scores to be analyzed in the study. The rationale was that the chosen number was a good-faith estimated number that could provide a cross-sectional representation of the members of the focused groups at the minimum level necessary for this study. One demographic identifier question Q2 after the informed consent agreement clause Q1, 10 quantitative questions with one possible answer, and four qualitative questions were presented to the survey participants.

Instrumentation

Members of the targeted groups in this study received an electronic arrangement of the questionnaire of the Appendix A that surveyed their preferences and opinions about data conversion to electronic archives from broader spectrum. The questionnaire included an agreement clause at the beginning, which prevented the survey participant from proceeding without the agreement. The introductory clause reaffirmed the informed consent forms of the Appendices C and D, which were used to solicit permission from participants for the study. The questionnaire also included provisions for identifying the survey taker's work-related demographic status within the study population. Conducting the planned investigations for this study required creating a unique survey instrument because neither previously existing standard nor the appropriately constructed instrumentation was available to use in the surveys. Participation for completing the questionnaire instrument electronically was regulated through process flow (see Appendix E, Figure E2).

Validity and Reliability

The discussion of validity and reliability was an essential part of a quantitative study, and marked the investigation noteworthy while ensuring that the statistical data at conclusion were in an admissible condition. The goal from a qualitative investigation was to describe and add to the nevertheless the existing knowledge (Morse, 2006) for which validity had a different function. The rigor in collecting qualitative data depended on a validation process that conventionally accepted the participants' responses in the survey as unconditionally permissible facts. Validity in the study associated the research questions with the research design's appropriateness through which the repeatability of results from the future investigations was possible, thus proving the reliability of the research (Creswell, 2002 cited

in Psalmonds, 2008). Factors such as appropriate research plans for conducting the experiments and properly drawn inferences from the research design were considered affecting the validity in a study (Creswell, 2005). This triangulation mixed methods design study required using factors for determining validity and reliability that combined both traditional quantitative and qualitative approaches.

Internal

According to Creswell (2005), the ascending problems from experimental procedures and participants' understandings of the study can change researcher's propensity to determine the cause-and-effect appropriately and disrupts intramural strength of the study, compelling researcher to conclude erroneously unexceptional results. The concluding results from a research are questionable, when researcher has misinterpreted the participant panelists' responses. For experimental design examples and inferences of the internal threats, Creswell (2005) recommended literary works by Cook and Campbell (1979), Reichardt and Mark (1998), and Tuckman (1999). The research participants may alter their perceptions in a study if circumstances change because of the time in a prolonged investigation for surveying their opinions, which it can result in a threat to the internal validity of the research.

External

Threats to external validity come from generalization. When extraneous causes are ruled out, researchers may suppose that the outcome of their research can be used to treat future recurrences. Creswell (2005) stated that such assumptions could result in external validity threats. Remember that Creswell (2005) referred to incorrect cause-and-effect inferences in a study could result from researchers misinterpretations because of the

experimental procedures and research participants' misperceptions that resulted in threats to the validity of the study. Three types of external threats to the validity of a research were identified by Creswell citing Cook and Campbell (1979) that could lead to generalization problems in following succession: a) interaction of selection and treatment, b) interaction of setting and treatment, and c) interaction of history and treatment.

Data Analysis

Neuman (2003) emphasized researchers may determine that a pattern has emerged from analyzing survey responses that the study subjects provided. A researcher may conclude subsequently for the qualitative output of the research that the emergence of similarities in perceptions is evidence for proving the researcher's hypothesis. Researchers can use seven strategies "to analyze qualitative data: the narrative, ideal types, successive approximation, the illustrative method, path dependency and contingency, domain analysis, and analytic comparison" (Neuman, 2003, p. 447). In the narrative strategy, a researcher relates detailed analysis of the subject's opinions chronologically to support the concrete statistical results arrived at upon the conclusion of the study. Ideally, for the analytic comparisons, the empirical data will be weighed against an ideal model (Neuman, 2003). The researcher would need to acquire analytical knowledge for performing statistical tests (e.g., t-test, ANOVA, regression, chi-square) on numerical results for the quantitative portion of the research (Burton, 2003; McMullin, 2003). Neuman, Plano-Clark, Lane, and Roberts (2004) provided four case studies that illustrated such proceedings. The chi-square analysis should aid researchers in determining if goodness of fit between results from the collected data to the null hypothesis existed, or rule for the independence between two variables instead (Jaisingh, 2000; Thorne & Giesen, 2000; Kuzma, 1998).

In this study plan, the chi-square goodness of fit test applied for each of the survey questions from the targeted groups, who represented the electronics designers and the manufacturing engineers, and produced data analysis for the quantitative prediction. The expected value in each category for the independence test was calculated from product of the sum of numbers listed for the total row value and the total column value in the same category, which it then was divided by the sum of all observed values. The number resulting from this computation was used for the sample explanation (Thorne & Giesen, 2000) (see Appendix F for more explanation on the formula). The goodness of fit test examined frequency of the distribution or the proportion in a sample to determine if there was a pattern, which fit to the hypothesized assumption. Subsequently, degrees of freedom (df) were determined from total rows and columns that make up the categories. The calculation of the chi-square tests obtained from survey results were compared then to test standard (TS) values at the 0.5% and 1% significance levels from the chi-square distribution table with the corresponding degrees of freedom of the chi-square test. If the computed chi-square test value fell inside the region of significance, the null hypothesis was rejected. In other words, if the computed chi-square test yielded a larger value than the value listed in the TS table, then the possibility of fit from the observed result to the hypothesized expectation did not exist.

To discover if similarities in the users' perceptions of data availability from online sources existed, the researcher used the latest available version of the Statistical Package for the Social Sciences (SPSS) tool. SPSS is a statistical software tool commonly used for sampling, validating samples, reliability testing, and for finding specific research questions (Pallant, 2007 cited in Psalmonds, 2008). The analytic domain analysis of the participants'

responses to open-ended questions revealed such attributes as problematic steps in designing, a preference for online searching, and reliable locations for archiving part specifications. The examination of the analysis of the data from SPSS results for the qualitative responses in conjunction with the analysis obtained from the quantitative construct facilitated the triangulations process for the study results and subsequent conclusions about this research.

Summary

In this study, the mixed methods design for researching the legacy-data conversion problem for some part-specifications from the paper-based archives to online engineering databases investigated the existing inaccessibility dilemma. The research design incorporated the mixed methods design for research studies with the triangulation approach in which the analytical domain analysis of data from qualitative open-ended questions resulted in explaining the calculations from the statistical analysis of data obtained from the quantitative questions. Chapter 3 included reasons for the appropriateness of the chosen research design. For the statistical analysis, the researcher had chosen the chi-square test for goodness of fit for examining the null hypotheses. The use of a latest version of the SPSS tool in determining how the selected attributes from textual responses may have led to identifying trends and the emerging pattern for the online information accessing preference. The questionnaire on the survey instrument described in chapter three was administered on the computational network of the permitting firm (e.g., NASA), and distributed among the electronics designers and manufacturers with the goal of collecting completed surveys from 50 engineers for use in this study. The purpose of this triangulation mixed methods design study was to investigate the legacy-data conversion problem of online information storage, inquiry, access, and informational availability. The discoveries in the research were

presented in the form of tabulated calculation results, pertinent graphics, and written statements interpreting and analyzing the data in chapter 4.

CHAPTER 4: PRESENTATION OF THE RESULTS

The purpose of this mixed methods study was to investigate the existing non-obsolete piece-part specifications data conversion problem for better understanding of the void in online digital database repositories. The presentation of corroborating evidences on the conversion problem of the non-obsolete piece-part specification and its unavailability from the online databases was anticipated to help engineers at NASA divisions who still used those specifications. This study established a level of awareness for improving the online inquiries for NASA and other information users. To understand better about influencing factors that could have contributed to the information void phenomenon, both quantitative and qualitative investigations were conducted simultaneously. The survey instrument included both open-ended and closed-ended questions that related to the legacy-data conversion problem for triangulating the resulting surveyed data through this research for successive interpretation.

The survey instrument was presented as Likert-type questionnaire and was distributed by Survey Monkey (SM), a commissioned Internet-based surveying company, through the enterprise's communications network to its registered members from manufacturing, processing, Internet, computing, software and technology audiences. The questionnaire contained 12 quantitative and four qualitative questions designed specifically for obtaining the corroborating evidences from the interpretations of the qualitative discoveries and the discrete statistics calculations of the quantitative analyses. For the evaluations process, the participants' responses were sorted by the completeness of the answers and valid data was collected through fully answered questionnaires from the separated acceptable responses. The intention from conducting this exercise was to gain the deeper understanding on the

existing information void from the online repositories and to discover the observed participants' perceptions concerning their reactions to answering the four research questions. The four research questions were as follows:

1. Why conversion of information from paper-based records to electronic databases are difficult and costly efforts?
2. How can electronically archived data for part-specifications benefit the engineering community?
3. Why archived data in popular search engines and databases are devoid of some part-specifications?
4. How can conversion of information from paper-based record to electronic database guarantee preservation for uncommon, non-obsolete, but useful information best with the accessibility?

Additional intention from performing this research was to evaluate three hypotheses that formed around the discovered research problem that required providing tangible proof for the advantages of the electronically stored information in contrast to paper-based archives. The statistical evaluations of the collected survey-data resulted in sufficient answers for the proposed research hypotheses as follows:

$H_0$1: There is no significant direct relationship between the perceived information obsolescence, loss or deficient use, and inaccessibility of the data from online databases resulting from conversion neglect or management's decision to circumvent digitization of the paper-based record.

H_a1: There is a significant direct relationship between the perceived information obsolescence, loss or deficient use, and inaccessibility of the data from online

databases resulting from conversion neglect or management's decision to circumvent digitization of the paper-based record.

$H_0$2: There is no significant direct relationship between the popularity of inquiring information online because of instantaneous availability of the data and threatening imposition to boycott the data repositories that remain on paper media.

H_a2: There is a significant direct relationship between the popularity of inquiring information online because of instantaneous availability of the data and threatening imposition to boycott the data repositories that remain on paper media.

$H_0$3: There is no significant direct relationship between the perceived online frequencies of use for non-obsolete specialized data, guaranteed availability and preservation of such information, and conversion of the paper-based records to digital archives.

H_a3: There is a significant direct relationship between the perceived online frequencies of use for non-obsolete specialized data, guaranteed availability and preservation of such information, and conversion of the paper-based records to digital archives.

Collected data evaluations from the selected questionnaires that the participants' responses had provided for this research were as follows:

Population

Discovering corollary resolutions (Cooper & Schindler, 2003) for the information void problem that had affected popular databases was possible through analysis of the collected responses from targeted individuals (the survey audiences), who were the working members from the manufacturing, processing, Internet, computing, software, and technology divisions. An SM agent solicited a total of 92 audiences from the SM membership listing. One survey participant had refused to agree to the terms of participation by disagreeing to the

informed consent form and 22 others had not finished the close-ended questions completely, whose identifications and other information were excluded from the final survey scores. The remaining 69 entries from the targeted survey participants formed basis of the research analyses. The occupations of those survey participants from the final survey scores indicated 16% designers, 29% manufacturers, and 55% other than the first two demographics (see Appendix G for the graphical test results). The graphical illustrations on Figure G2 would depict surveyed participants' population visually.

Data Organization and Collection Process

The survey instrument containing 12 close-ended questions for the survey participants to respond with single answer from prelisted responses began with a question specifically intended to determine if the participant had agreed to the terms of participation in research and had reviewed the informed consent form. Questions two through 12, each with possibility for single answer to choose, were to generating the numerical data for the ANOVA statistics. The four open-ended questions 13 through 16 were intended to generate the leadership themes from the consensus of the opinions for answering research questions based on the information void and inaccessibility problem over the Internet database repositories. The nonparametric chi-square tests were performed on the collected data from the survey responses to determine both goodness-of-fit and the independence (Jaisingh, 2000; Thorne & Giesen, 2000; Kuzma, 1998) for the research variable. The hypotheses were evaluated using the chi-square goodness-of-fit tests.

Frequency distributions.

The parametric tests indicated the frequencies of the response distributions for each of the given variables on Q2 through Q12. For the variable in third question (When you are

searching for reliable information, do you resort to one of the following choices?), 86% of the respondents indicated Internet search engines were their choices as demonstrated graphically in Figure G3.

The third variable from the survey instrument was intended additionally to reveal statistical significance favorable in corroborating the results collected from perceptions of opinions through question 13 of the survey instrument with the anticipation of discovering answers for second and the fourth research questions. Audience responses to the fourth variable on the survey instrument showed two relatively close indicators. Replacement of the item for which specification data was not available received 39% scoring and was second to 55% highest score that indicated respondents' preference to asking other members in their company for advice, as depicted in Figure G4.

The fourth variable on the survey instrument also was intended to reveal additional statistical significance on corroborating the insights from the collected opinions through question 13 of the survey instrument in anticipation to respond to the third research question. Surveyed participants responded to the fifth variable from survey instrument with 72% as the highest score in favor of the Internet databases, as shown in Figure G5.

The fifth variable on the survey instrument was intended additionally to reveal a statistical significance to corroborate the insights gained from the collected opinions through open-ended questions with the anticipation of responding to the first research question that had been stated in the beginning of this chapter.

The sixth variable on the survey instrument related to both second and the third hypotheses. The audiences responded with 48% favoring to use popular search engines from the Internet for looking up classified information, which the trailing 26% responses for rarely

using any popular search engines remained the second highest score. The graphical frequency and percentage distributions of the responses shown on Figure G6 displayed the audiences' reactions to the sixth survey variable.

The seventh variable on survey instrument was designed to collect data for evaluating the first hypothesis. It also was intended to become the source of measuring the consensus for relying on recorded information that was stored on paper-based materials. The audiences' convincing reactions with 39% choosing rarely as their answer to the use of paper records, which trailed by 30% responses with never searching through paper-based records, indicated that the paper-based archives were not favorable sources of the classified information retrieval. The results also confirmed a new tendency in data acquisition preference from the participating audience on information searching that favored the online databases. Figure G7 displays those distributions for the frequencies and percentages resulted from the seventh variable.

The eighth variable on the survey instrument was designed to measure the audiences' perceived choice on determining if the Internet based information repositories had become alternative sources for any information seeking that replaced libraries. Audiences gave a score of 57% agreeing to Internet becoming the alternate source to libraries with 19% strongly agreeing to the same thought. Only 10% chose to disagree or remained undecided. The eighth variable was intended also to indicate a statistical significance for evaluating the second hypothesis. Figure G8 depicted a graphical presentation of the responses showing the frequencies and percentages of participation.

The ninth variable on the survey instrument was intended to measure the audience responses for determining if the parts would be considered obsolete for which the

specification data could not be found. This variable was considered also to result in a statistical significance for evaluating the third hypothesis. The parametric distribution of the frequencies with the responses to ninth variable from the collected survey results indicated most audiences (38%) disagreed to considering the parts becoming obsolete. Closely followed 28% were undecided, while 20% thought that indeed parts could be considered obsolete. These measured scores with the relatively close values were indicative of some uncertainty factors entering the audiences' decision process, as the histogram chart from Figure G9 revealed.

The tenth variable on the survey instrument was designed for measuring the security of the recorded data saved on the paper-based media. The variable also related directly to the first null hypothesis. Most audiences disagreed with a 43% scoring that indicated the information indeed could be lost if digitally converted archives as backups was not maintained. The undecided responses were from 23% of the audiences. The frequency and percentage bar graphs from Figure G10 depicted these scoring results.

The eleventh variable on the survey instrument was designed for determining if the availability of the popular search engines on the Internet had introduced reasons for considering threats against paper-based archives. This variable also was considered to produce statistical significance for evaluating the second null hypothesis. The overwhelming 48% of the respondents proved that indeed there was substantial threat from the online search facilities to the continuation of the paper-based archives. This decision on the online databases threatening the paper-based archives was supported additionally by 22% of the audience responding strongly with disagreeing to the statement of the eleventh variable on

the questionnaire. The frequency and percentage bar graphs shown on Figure G11 were the depiction of that decision.

The twelfth variable on the survey instrument was designed to collect statistical significance for evaluating the third null hypothesis and for determining if data conversion from paper-based records to the electronic repositories would not guarantee information availability, safety, and the frequent use. Responses from the surveyed audiences resulted in 43% agreeing with the given statement in the variable question that sufficient proof was not obtainable to guarantee the safety, availability, and frequent use of the data once it was converted from paper-based records. The surveyed audiences also gave a score of 30% disagreeing with the statement of the twelfth variable. This score was an indication that perhaps data conversion could be considered as the guaranteed source for information availability, safety, and its frequent use through online repositories. Figure G12 included the graphical depiction of those two distinctly separated thoughts.

The histogram curve resulting from frequencies of the responses in Figure G12 clearly indicated that the distribution of probability would have been expected to spread evenly between the disagreed and the agreed groups with its peak at the indecisive responses region. This distinctive range in the surveyed audiences responses could have resulted from negative structure in the expression of the variable statement that could have confused the survey participants.

Researched themes.

The survey variables with the open-ended questions were structured for the collection of opinions and the expressed thoughts from the audience that would support the three

themes of leadership, leadership interest, and expectation for the triangulation purposes of the qualitative and quantitative analyses. The qualitative variable with the open-ended question 13 in conjunction with the variables three, four, seven, and nine of the survey instrument were reflective of the leadership theme. The qualitative variables from questions 14 and 15 in combination with the quantitative variable from survey question 10 reflected the leadership interest theme. The quantitative variable from the survey question 12 aggregated with the qualitative variable of the survey question 16 to reflect the expectation.

Descriptive Statistics

To produce analyses with descriptive statistics for determining both goodness-of-fit and the independence of the variables on survey instrument, and examining the hypotheses, chi-square tests were applied. The goodness-of-fit applied to single categorical variables using the IBM SPSS statistics 20 software, and the chi-square test of independence was done with the statistical capabilities embedded in the Microsoft Excel. In the goodness-of-fit calculation, the probability is assumed to fit a normal distribution pattern from which the expected values are computed to be equal for each category under the observation (Thorne & Giesen, 2000). The formula with $df = K-1$ was used to calculate the degree of freedom (df) for the goodness-of-fit evaluations, where K represented the number of categories. The $x^2 = \sum [(O - E)^2 / E]$ formula applied to both chi-square test processes, where x^2 represented the calculated value of chi-square, O represented the discrete frequency or the percentage for an observed value, and E represented the value for corresponding distributed expectation.

The degree of freedom $df = (R-1)(C-1)$ was calculated for the independence test using the expressed formula, where R represented number of rows and C represented number of columns. Probability distribution of the expected values is not presumed to be uniform for

the chi-square test of independence (Thorne & Giesen, 2000). The alternative method for calculating the expected values with E = [(RT * CT)/N] formula returned in corresponding expected value computations, where RT represented the numerical sum for row, CT was the numerical sum for the corresponding column, and N was the numerical sum of the total observations.

For the purpose of calculating descriptive statistics significances pertinent to analysis, the survey instrument variables were grouped according to categorical dependencies in the variables. Variables designated by survey question numbers four, five each contained four dependent variables, and the survey instrument variables six through 12, additional to number three, each contained five categories. The survey instrument variables one and two were not included in chi-square tests because those variables were the instruments for determining the participants' understanding of the informed consent form, agreement to the terms of participation in the survey, and demographics.

Goodness-of-fit.

The statistical significances of the surveyed variables were calculated and each of the categorically dependent variables that corresponded to specific question was examined for its fit relationship to collected data from the survey using a separate chi-square goodness-of-fit test. The SPSS statistics software applied in each of the chi-square computing cases to ensure producing descriptively unique numerical results. Results from the computations were entered in tabulated forms with both the observed and the calculated numbers from the expectations. The analysis findings were as follows:

For the survey variable question three asking the survey audiences to choose one of the five possible outcomes (library books, newspaper articles, Internet search engines, peer

reviewed articles online, and word of moth from experts), the calculated chi-square value was X^2 (4, N = 69) = 185.710 with the 99% confidence level. The computed values in Table 1 were the corresponding numerical results for Q3.

Table 1

Chi-Square Goodness-Of-Fit Test Parameters for Variable 3, (N = 69)

Categories	Observed N[a]	Expected N[b]	Residual
1. Library books	2	13.8	-11.8
2. Newspaper articles	1	13.8	-12.8
3. Internet search engines	59	13.8	45.2
4. Peer reviewed articles on the Web	5	13.8	-8.8
5. Word of mouth from experts	2	13.8	-11.8
Total	69		

Note. Numerical data include values for chi-square goodness-of-fit calculation.
[a]The observed N values from resulting answers given by the survey participants to question that associated with variable Q3: When you are searching for reliable information, do you resort to one of the following choices? Please select. [b]The computed equal values for the corresponding expectation.
* X^2 (4, 69) = 185.710, p = .01 with df = 4.

For the survey variable question four asking the survey audiences to choose one of the four possible outcomes (make assumption, replace item, ask others opinion, and take no action), the calculated chi-square value was X^2 (3, N = 69) = 57.435 with the 99% confidence level. The numerical values for computing the chi-square results were shown in Table 2.

Table 2

Chi-Square Goodness-Of-Fit Test Parameters for Variable 4, (N = 69)

Categories	Observed N[a]	Expected N[b]	Residual

1. Make an assumption	2	17.3	-15.3
2. Replace item with another for which valid data is available	27	17.3	9.8
3. Asking others opinions	38	17.3	20.8
4. Take no action	2	17.3	-15.3
Total	69		

Note. Numerical data include values for chi-square goodness-of-fit calculation.
[a]The observed N values from resulting answers given by the survey participants to question that associated with variable Q4: When you cannot find reliable information about an item, do you resort to one of the following? Please select. [b]The computed equal values for the corresponding expectation.
* X^2 (3, 69) = 57.435, p = .01 with df = 3.

For the survey variable question five asking the survey audiences to choose one of the four possible outcomes (word of mouth, expert opinion on TV, paper archives, and online databases), the calculated chi-square significance was X^2 (3, N = 69) = 92.797 with the 99% confidence level. This computed value resulted from the numerical data shown in Table 3.

Table 3

Chi-Square Goodness-Of-Fit Test Parameters for Variable 5, (N = 69)

Categories	Observed N[a]	Expected N[b]	Residual
1. Words of mouth	1	17.3	-16.3
2. Expert's opinion on TV	1	17.3	-16.3
3. Archived paper records (e.g., library books)	17	17.3	-.3
4. Online databases on the Internet	50	17.3	32.8
Total	69		

Note. Numerical data include values for chi-square goodness-of-fit calculation.
[a]The observed N values from resulting answers given by the survey participants to question that associated with variable Q5: Which method do you think engineers prefer to choose when searching for information? Please select. [b]The computed equal values for the corresponding expectation.
* X^2 (3, 69) = 92.797, p = .01 with df = 3.

For the survey variable question six asking the survey audiences to choose one of the five possible outcomes (never, rarely, not sure, often, and always), the calculated chi-square value was X^2 (4, N = 69) = 42.522 with the 99% confidence level. This computed value resulted from the numerical data shown in Table 4.

Table 4

Chi-Square Goodness-Of-Fit Test Parameters for Variable 6, (N = 69)

Categories	Observed N[a]	Expected N[b]	Residual
1. Never	9	13.8	-4.8
2. Rarely	18	13.8	4.2
3. Not sure	6	13.8	-7.8
4. Often	33	13.8	19.2
5. Always	3	13.8	-10.8
Total	69		

Note. Numerical data include values for chi-square goodness-of-fit calculation.
[a]The observed N values from resulting answers given by the survey participants to question that associated with variable Q6: How often do you look up through popular search engines for the classified information and parts specifications? Please indicate. [b]The computed equal values for the corresponding expectation.
* X^2 (4, 69) = 42.522, p = .01 with df = 4.

For the survey variable question seven asking the survey audiences to choose one of the five possible outcomes (never, rarely, not sure, often, and always), the calculated chi-square value was X^2 (4, N = 69) = 30.928 with the 99% confidence level. This computed value resulted from the numerical data shown in Table 5.

Table 5

Chi-Square Goodness-Of-Fit Test Parameters for Variable 7, (N = 69)

Categories	Observed N[a]	Expected N[b]	Residual
1. Never	21	13.8	7.2
2. Rarely	27	13.8	13.2
3. Not sure	8	13.8	-5.8
4. Often	12	13.8	-1.8
5. Always	1	13.8	-12.8
Total	69		

Note. Numerical data include values for chi-square goodness-of-fit calculation.
[a]The observed N values from resulting answers given by the survey participants to question that associated with variable Q7: How often do you search archived books and paper records for the classified information and part specifications? Please indicate. [b]The computed equal values for the corresponding expectation.
* X^2 (4, 69) = 30.928, p = .01 with df = 4.

For the survey variable question eight asking the survey audiences to choose one of the five possible outcomes (never, rarely, not sure, often, and always), the calculated chi-square value was X^2 (4, N = 69) = 61.217 with the 99% confidence level. This computed value resulted from the numerical data shown in Table 6.

Table 6

Chi-Square Goodness-Of-Fit Test Parameters for Variable 8, (N = 69)

Categories	Observed N[a]	Expected N[b]	Residual
1. Strongly disagree	3	13.8	-10.8
2. Disagree	7	13.8	-6.8
3. Not sure	7	13.8	-6.8
4. Agree	39	13.8	25.2
5. Strongly agree	13	13.8	-.8
Total	69		

Note. Numerical data include values for chi-square goodness-of-fit calculation.
[a]The observed N values from resulting answers given by the survey participants to question that associated with variable Q8: How do you respond to following statement? The databases on the Internet are alternatives to the libraries. [b]The computed equal values for the corresponding expectation.
* X^2 (4, 69) = 61.217, p = .01 with df = 4.

For the survey variable question nine asking the survey audiences to choose one of the five possible outcomes (never, rarely, not sure, often, and always), the calculated chi-square value was X^2 (4, N = 69) = 24.551 with the 99% confidence level. This computed value resulted from the numerical data shown in Table 7.

Table 7

Chi-Square Goodness-Of-Fit Test Parameters for Variable 9, (N = 69)

Categories	Observed N[a]	Expected N[b]	Residual
1. Strongly disagree	7	13.8	-6.8
2. Disagree	26	13.8	12.2
3. Not sure	19	13.8	5.2
4. Agree	14	13.8	.2
5. Strongly agree	3	13.8	-10.8
Total	69		

Note. Numerical data include values for chi-square goodness-of-fit calculation.
[a]The observed N values from resulting answers given by the survey participants to question that associated with variable Q9: How do you respond to following statement? If the specification data is not easily obtainable, then the selected part probably is obsolete. [b]The computed equal values for the corresponding expectation.
* X^2 (4, 69) = 24.551, p = .01 with df = 4.

For the survey variable question10 asking the survey audiences to choose one of the five possible outcomes (never, rarely, not sure, often, and always), the calculated chi-square value was X^2 (4, N = 69) = 30.058 with the 99% confidence level. This computed value resulted from the numerical data shown in Table 8.

Table 8

Chi-Square Goodness-Of-Fit Test Parameters for Variable 10, (N = 69)

Categories	Observed N[a]	Expected N[b]	Residual
1. Strongly disagree	11	13.8	-2.8
2. Disagree	30	13.8	16.2
3. Not sure	16	13.8	2.2
4. Agree	9	13.8	-4.8

5. Strongly agree	3	13.8	-10.8
Total	69		

Note. Numerical data include values for chi-square goodness-of-fit calculation.
[a]The observed N values from resulting answers given by the survey participants to question that associated with variable Q10: How do you respond to following statement? Parts-specification data, which are saved on the paper records, cannot fade, become inaccessible or obsolete in the absence of digitally converted archives. [b]The computed equal values for the corresponding expectation.
* X^2 (4, 69) = 30.058, p = .01 with df = 4.

For the survey variable question 11 asking the survey audiences to choose one of the five possible outcomes (never, rarely, not sure, often, and always), the calculated chi-square value was X^2 (4, N = 69) = 41.362 with the 99% confidence level. This computed value resulted from the numerical data shown in Table 9.

Table 9

Chi-Square Goodness-Of-Fit Test Parameters for Variable 11, (N = 69)

Categories	Observed N[a]	Expected N[b]	Residual
1. Strongly disagree	15	13.8	1.2
2. Disagree	33	13.8	19.2
3. Not sure	6	13.8	-7.8
4. Agree	13	13.8	-.8
5. Strongly agree	2	13.8	-11.8
Total	69		

Note. Numerical data include values for chi-square goodness-of-fit calculation.
[a]The observed N values from resulting answers given by the survey participants to question that associated with variable Q11: How do you respond to following statement? Popularity of online search engines, such as Google, and the online searching trend does not threaten paper form of archiving. [b]The computed equal values for the corresponding expectation.
* X^2 (4, 69) = 41.362, p = .01 with df = 4.

For the survey variable question 12 asking the survey audiences to choose one of the five possible outcomes (never, rarely, not sure, often, and always), the calculated chi-square value was X^2 (4, N = 69) = 37.844 with the 99% confidence level. This computed value resulted from the numerical data shown in Table 10.

Table 10

Chi-Square Goodness-Of-Fit Test Parameters for Variable 12, (N = 69)

Categories	Observed N[a]	Expected N[b]	Residual
1. Strongly disagree	7	13.8	-6.8
2. Disagree	21	13.8	7.2
3. Not sure	9	13.8	-4.8
4. Agree	30	13.8	16.2
5. Strongly agree	2	13.8	-11.8
Total	69		

Note. Numerical data include values for chi-square goodness-of-fit calculation.
[a]The observed N values from resulting answers given by the survey participants to question that associated with variable Q12: How do you respond to following statement? Converting paper records to digital archives for the online search does not guarantee information availability, safety, and its frequent use. [b]The computed equal values for the corresponding expectation.
* X^2 (4, 69) = 37.844, p = .01 with df = 4.

Test of independence.

The chi-square test of independence procedures used to provide descriptive statistic values of the probabilities for determining if the variables were independent. According to convention, the null hypothesis is presumed to imply variables are independent (Thorne & Giesen, 2000). The null hypothesis was rejected when the calculated chi-square significances resulted in larger number than the given critical significance expressed by the $X^2_{comp} \geq X^2_{crit}$ [df = (R - 1)(C - 1)], according to Thorne and Giesen (2000). The calculated chi-square value between variables four and five was X^2 (3, N = 69) = 76.8020646 > 12.838, $p < 0.005$, which was greater than the value for critically statistical significance of 0.05% and resulted in considering possibility for dependence between the two variables. Data presentations in Table 11 show the results of the survey with chi-square test of independence.

Table 11

Chi-square Test of Independence for Selected Variables, (N = 69)

Variable and Category	Observed N[a]	Expected N[b]
Q4: When you cannot find reliable information about an item, do you resort to one of the following? Please select.		
1. Make an assumption	2	1.5
2. Replace item with another for which valid data is available	27	14
3. Asking others opinions	38	27.5
4. Take no action	2	26
Variable and Category	Observed N[a]	Expected N[b]
Q5: Which method do you think engineers prefer to choose when searching for information? Please select.		
1. Words of mouth	1	1.5
2. Expert's opinion on TV	1	14
3. Archived paper records (e.g., library books)	17	27.5
4. Online databases on the Internet	50	26
Chi-square *df* = 3 $\chi^2_{0.005,\,3}$ =12.838		76.802

Note. Numerical data include values for chi-square test of independence calculation.
[a]The observed N values from resulting answers given by the survey participants to question that associated with variables Q4 and Q5. [b]The computed values for the corresponding expectation using the alternate E = [(RT * CT)/N] method.
* X^2 (3, 69) = 76.802, $p < .005$ with $df = 3$.

Chi-square test of independence calculation for variables six and seven resulted value X^2 (4, N = 69) = 17.6857143 > 14.86, $p < 0.005$, which was greater than the value for the critically statistical significance of 0.05% that was indication for considering the possibility for dependence between those two variables. Data for variables six and seven from the surveyed results with the independence calculation results are presented in Table 12.

Table 12

Chi-square Test of Independence for Selected Variables, (N = 69)

Variable and Category	Observed N[a]	Expected N[b]
Q6: How often do you look up through popular search engines for the classified information and parts specifications? Please indicate.		
1. Never	9	15
2. Rarely	18	22.5
3. Not sure	6	7
4. Often	33	22.5
5. Always	3	2
Variable and Category	Observed N[a]	Expected N[b]
Q7: How often do you search archived books and paper records for the classified information and part specifications? Please indicate.		
1. Never	21	15
2. Rarely	27	22.5

3. Not sure	8	7
4. Often	12	22.5
5. Always	1	2
Chi-square $df = 4$ $\chi^2_{0.005, 4} = 14.860$		17.686

Note. Numerical data include values for chi-square test of independence calculation. [a]The observed N values from resulting answers given by the survey participants to question that associated with variables Q6 and Q7. [b]The computed values for the corresponding expectation using the alternate E = [(RT * CT)/N] method.
* X^2 (4, 69) = 17.686, $p < .005$ with $df = 4$.

The survey variables eight through 12 were evaluated in one group for determining correlation among the variable through chi-square test of independence. The calculation of the chi-square test of independence for these variables resulted X^2 (16, N = 69) = 90.1028028 > 34.267, $p < 0.005$, which was greater than the value for critically statistical significance of 0.05% and resulted in considering the possibility for dependence among those variables. Data for variables eight through 12 from the surveyed results with the independence calculations are presented in Table 13.

Table 13

Chi-square Test of Independence for Selected Variables, (N = 69)

Variable and Category	Observed N[a]	Expected N[b]
Q8: How do you respond to following statement? The databases on the Internet are alternatives to the libraries.		
1. Strongly disagree	3	8.6
2. Disagree	7	23.4
3. Not sure	7	11.4
4. Agree	39	21

5. Strongly Agree	13	4.6

Variable and Category	Observed N[a]	Expected N[b]
Q9: How do you respond to following statement? If the specification data is not easily obtainable, then the selected part probably is obsolete.		
1. Strongly disagree	7	8.6
2. Disagree	26	23.4
3. Not sure	19	11.4
4. Agree	14	21
5. Strongly Agree	3	4.6

Variable and Category	Observed N[a]	Expected N[b]
Q10: How do you respond to following statement? Parts-specification data, which are saved on the paper records, cannot fade, become inaccessible or obsolete in the absence of digitally converted archives.		
1. Strongly disagree	11	8.6
2. Disagree	30	23.4
3. Not sure	16	11.4
4. Agree	9	21
5. Strongly Agree	3	4.6

Variable and Category	Observed N[a]	Expected N[b]
Q11: How do you respond to following statement? Popularity of online search engines, such as Google, and the online searching trend does not threaten paper form of archiving.		
1. Strongly disagree	15	8.6
2. Disagree	33	23.4
3. Not sure	6	11.4
4. Agree	13	21
5. Strongly Agree	2	4.6

Variable and Category	Observed N[a]	Expected N[b]
Q12: How do you respond to following statement? Converting paper records to digital archives for the online search does not guarantee information availability, safety, and its frequent use.		
1. Strongly disagree	7	8.6
2. Disagree	21	23.4
3. Not sure	9	11.4
4. Agree	30	21
5. Strongly Agree	2	4.6
Chi-square		90.103
$df = 16$		
$\chi^2_{0.005, 16} = 34.267$		

Note. Numerical data include values for chi-square test of independence calculation. [a]The observed N values from resulting answers given by the survey participants to question that associated with variables Q8, Q9, Q10, Q11, and Q12. [b]The computed values for the corresponding expectation using the alternate E = [(RT * CT)/N] method.
* X^2 (16, 69) = 90.103, $p < .005$ with $df = 16$.

Research Questions

The four research questions (R1, R2, R3, and R4) were associated with three survey instrument variables Q3, Q4, and Q5. The survey questions two through 12 were considered independent variables and the corresponding choices for answer were the dependent variables in each case. The purpose from stating the third variable (When you are searching for reliable information, do you resort to one of the following choices?) was to gain measurable insight to respond to both the second question (R2) and the fourth question (R4) with some evaluative certainties. The aim from the stated question in variable four (When you cannot find reliable information about an item, do you resort to one of the following?) was to obtain measurable responses to address the third question (R3) with the evaluating certainty. The question in variable five: (Which method do you think engineers prefer to

choose when searching for information?), was deliberate to result for measurable responses with which the answer to question one (R1) could be discovered.

Answer to R1 (Why do the information conversions from paper-based records to electronic databases become difficult and costly efforts?) required use of Q5 data from which survey audiences had scored 72% on Internet databases and 25% on paper-based archives resulted in using corroborative opinions to Q15 for plausible answer determination. Audience opinions from Q15 showed 27.5% of surveyors considered combination of time, money, and resources were the reasons for information void in electronic databases, despite majority preference favoring the Internet searches. Both R2 (How can electronically archived data for part-specifications benefit the engineering community?) and R4 (How can conversion of information from paper-based record to electronic database guarantee preservation for uncommon, non-obsolete, but useful information best with the accessibility?) associated with Q3. Audience responses to Q3 favored the Internet search engines by a strong 86% majority.

This high score from the Q3 responses with majority opinions (53.62%) reporting on digital databases as their given expressions on Q16 led to a triangulating decision that accepted the Internet databases as practical sources preferred by users for preserving and accessing the information. The Q4 association to R3 (Why do the archived data from popular search engines and databases lack some part-specifications?), where 55% of the audiences responded to asking others opinions when they could not find reliable information, directed attention to using the extracted majority consensus from Q13. The expressed opinions on Q13 showed that 49.28% of the respondents thought the information searching was problematic and consumed majority of their time on any project. Asking the opinions of

others seemed to be a quicker way to find answer. The analogy resulting from the Q4 and R3 association, with the understandings drawn from explanations on Q13, was that if the reliable data was available to researchers from the online search engines, then the retrieval of usable information was not a time-consuming and challenging effort for the surveyed audience.

Theme Analysis

The last four variables on the survey instrument were qualitative questions for assemblage of the collective personal thoughts and expressions from the participating surveyed audiences. The variable 13 strategies was for the discovery of the leadership theme in which the audiences were asked to express their thoughts on what could be the problematic endeavor for engineering or manufacturing. Four of the respondents indicated human elements, such as mistakes and indecisiveness, 10 were undecided, 21 provided useless or no thoughts, and 34 (49.3%) of the audiences advocated to the difficulties of accessing reliable information. The strategy from variables 14 and 15 meant to discover the leadership interest theme for understanding who could benefit from describing the data conversion problem, digital archiving of the part-specification, and reasons for the unavailability of some information from the Internet databases.

The survey audiences responded to Q14 with 13 undecided, 22 gave useless or no thoughts, and 34 (49.3%) indicated that the information users would benefit. Responses to Q15 fluctuated with 10 undecided, 23 giving useless input, and 36 (52%) provided comments that described 10% thought obsolete parts specifications were the reason for information unavailability, 14.5% thought the information was of proprietary nature, and 27.5% considered combinations of time, money, and resources were the reasons. The strategy in variable 16 was to discover the expectation theme. Participants responded with 10

undecided, 20 giving useless or no response to Q16, and 39 provided answers from which one person favored books, another thought stone tablets would preserve the information better, and 37 (53.62%) of the surveyors favored online databases.

Hypothesis Analysis

Survey variables six through 12 applied to hypotheses H1, H2, and H3 from which the variable 10 (Q10) specifically related to $H_0 1$, variable 11 (Q11) as the direct determinant for $H_0 2$, and the variable 12 (Q12) specific determinant for $H_0 3$. The chi-square goodness-of-fit test result $X^2 (4, N = 69) = 30.058 > 13.277, p < 0.01$ was strong indication that for the statistically critical significance of 10% probability or lesser, the $X^2_{comp} (4, N = 69)$ would fall inside test region, and it was strong reason for rejecting $H_0 1$. Goodness-of-fit test computation on Q11 resulted in $X^2 (4, N = 69) = 41.362 > 13.277, p < 0.01$, which also was a greater number than the probability factor for $df = 4$ with 10% critically statistical error. The $H_0 2$ was rejected as well because $X^2_{comp} (4, N = 69)$ value was well within the critical test region again. The goodness-of-fit test calculation for Q12 resulted in $X^2 (4, N = 69) = 37.884 > 13.277, p < 0.01$ that once again lent to rejection for $H_0 3$ because $X^2_{comp} (4, N = 69)$ value dropped inside of the 10% test critical region.

The summary of the quantitative analyses for variables Q10, Q11, and Q12 with the corroborating results from Q13, Q14, Q15, and Q16 evaluations triangulated around three specific decisions. The first decision encompassed an understanding that emphasized most information users would consider searching for reliable information and the time spent on collecting data would introduce additional difficulties, specifically for the engineering endeavors, and in larger sense for any use. Considering paper-based record searches were extremely time consuming, inefficient, and with probability for the recorded data to become

illegible or unattainable because of time and environmental deterioration, once the archived information was discovered it did not seem to help the leadership in a thoroughly positive way. The second decision encompassing the leadership interest focused on gaining advantages of the online database capabilities. The evidence showing most information seekers preferred to access information from the Internet and considered paper-based records increasingly adding to unpopularity, and the threats from digital technology advancements, amplified the data conversion decision as necessity for the leadership interest.

No matter how old an obscure data was or even if the information belonged to confidential proprietary class, and regardless of the difficulties of assembling the right resources for achieving the data conversion, users preferred retrieving their information from the online repositories. The third decision basing on the expectation theme considerations was that the digitally preserved archival conversions of the information obtained from paper-based records was accessed frequently, instantly available at will, and was thought to remain safe from possible damages caused by preventable data-corruption.

Generalization

In this mixed methods study, the descriptive statistical evaluations with the obtained responses to open-ended questions on the questionnaire were applicable for generalization of the effects to all information users because using the Internet as information warehouse for immediately accessing was pertinent to users other than exclusively the engineers. The Internet use reportedly was the innovative and expected form of searching for reliable information on a global distribution basis (Palmer & Eriksen, 2000), which most users preferred to access. From the selected survey results with completely answered quantitative questions, 38 participants (55%) marked other as their job classification, 20 participant (29%)

indicated they were manufacturers, and remaining 11 people (16%) were designers who contributed collectively to 49% of the remarks indicating all users benefited from online data sources. If the collective 49% opinions distributed evenly among the three work-related categories, the 16.3% significant votes from each work-group would result. Testing the hypothesis for goodness-of-fit test that there were no differences in error distributions across the three working groups on 10% critical statistic, X^2 (2, N = 148.9) = 1.017, $p > 0.1$ calculation confirmed the null hypothesis, which meant that all three groups equally had given their opinions.

Validity and Reliability

Based on questionnaire design and its variables, the validity for this study subsisted. All questions on the survey instrument design were appropriate to the research (Creswell, 2002 cited in Psalmonds, 2008) and indicated that the repeatability of the similarly valid outcomes within future trials would be possible. All of the selected participants had responded to the survey questions with their valid responses. Entries for the open-ended questions were considered valid textual responses because the collecting agent (Survey Monkey) screened all entries as valid, regardless of usefulness or not. The subjectivity through this research and the possibility of influencing the survey audiences with the limited and prelisted answers in the quantitative response section were the resulting errors by design for the study.

The reliability in obtaining similar results from subsequent researches referred to the repeatability concern, which the surveyed audiences' responses on questions three through 12 had addressed positively. The difficulty in establishing the reliability of the survey instrument was minimal because the majority of the surveyed questions consisted of

quantifiable variables. Strong indicators: 86% on Q3 for Internet search engines, 72% on Q5 for databases, 52% on Q6 searching popular engines for classified information, 69% on Q7 no paper records, 76% on Q8 Internet replacing libraries, and 70% on Q11 admitting to threats on paper archives solidified similar future responses.

Summary

The digital conversion problem of the existing non-obsolete piece-part specifications data from paper-based records for the purpose of better understanding the contributing factors to the void in the online databases through mixed methods study investigated. Decisions based on the analyses of the collected data from answers given by 69 subsequently selected audience responses from survey. Survey audiences were the affiliates of an online agent, the Survey Monkey, commissioned for distributing the survey instrument. The survey instrument included the letter of informed consent form, 12 close-ended questions with prelisted possible answers for the quantitative variables, and four open-ended questions for collecting qualitative expressions for the research analyses. Four research questions and three hypotheses were precipice on the designing of the statements of the questions that formed survey instrument variables.

Research questions were as follows:

1. Why do the information conversions from paper-based records to electronic databases become difficult and costly efforts?
2. How can electronically archived data for part-specifications benefit the engineering community?
3. Why do the archived data from popular search engines and databases lack some part-specifications?

4. How can conversion of information from paper-based record to electronic database guarantee preservation for uncommon, non-obsolete, but useful information best with the accessibility?

The results of the surveys for the quantifiable answers statistically calculated to determine the chi-square goodness-of-fit and independence tests for the survey variables and the evaluation of the research hypotheses. The research hypotheses were as follows:

$H_0$1: There is no significant direct relationship between the perceived information obsolescence, loss or deficient use, and inaccessibility of the data from online databases resulting from conversion neglect or management's decision to circumvent digitization of the paper-based record.

H_a1: There is a significant direct relationship between the perceived information obsolescence, loss or deficient use, and inaccessibility of the data from online databases resulting from conversion neglect or management's decision to circumvent digitization of the paper-based record.

$H_0$2: There is no significant direct relationship between the popularity of inquiring information online because of instantaneous availability of the data and threatening imposition to boycott the data repositories that remain on paper media.

H_a2: There is a significant direct relationship between the popularity of inquiring information online because of instantaneous availability of the data and threatening imposition to boycott the data repositories that remain on paper media.

$H_0$3: There is no significant direct relationship between the perceived online frequencies of use for non-obsolete specialized data, guaranteed availability and preservation of such information, and conversion of the paper-based records to digital archives.

H_a3: There is a significant direct relationship between the perceived online frequencies of use for non-obsolete specialized data, guaranteed availability and preservation of such information, and conversion of the paper-based records to digital archives.

The corroborative results of the qualitative analysis assisted in triangulating the researched themes for expectation, leadership, and the leadership interest with the results from the statistical analyses for decisions in support of the Internet database storage for the preservation of information. The expectation equated to 53.6% considering the Internet-based digital repositories as the best place for all types of useful information storage, which enabled information accessibility and availabilities. For the leadership interest with 27.5% indicating combinations of time, money, and resources as the primary reason for information void from the online databases combined with the 49% concurrence for all users benefiting from the Internet database accessing shaped the warning for the information managements. Triangulated decision on the leadership theme came from 49.28% agreements for difficulties in valid information discovery that often led to increases in costs for engineering endeavors that culminated searching the data.

The rejections of all three null hypotheses based on the critical statistical significance of ($p = 0.01$) in goodness-of-fit test calculations through SPSS statistical evaluations in this research. The interdependencies of the survey instrument variables determined using the statistical test of independence for ($p = 0.005$) significance. The Chapter 5 includes conclusions, implications, recommendations for future studies, recommendations for the information leaderships to consider the benefits of data conversion, and the importance of the online repositories.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

This chapter concludes the study on information loss: exploring the information systems management's neglect affecting softcopy reproduction of heritage-data. Absence of an existing none obsolete piece-part specification data conversion detected from the popular online digital database repositories. The purpose of investigating such void based on the information inquiry preferences with the focus to discover changes in searching methods and understand better about online data accessing, the availability of the information, and the possibility for information loss if the users could not find data from electronic archives. The investigations through mixed-methods research resulted in rejecting all three null hypotheses that had formed the preliminary grounds for this study. The mixed-methods design (Creswell, 2002, 2005, Neuman, 2003) enabled triangulation of the interpretative results for three thematic understandings on leadership, leadership interest, and expectation.

The purpose of conducting an online survey was to investigate the legacy-data conversion problems with none obsolete piece-parts specifications that could not be found from online engineering databases with the intension to understand better the reasons for such deficiencies from the Internet sources. The identified reasons for such omissions believed to be instructive to determining if the neglect or deliberate decision by the information systems managers to circumvent the paper-based data conversions for digital database archiving would result in information loss as projected initially to be the case. Research foundation was based on four questions and three hypotheses. The null hypotheses were addressed through quantifiable statistics and the interpretation of the expressions from qualitative collections triangulated to form the answers for research questions. Research questions and hypotheses were as follows:

1. Why do the information conversions from paper-based records to electronic databases become difficult and costly efforts?
2. How can electronically archived data for part-specifications benefit the engineering community?
3. Why do the archived data from popular search engines and databases lack some part-specifications?
4. How can conversion of information from paper-based record to electronic database guarantee preservation for uncommon, non-obsolete, but useful information best with the accessibility?

$H_0$1: There is no significant direct relationship between the perceived information obsolescence, loss or deficient use, and inaccessibility of the data from online databases resulting from conversion neglect or management's decision to circumvent digitization of the paper-based record.

H_a1: There is a significant direct relationship between the perceived information obsolescence, loss or deficient use, and inaccessibility of the data from online databases resulting from conversion neglect or management's decision to circumvent digitization of the paper-based record.

$H_0$2: There is no significant direct relationship between the popularity of inquiring information online because of instantaneous availability of the data and threatening imposition to boycott the data repositories that remain on paper media.

H_a2: There is a significant direct relationship between the popularity of inquiring information online because of instantaneous availability of the data and

threatening imposition to boycott the data repositories that remain on paper media.

$H_0$3: There is no significant direct relationship between the perceived online frequencies of use for non-obsolete specialized data, guaranteed availability and preservation of such information, and conversion of the paper-based records to digital archives.

H_a3: There is a significant direct relationship between the perceived online frequencies of use for non-obsolete specialized data, guaranteed availability and preservation of such information, and conversion of the paper-based records to digital archives.

Services of the Internet-based company Survey Monkey (SM) were acquired to solicit participants for this academic research and the dispersing of the questionnaire. The electronically distributed questionnaire included three sections: 1) informed consent form, 2) instructions on taking the survey, 3) survey questions for both quantitative and qualitative discoveries. The commissioned agent SM polled survey audiences from the company's membership listing through which the final candidates with fully responded questionnaires were selected for this study. The study included descriptive statistical analyses with both chi-square goodness-of-fit tests and chi-square tests of independence through which research hypotheses were evaluated and subsequently the null-hypotheses rejected. Interpretation of the expressions from open-ended responses resulted in triangulating for three thematic conclusions that encircled expectation, leadership, and the leadership interest. The final decisions deriving from the research discoveries including the targeted population, process

for data collection, statistical analyses, thematic decisions, and other inferences in this study follow.

Data Collection, Analyses and Discoveries

Selection of the survey scores for final evaluations resulted in choosing only the completely responded questionnaires from the survey participants who had agreed to the terms of participation for this study. Three categories separated demographics for the participant occupations. The majority of the participants were from the general category, followed by manufacturers, and designers. Significant number of participants had indicated they preferred and used the Internet as their first choice to inquiring reliable information. This result from the survey supported discoveries from literature that indicated searching through online databases was instantaneous and emergent choice for the information accessing (Chrzastowski, 2003; de Acuñ & Agenjo, 2005). In the absence of the reliable online information, many had preferred to ask other colleges opinions that would have led to a valid source.

The overall perceptions noted that most engineers preferred to use the online databases. The majority of the survey participants indicated often they referenced the popular online search engines to lookup for the classified information. The majority neither did search through books and paper records to locate classified information. Greater number of participants agreed that the online databases were alternatives to libraries. Survey participants delivered divided decisions on the question of parts obsolescence with the majority indicating that parts still could remain useable despite unattainability of the technical specifications. They disagreed with the idea that the printed forms of specifications on the paper would remain permanently safe and accessible.

The majority also had disagreed that the presence of the online databases could not have threatened paper-based archiving. The surveyed audiences gave another split decision with the majority agreeing to the statement that the digital conversion was not a definitive guarantee for the frequent use, availability, and safety of the archived information. Expressed thoughts were indicative of the following decisions: a) searching reliable information through paper records was cumbersomeness, b) the Internet searching benefited all equally, c) obstacles existed in data conversion, and d) the online databases were the promising venues for the security of data. The archival void for digital information seeking problem (Erdogan, 2009) corroborated with the researched discoveries through investigative analysis. The question of heritage-data loss resulting from unavailability of the digital conversion conferred upon the discovered analysis, shortages of literatures on the subject, and earlier studies examining the problem. Study results correlated the productivity improvement caveat suggested in the "How Going Paperless" (2008) article for the information seekers who took advantages of the online searches from the Internet.

Implications

Sufficient interest from the surveyed audiences shown on the Internet use and the digitally converted data available from the online sources confirmed the paradigmatic shift in the information retrieving method and indicated that paper-based information archiving is less attractive. Surveyed audiences preferred finding their inquired information from a managed online database (Blythe, 2007; Chandler, 2006; Chow & Chan, 2010, and; Erdogan, 2009) by 53.62% emphasizing online databases and searching through the Internet. This study resulted in considering the paper-based information at risked of becoming obsolete or undesired when the efforts for retrievals returned unsuccessful. All users will benefit from

paper-based information conversions to the electronically accessible data formats. Popular online engineering databases are better archiving places for data on part-specifications and other technical information.

Recommendations

Three primary commendations benefiting leadership effectiveness for the information management processing affect social consequences of making the information easily available through digital conversion presentation. These recommendations reflected the significances of this study. The information technology leaders, specifically the CIOs, are encouraged to pay deeper attention to the results from this study and apply the knowledge to data conversion policy. Information technology leaders reading about this study should notice substantive changes have occurred in the information inquiry habits, indicating paradigmatic shift in peoples' preference (Kim, Bartlett, & Lehmann, 2005). The leading executive CIOs should recognize that despite paradigmatic change of habits for information inquiries and public gravitation to use the Internet, some human knowledge remains on paper-based records (de Acuñ & Agenjo, 2005; Gauri, 2006, and; Guallar & Abadal, 2009). Based on discoveries and the statistical results of this study, the following recommendations were suggested.

Recommendations for leadership practice.

Consider the significance of the responses given to the first fundamental question: "When you are searching for reliable information, do you resort to one the following choices?" The results from this study indicated X^2 (4, N = 69) = 185.710, p = 0.01 with 86% of the respondents relying on the Internet for valid information, which was basis for strongly recommending that information leaders incorporate digital conversion benefits for the online

database access in their practice. With the availability of the online information for an instantaneous access, the problem of not finding technical data on part-specification would disappear. Additional analysis resulting to X^2 (3, N = 69) = 92.797, p = 0.01 with 72% of responses indicating that most engineers search online databases provided further motivation for recommending that the leadership practice specifically includes data conversions for all technical information. Neglecting to incorporate necessary procedures for the collection and conversion of the paper-based information for obscured but not obsolete records would result in the obscurity of such information.

With a basic networking connection, anyone can access the Internet and benefit from the online information searching capability on the interested information inquires through popular search engines, which the 49% of the targeted survey participants indicated they were agreeing. The leading information technology managers should consider the discoveries and the recommended cautions from this study when they are providing information services to users by applying the new knowledge in their practice. The leadership theme presented through the given recommendations in this section.

Recommendations for policy.

Two distinct patterns recommended for the policies on gathering information and the online disseminations as follows:

1. Establishing information technology department or group that separately is resourced within the office of the chief information officer and tasked exclusively to dedicate time and energy to seeking and gathering non-obsolete paper-based information for digital conversion.

2. Ensuring that all of the collected paper-based records are translated to valid and equally meaningful electronic forms for importation to the online database repositories with routine backup schedules.

Both results from survey questions Q5: "Which method do you think engineers prefer to choose when searching for information?" and Q7: "How often do you search archived books and paper records for the classified information and part specifications?" showed leadership interest best served with data conversion to digital archives. The rejection of the $H_0 1$ through X^2 (4, 69) = 30.058, p = .01 additionally to computations of X^2 (3, 69) = 92.797, p = .01 and X^2 (4, 69) = 30.928, p = .01 were proofs for recommending the above policies.

Recommendations for future researches.

This study included survey results from specifically targeted groups with explicit backgrounds. To collect a broader spectrum on the users reactions, which could furnish additional supportive responses or provide contradictions to the central discoveries from this study, future researches recommended examining the subject of the heritage data conversions from paper-based records on other than the part-specifications information. Such investigations could be based on the method with which the approach to conclusions in this study was made. Soliciting more individuals to participate in future surveys, including more specific questions on the questionnaires, seeking audiences from completely different occupational fields, allocating more time for data collections, and using multiple agents for the survey processing could enhance future studies and would result in better understandings. The following details recommended to the researchers for future studies.

To discover span, depth, and the magnitude of information unavailability problem from the online sources, a future researcher can ask directly if the survey participants have

encountered the unavailability problems while searching the Internet. The responses would show what others with different backgrounds and professions may have experienced that either could add to the knowledge discovery from this study or would produce a new discovery. The opportunity for describing the encountered problems can be given in a subsequently open-ended question. Tabulating the collected answers should result in discovering other none digitally converted information issues apart the parts-specifications problem discussed in this study. Later research results could be evaluated then statistically for the correlations to data obtained from this study using statistical process such as Pearson product-moment correlation.

Conclusions

The qualitative variable from survey instrument with the open-ended question 13 in conjunction with the variables three, four, seven, and nine formed the triangulating interpretation reflective of the leadership theme. The qualitative variables from questions 14 and 15 in combination with the quantitative variable from survey question 10 formed the triangulating outcome reflecting the leadership interest theme. The aggregated results from the qualitative variable 16 in conjunction with the quantitatively obtained result from variable 12 of the survey question triangulated to reflect interpretation of the research outcome for the expectation. The majority reaction with the 72% of the surveyed audiences responding to the Internet databases on the survey variable Q5 together with the expressed opinions from the Q15 resulted in determining the answer for research question R1 primarily to be the combination of time, money, and resources. The majority reactions to Q3 with the 86% of responding audiences choosing the Internet search engines for their answers combined with

the 53.62% of the opinions from Q16 stating digital databases were the best places for preserving the information resulted in determining answers for research questions R2 and R4.

The majority reactions to Q4 with the 55% of responding audiences deciding on asking others opinions when reliable information was not readily available to them combined with the 49.28% of expressions from Q13 describing difficulties of searching information resulted in determining answer for research question R3. The answer to R3 returned to most expressed opinions in Q15, which reflected neglect in heritage data conversion because of time, money, and resources concern. The chi-square goodness-of-fit test X^2 (4, N = 69) = 30.058, $p < 0.01$ from survey question Q10 calculation resulted in rejecting the $H_0$1. The calculation of the goodness-of-fit test X^2 (4, N = 69) = 41.362, $p < 0.01$ from Q11 rejected $H_0$2, and the goodness-of-fit test X^2 (4, N = 69) = 37.884, $p < 0.01$ for Q12 was the reason for rejecting $H_0$3. The degree of freedom $df = 4$ was applicable to all three statistical analyses.

Final Summary

The results from this study had indicated that the possibility of information obscurity and loss existed for the non-obsolete data that remained in the paper-based archives and possibly used in rare occasion. The conversion of paper-based information from records to the online databases often were not accomplished because the information had become obsolete or that information management had concerns about either the cost of undertaking the conversion process, employing the needed human resources, time requirement, or combination of the preceding reasons. The study result also strongly indicated the use interests in using the Internet and the online databases for the reliable information through faster inquiries. The technical information such as part-specifications normally were searched and retrieved from electronic archives by the engineering community. The

electronically converted and stored data in the online databases were safe with the regularly backups and remained protected.

Archived data from paper-based media could fade away, become inaccessible to users because of not knowing their archiving location. Popularity of the digital archives and often uses of popular search engines by people were threatening the data repositories that remained on paper media. The preliminary assumptions at the beginning of this study was that the engineering people used, or strongly preferred to use, online databases for accessing technical information on part-specifications. Next assumption spun with the idea that online databases were replacing the libraries and the paper-based archives (Chrzastowski, 2003; Kousha, & Thelwall, 2007). Another assumption was based on the idea that electronically preserved information was superior to its paper-based counterpart in easier accessibility, availability advantage, and preferred method of searching.

These assumptions resulted in setting the preliminary biases before this research began. Researcher's personal observations from the daily work and other environments supported both primary assumptions and the biases, which later reviews of the literatures produced additional support and confirmations for investigations. The results of exercising mixed-methods research for the information loss: exploring the information systems management's neglect affecting softcopy reproduction of heritage-data topic added confidence to researcher's preliminary assumptions with the supporting experience. This final summary concludes investigations on the topic of none digitally converted piece parts-specification from the titled study.

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APPENDIX A: SURVEY INSTRUEMENT

Terms of participation:

I (participant) understand that by taking this survey I am obligated to answer each question truthfully, keep my answers private by not sharing any answers with anyone else, and further agree to not making copies (printed or electronically) of the information presented in this survey. I also will not download any of the information presented with this survey. I understand that all answers will be kept in a safe place by researcher where identities of the participants will be kept confidential and protected for maximum period of three years for purpose of research verification after which time all survey records will be destroyed in shredding.

In addition to agreeing to the above terms, I will give permission for using my answers that I voluntarily provide by signing separate electronically distributed informed consent form. Answers to these survey questions will be used only to help with the current and possible future research on information archiving decision.

Table A1

Quantitative and Qualitative Questions on the Survey Instrument — The Questionnaire

Quantitative Question	Possible Answers for Scoring
Q1: Will you "agree" or "disagree" with the terms of participation for survey? Please indicate by checking off your selection.	1. Agree, 2. Disagree
Q2: Indicate which one is your function.	1. Designer, 2. Manufacturer 3. Other
Q3: When you are searching for reliable information, do you resort to one of the following choices? Please select.	1. Library books 2. Newspaper articles 3. Internet search engines 4. Peer reviewed articles on the Web 5. Word of mouth from experts
Q4: When you cannot find reliable information about an item, do you resort to one of the following? Please select.	1. Make an assumption 2. Replace item with another for which valid data is available 3. Asking others opinions 4. Take no action
Q5: Which method do you think engineers prefer to choose when searching for	1. Words of mouth 2. Expert's opinion on TV

information? Please select.	3. Archived paper records (e.g., library books) 4. Online databases on the Internet
Q6: How often do you look up through popular search engines for the classified information and parts specifications? Please indicate.	1. Never 2. Rarely 3. Not sure 4. Often 5. Always
Q7: How often do you search archived books and paper records for the classified information and part specifications? Please indicate.	1. Never 2. Rarely 3. Not sure 4. Often 5. Always
Q8: How do you respond to following statement? The databases on the Internet are alternatives to the libraries.	1. Strongly disagree 2. Disagree 3. Not sure 4. Agree 5. Strongly agree
Q9: How do you respond to following statement? If the specification data is not easily obtainable, then the selected part probably is obsolete.	1. Strongly disagree 2. Disagree 3. Not sure 4. Agree 5. Strongly agree
Q10: How do you respond to following statement? Parts-specification data, which are saved on the paper records, cannot fade, become inaccessible or obsolete in the absence of digitally converted archives.	1. Strongly disagree 2. Disagree 3. Not sure 4. Agree 5. Strongly agree
Q11: How do you respond to following statement? Popularity of online search engines, such as Google, and the online searching trend does not threaten paper form of archiving.	1. Strongly disagree 2. Disagree 3. Not sure 4. Agree 5. Strongly agree
Q12: How do you respond to following statement? Converting paper records to digital archives for the online search does not guarantee information availability, safety, and its frequent use.	1. Strongly disagree 2. Disagree 3. Not sure 4. Agree 5. Strongly agree

Qualitative Questions	Expressive Answers
Q13: What is the most problematic, time-consuming, and costly effort in designing or manufacturing activities?	"Please give your explanation in few sentences."
Q14: Who may benefit from describing the problem, if any, with the online parts specification finding, and where such information sources can exits?	"Please give your explanation in few sentences."
Q15: Why some listings for part specification currently do not exist in popular engineering search engines or databases?	"Please give your explanation in few sentences."
Q16: Where can the managers of information systems best preserve any rare, non-obsolete, but useful information that guarantees data from becoming inaccessible or obsolete?	"Please give your explanation in few sentences."

APPENDIX B: QUESTION LOGIC AND CODING

Table B1

Survey Instrument Question Types, Logic, and Coding

Question	Type	Description	Scoring	Reliability
Question1: Will you "agree" or "disagree" with the terms of participation for survey?	Informed consent screening		1. Agree, 2. Disagree	2
Question 2: Indicate which one is your function.	Defining population	Defines population, interest groups, for research	1. Designer, 2. Manufacturer 3. Other	3
Question 3: When you are searching for reliable information, do you resort to one of the following choices?	Quantitative	Expectation toward R2/R4 explanation	1. Library books 2. Newspaper articles 3. Internet search engines 4. Peer reviewed articles on the Web 5. Word of mouth from experts	5
Question 4: When you cannot find reliable information about an item, do you resort to one of the following?	Quantitative	Explanation toward R3 explanation	1. Make an assumption 2. Replace item with another for which valid data is available 3. Asking others opinions 4. Take no action	4
Question 5: Which method do you think engineers prefer to choose when searching for information?	Quantitative	Expectation toward R1 explanation	1. Words of mouth 2. Expert's opinion on TV 3. Archived paper records (e.g.,	4

			library books) 4. Online databases on the Internet	
Question 6: How often do you look up through popular search engines for the classified information and parts specifications?	Quantitative	Expectation relates to both H2 and H3	1. Never, 2. Rarely, 3. Not sure, 4. Often, 5. Always.	5
Question 7: How often do you search archived books and paper records for the classified information and part specifications?	Quantitative	Expectation relating to H1	1. Never, 2. Rarely, 3. Not sure, 4. Often, 5. Always	5
Question 8: How do you respond to following statement? The databases on the Internet are alternatives to the libraries.	Quantitative	Expectation relating to H2	1. Strongly disagree, 2. Disagree, 3. Not sure, 4. Agree, 5. Strongly agree	5
Question 9: How do you respond to following statement? If the specification data is not easily obtainable, then the selected part probably is obsolete.	Quantitative	Expectation relating to H3	1. Strongly disagree, 2. Disagree, 3. Not sure, 4. Agree, 5. Strongly agree	5
Question 10: How do you respond to following statement? Parts-specification	Quantitative	Directly relates to the $H_0$1	1. Strongly disagree, 2. Disagree, 3. Not sure,	5

data, which are saved on the paper records, cannot fade, become inaccessible or obsolete in the absence of digitally converted archives.			4. Agree, 5. Strongly agree	
Question 11: How do you respond to following statement? Popularity of online search engines, such as Google, and the online searching trend does not threaten paper form of archiving.	Quantitative	Directly relates to the $H_0 2$	1. Strongly disagree, 2. Disagree, 3. Not sure, 4. Agree, 5. Strongly agree	5
Question 12: How do you respond to following statement? Converting paper records to digital archives for the online search does not guarantee information availability, safety, and its frequent use.	Quantitative	Directly relates to the $H_0 3$	1. Strongly disagree, 2. Disagree, 3. Not sure, 4. Agree, 5. Strongly agree	5
Question 13: What is the most problematic, time-consuming, and costly effort in designing or manufacturing activities?	Qualitative	Exploratory probing	Indicators may be counted for piece-part-specification	May validate Q3, Q4, Q7, and Q9
Question 14: Who may benefit from describing the problem, if any, with the online parts	Qualitative	Leadership indicator	Leadership indicators for transactional and transformational changes on	

specification finding, and where such information sources can exist?			legacy-data conversions for engineering use	
Question 15: Why some listings for part specification currently do not exist in popular engineering search engines or databases?	Qualitative	May provide additional explanation to Q10		Corroborate highly with Q10
Question 16: Where can the managers of information systems best preserve any rare, non-obsolete, but useful information that guarantees data from becoming inaccessible or obsolete?	Qualitative	Leadership indicator	Leadership indicators for directing, transacting, and transforming	Corroborate highly with Q12

APPENDIX C: INFORMED CONSENT FORM/DESIGN-ENGINEER

UNIVERSITY OF PHOENIX

INFORMED CONSENT: PARTICIPANTS 18 YEARS OF AGE AND OLDER

Dear Electronics Design Engineer,
My name is Kamran R. Oskooie and I am a student at the University of Phoenix working on a Doctor of Management in Organizational Leadership degree. I am conducting a research study entitled Information Loss: Exploring the Information Systems Management's Neglect Affecting Softcopy Reproduction of Heritage-Data. The purpose of the research study is to discover trends, issues, and benefits that data conversion may provide to online inquiries and increased knowledge..

Your participation will involve accepting conditions set for the research, answering questiones in two parts by selecting the answer you see fit to the asked questions in part 1 and expressing your thoughts in part two. The average time for survey is around 20 minutes.. Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, you can do so without penalty or loss of benefit to yourself. The results of the research study may be published but your identity will remain confidential and your name will not be disclosed to any outside party.

In this research, there are no foreseeable risks to you except "none"

Although there may be no direct benefit to you, a possible benefit of your participation is helping to better understand unavailability of information online that could bring forth wider awareness to information managements.

If you have any questions concerning the research study, please call me at [redacted] and [redacted].

As a participant in this study, you should understand the following:

1. You may decline to participate or withdraw from participation at any time without consequences.
2. Your identity will be kept confidential.
3. Kamran R. Oskooie, the researcher, has thoroughly explained the parameters of the research study and all of your questions and concerns have been addressed.
4. If the interviews are recorded, you must grant permission for the researcher, Kamran R. Oskooie to digitally record the interview. You understand that the information from the recorded interviews may be transcribed. The researcher will structure a coding process to assure that anonymity of your name is protected.
5. Data will be stored in a secure and locked area. The data will be held for a period of three years, and then destroyed.
6. The research results will be used for publication.

"By signing this form you acknowledge that you understand the nature of the study, the potential risks to you as a participant, and the means by which your identity will be kept confidential. Your signature on this form also indicates that you are 18 years old or older and that you give your permission to voluntarily serve as a participant in the study described."

Signature of the interviewee _____ Date _____

Signature of the researcher _____ Date _____

APPENDIX D: INFORMED CONSENT FORM/MANUFACTURING-ENGINEER

UNIVERSITY OF PHOENIX

INFORMED CONSENT: PARTICIPANTS 18 YEARS OF AGE AND OLDER

Dear Electronics Manufacturing Engineer,
My name is Kamran R. Oskooie and I am a student at the University of Phoenix working on a Doctor of Management in Organizational Leadership degree. I am conducting a research study entitled Information Loss: Exploring the Information Systems Management's Neglect Affecting Softcopy Reproduction of Heritage-Data. The purpose of the research study is to discover trends, issues, and benefits that data conversion may provide to online inquiries and increased knowledge..
Your participation will involve accepting conditions set for the research, answering questiones in two parts by selecting the answer you see fit to the asked questions in part 1 and expressing your thoughts in part two. The average time for survey is around 20 minutes..
Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, you can do so without penalty or loss of benefit to yourself. The results of the research study may be published but your identity will remain confidential and your name will not be disclosed to any outside party.

In this research, there are no foreseeable risks to you except "none"

Although there may be no direct benefit to you, a possible benefit of your participation is helping to better understand unavailability of information online that could bring forth wider awareness to information managements.

If you have any questions concerning the research study, please call me at [redacted] and [redacted].

As a participant in this study, you should understand the following:

1. You may decline to participate or withdraw from participation at any time without consequences.
2. Your identity will be kept confidential.
3. Kamran R. Oskooie, the researcher, has thoroughly explained the parameters of the research study and all of your questions and concerns have been addressed.
4. If the interviews are recorded, you must grant permission for the researcher, Kamran R. Oskooie to digitally record the interview. You understand that the information from the recorded interviews may be transcribed. The researcher will structure a coding process to assure that anonymity of your name is protected.
5. Data will be stored in a secure and locked area. The data will be held for a period of three years, and then destroyed.
6. The research results will be used for publication.

"By signing this form you acknowledge that you understand the nature of the study, the potential risks to you as a participant, and the means by which your identity will be kept confidential. Your signature on this form also indicates that you are 18 years old or older and that you give your permission to voluntarily serve as a participant in the study described."

Signature of the interviewee _____ Date _____
Signature of the researcher _____ Date _____

APPENDIX E: QUESTIONNAIRE PROCESS FLOW FOR DATA COLLECTION

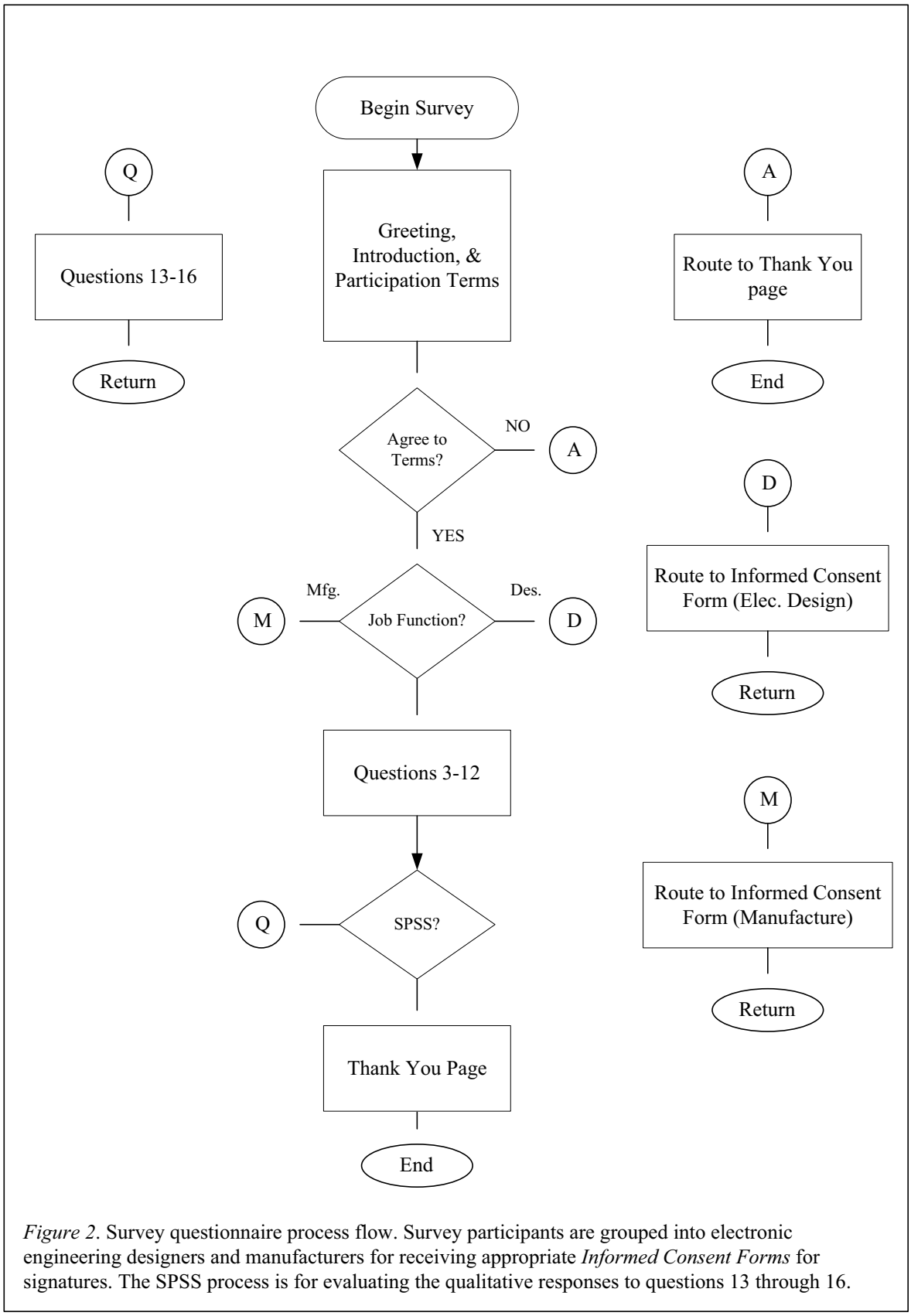

Figure 2. Survey questionnaire process flow. Survey participants are grouped into electronic engineering designers and manufacturers for receiving appropriate *Informed Consent Forms* for signatures. The SPSS process is for evaluating the qualitative responses to questions 13 through 16.

APPENDIX F: CHI-SQUARE TEST CALCULATION

$x^2 = \sum [(O - E)^2 / E]$, where x^2 denotes chi-square test value, $\sum$ used to indicate the sum of all terms, O represents a single observed value, and E the corresponding expected value (Thorne & Giesen, 2000, p. 329).

E = [(RT * CT)/N], where RT is the total value obtained from adding numbers in the cells from a row, CT is the total value obtained from adding numbers in the cells for a column, and N is the total number of observations (Thorne & Giesen, 2000, p. 333).

df = (R -1)(C -1), where df denotes the degrees of freedom in chi-square test, R is the number of rows in the chi-square test tabulation, and C indicates the number of columns in the same table of frequency (Thorne & Giesen, 2000, p. 336).

df = K -1 applies to chi-square goodness-of-fit test, where K denotes total number of categories for a variable.

$X^2_{comp} \geq X^2_{crit}$ [df = (R - 1)(C - 1)] results in rejecting the Null-Hypothesis (Thorne & Giesen, 2000, p. 333).

APPENDIX G: GRAPHIC CHARTS FOR FREQUENCY AND PERCENTAGE

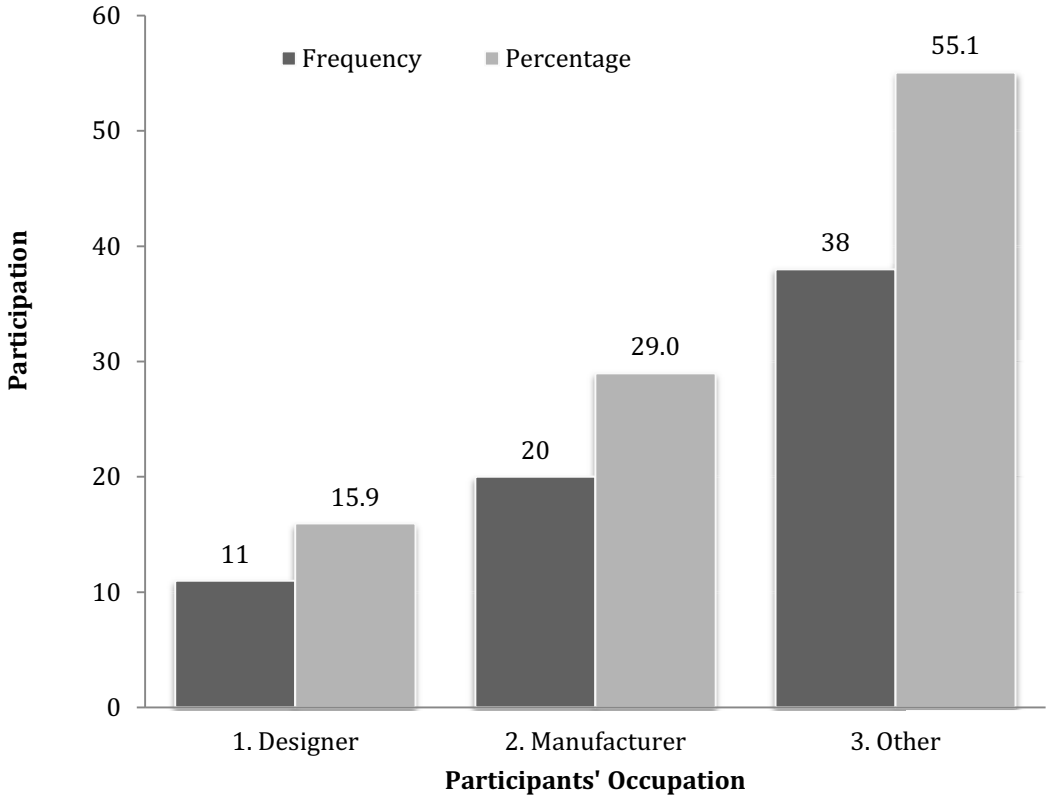

Figure G2. Populations spread of the surveyed audiences representing primary occupations for designing and manufacturing. Demographics for the gender difference were not investigated. Decision for the exclusion was based on the perception that both sexes equally were motivated in their information searching practice.

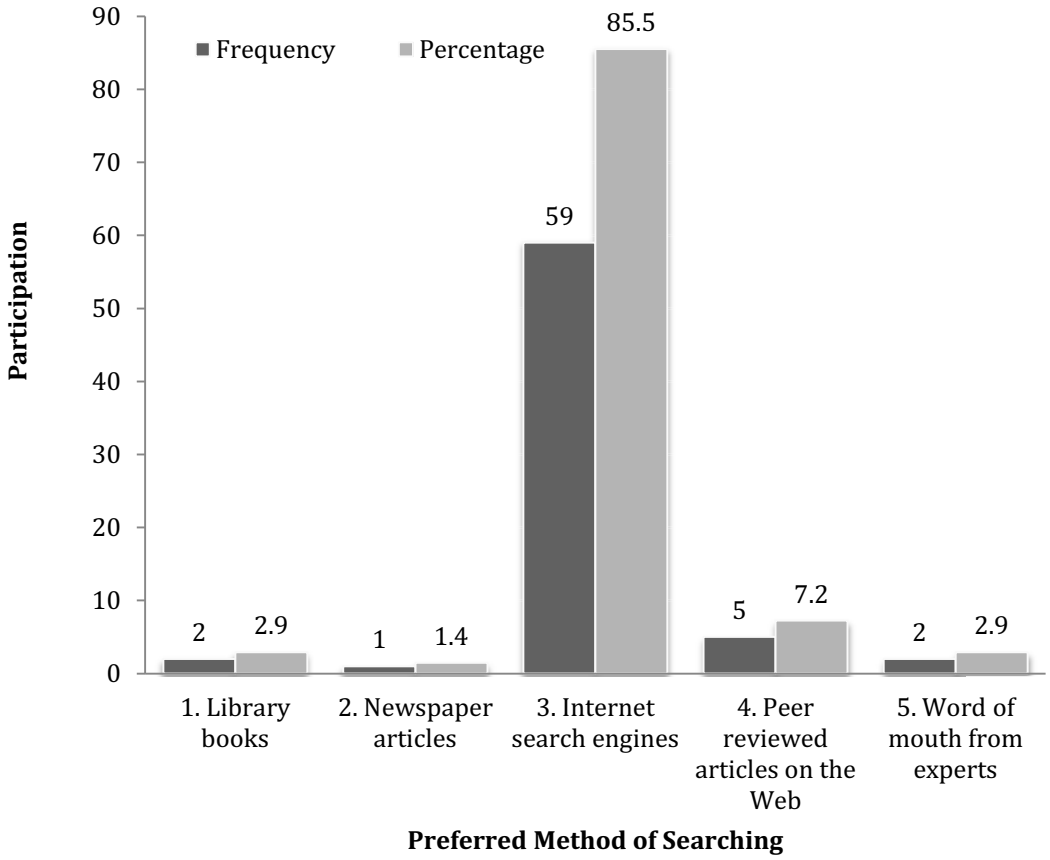

Figure G3. Preferred source indicated by surveyed audiences to research reliable information. The majority of participants responded choosing the Internet over the other selections. The Internet was considered a reliable source, even perceived to enable access to the peer-reviewed articles.

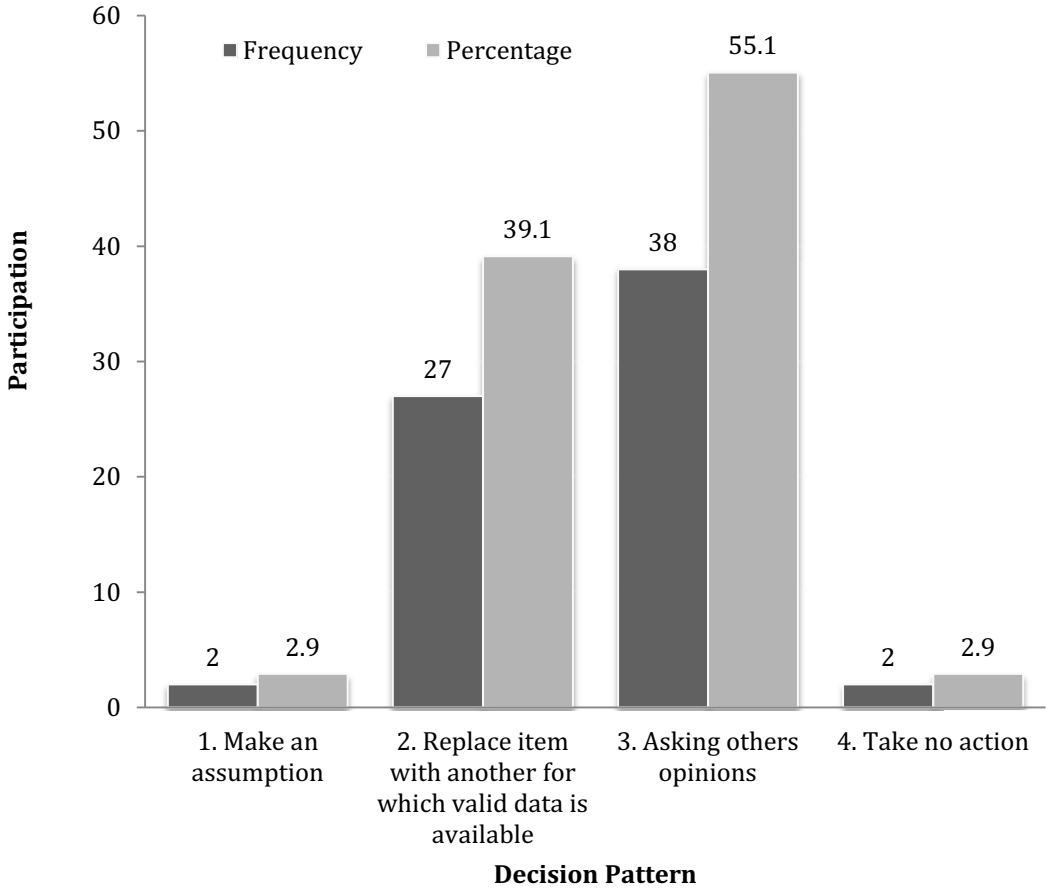

Figure G4. Preferred approaches to resolving unavailable information problem showed surveyed audiences would resort to replacing an item. Higher degree to resorting to ask others opinions would precede the replacement option.

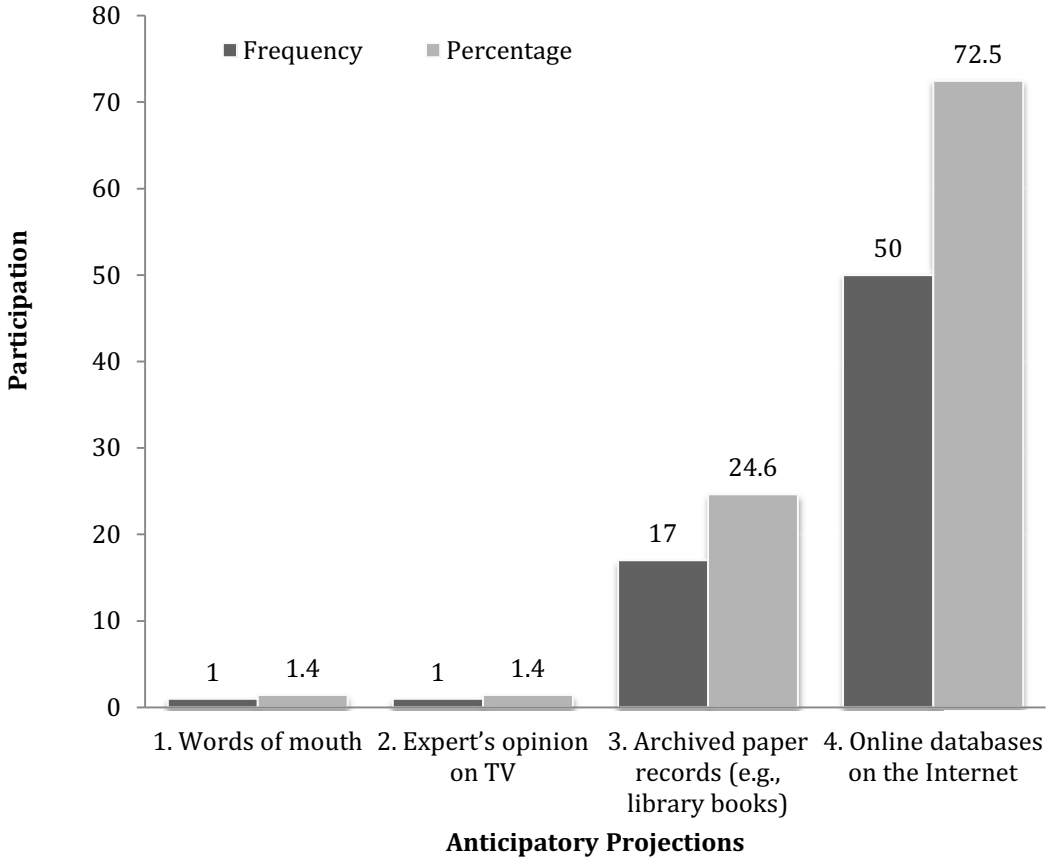

Figure G5. Perceived reactions from surveyed audiences showed engineers conventionally chose to acquire technical information from the online database. Smaller percentage on the choice of still referencing the books indicated that recorded technical data on paper was the secondary choice.

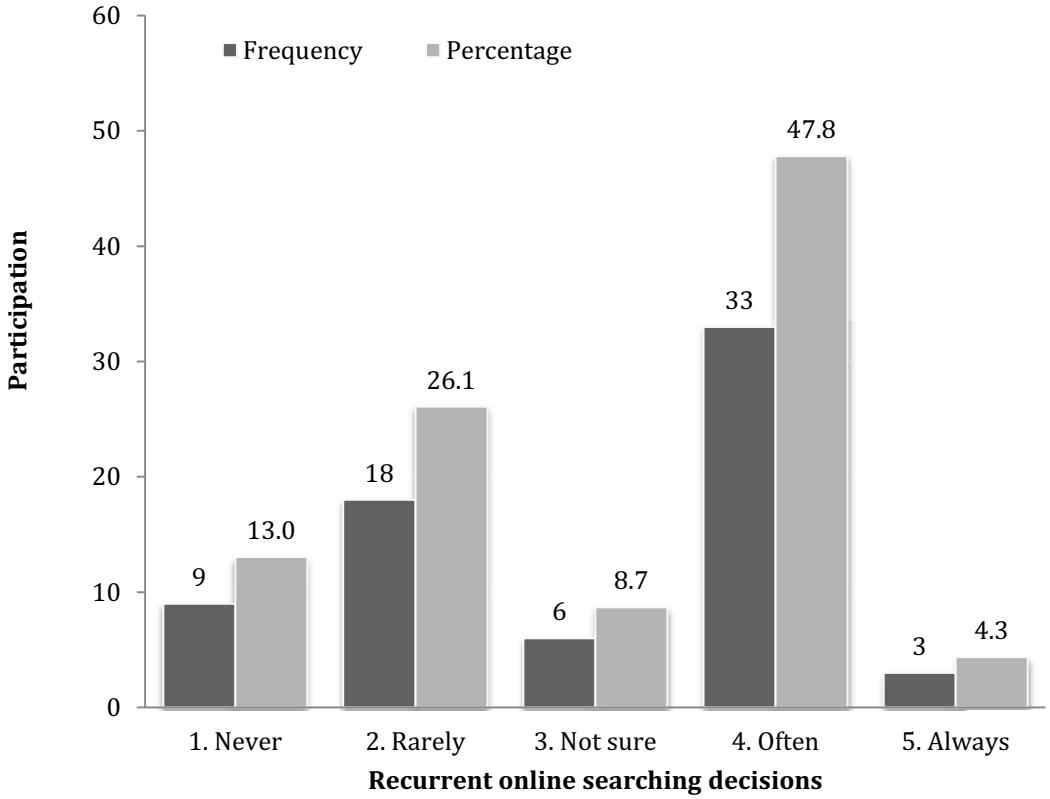

Figure G6. Reactions from the surveyed audiences showed most people using online databases for classified information was predisposition to take the easier path for seeking consistent data. Lesser scores representing the rarely and the never uses of search engines was because of some doubts respondents had on finding private information from the unsecured online sources such as search engines.

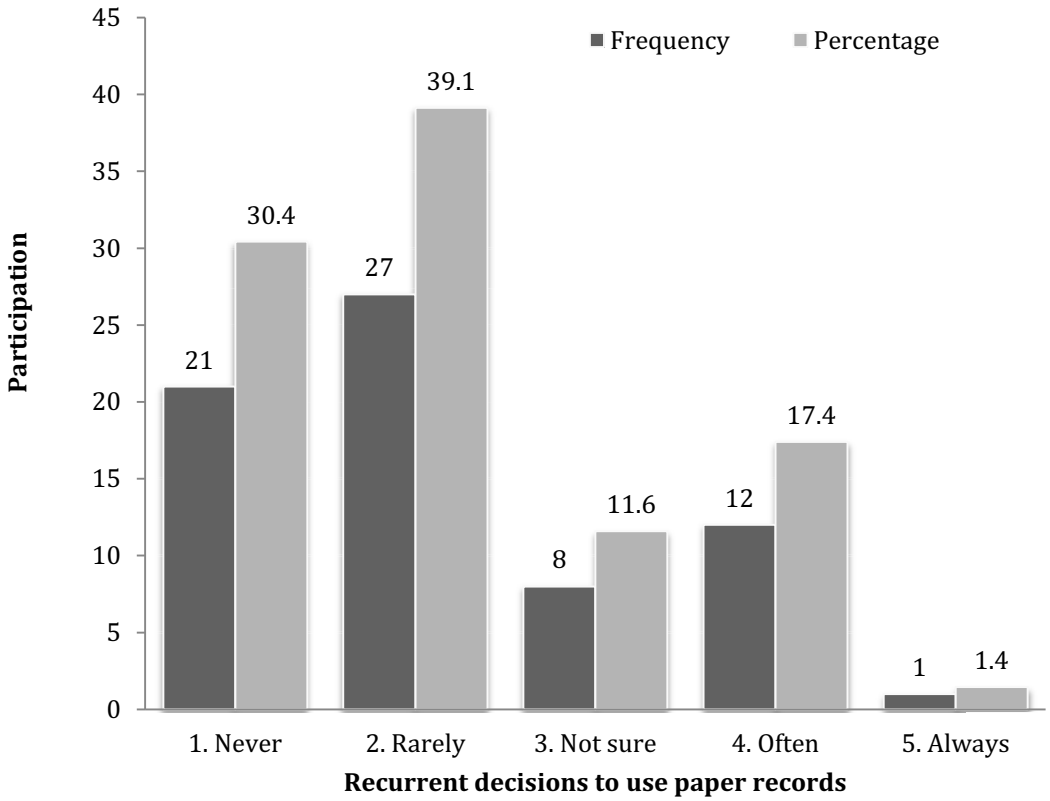

Figure G7. Reactions from the surveyed audiences to the question of using paper-based records to search for the classified information supported previously given answers to the survey variable Q7 question. The bar chart results showed participants who used the online search engines rarely or never used the paper-based records.

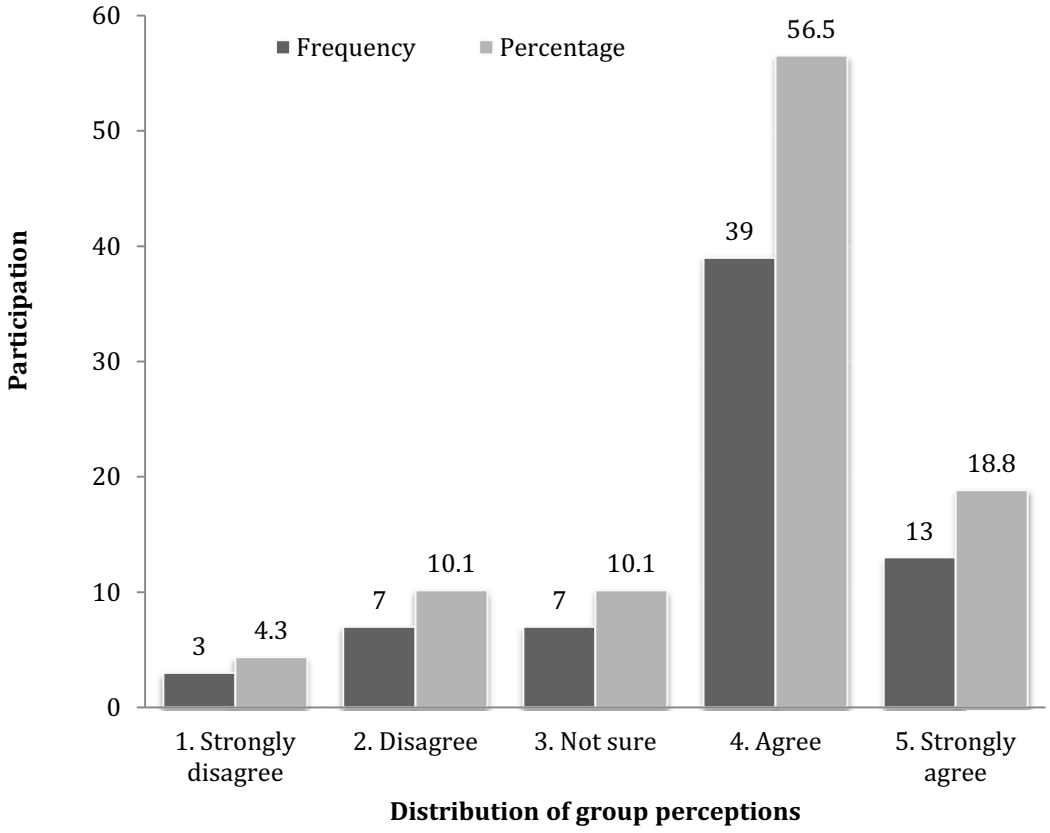

Figure G8. Reactions from the surveyed audiences showing databases from the Internet were undoubtedly the alternative searching sources for the reliable information. The combined results from both agree and strongly agree responses were favorably supportive of the decision to using online sources through the Internet.

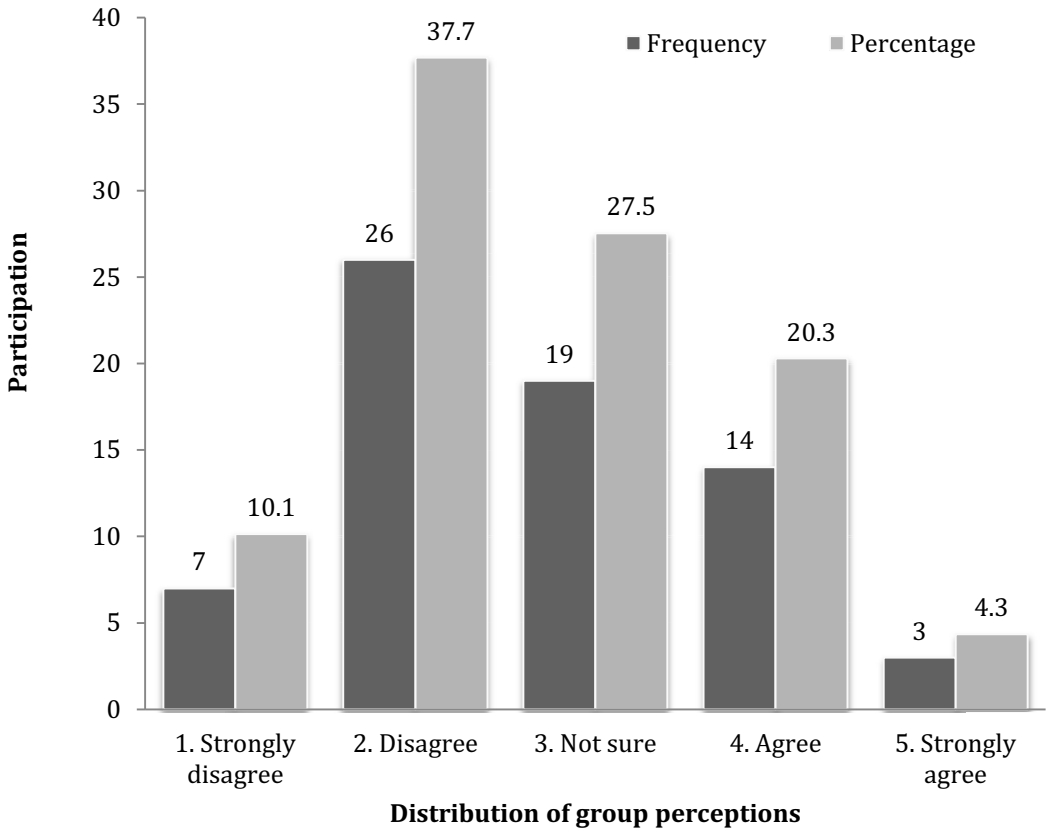

Figure G9. Surveyed audiences' reactions to the question of obsolescence possibility of the parts for which technical data were not available showed that parts still could be usable regardless of missing specifications. Survey results reflecting the uncertainty percentage and the responses to agreeing with the statement of the survey variable Q9 question indicated there remained the possibility for discarding such components.

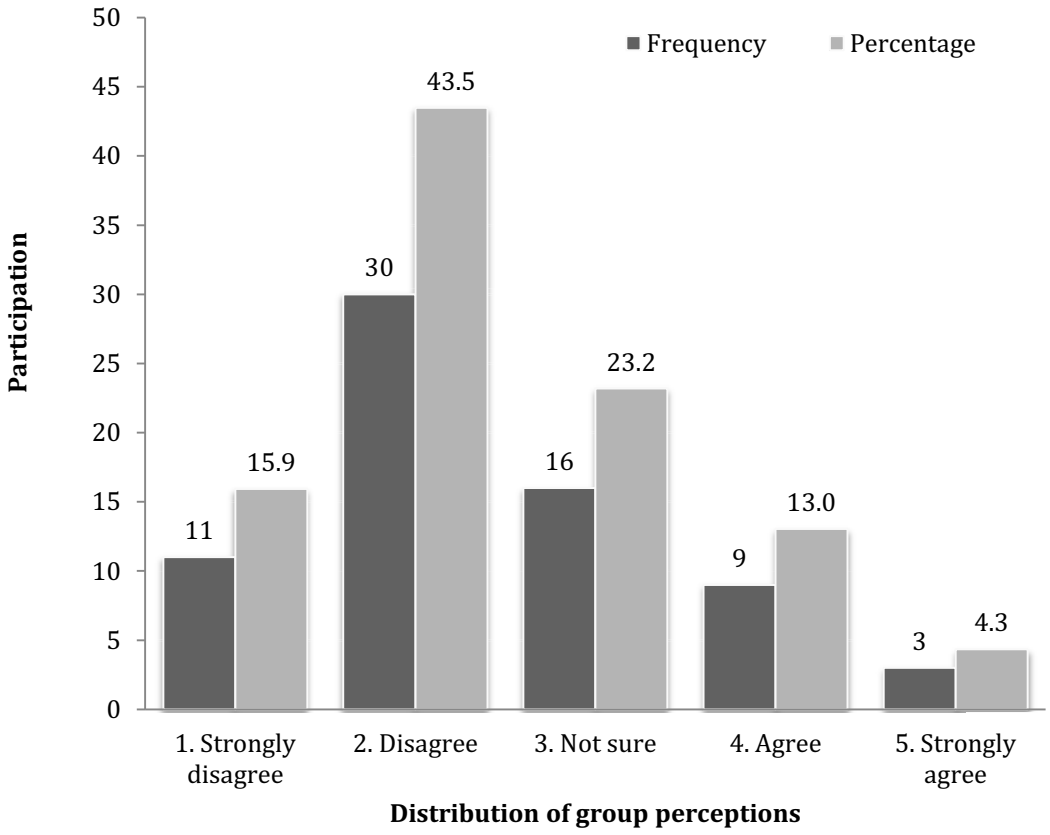

Figure G10. Surveyed audiences' reactions to answering the Q10 question showed that chances for the loss of information, its availability, and security existed in the absence of digitally converted archives. The strong indicator for the survey participants contributing to such decision outcome was the convincing chance of information fading effect.

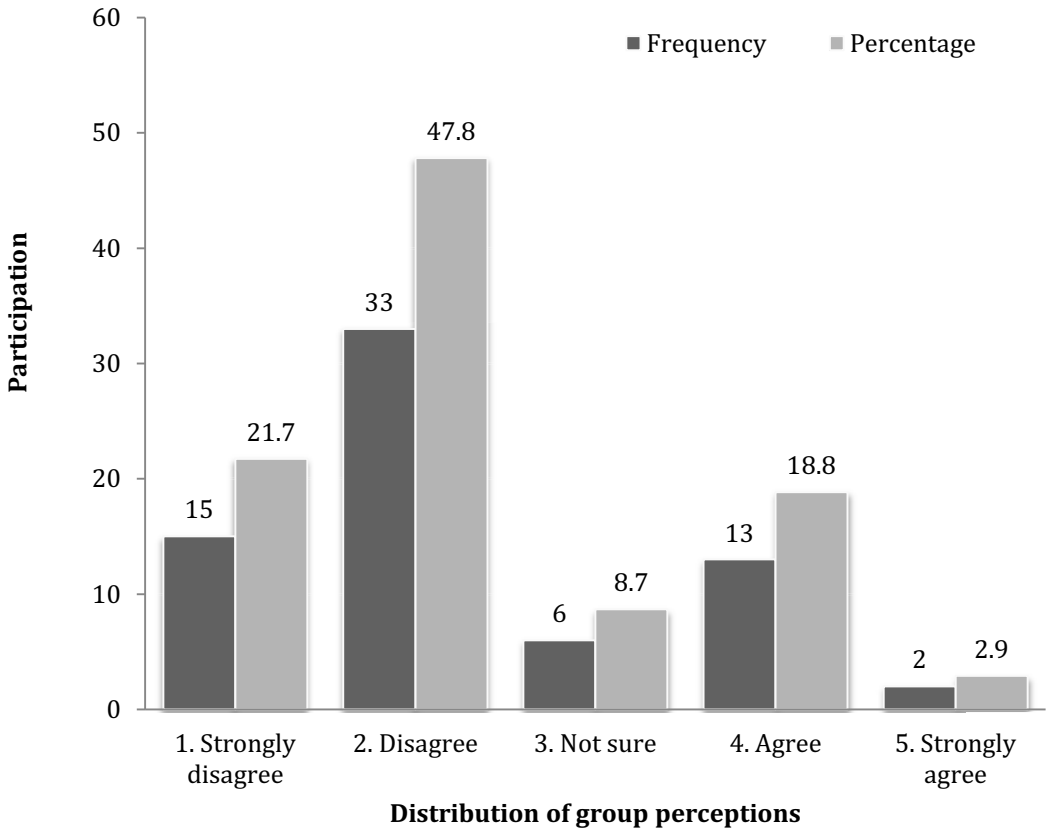

Figure G11. Surveyed reactions to answering Q11 clearly indicated that the online searching was threatening paper archives. The combined results from strongly disagreeing and the disagreeing scores showed there were more consensuses to support the fact that paper-based records were less favorite sources of information.

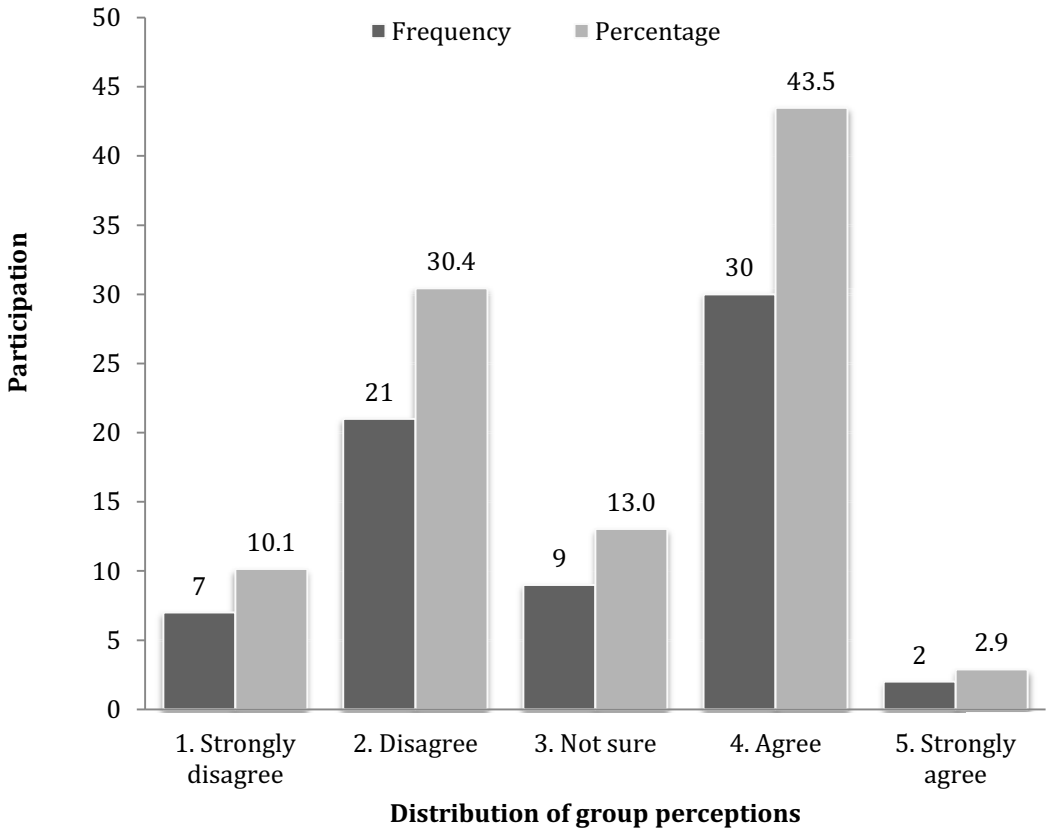

Figure G12. Reactions from the surveyed audiences indicating that the digital conversions from paper-based records were not guarantee for the information availability, safety, and the frequent use. The combined results from strongly disagreeing and the disagreeing scores showed that the chance existed for data safety, its availability, and frequent access from digital archives.