Journal of Information Security and Applications 36 (2017) 1–10

Contents lists available at ScienceDirect

Journal of Information Security and Applications

journal homepage: www.elsevier.com/locate/jisa

Integrating information quality dimensions into information security risk management (ISRM)

Palaniappan Shamala[a], Rabiah Ahmad[b], Ali Zolait[c,*], Muliati Sedek[d]

[a] Faculty of Computer Science and Information Technology, Universiti Tun Hussein Onn Malaysia (UTHM), Johor, Malaysia
[b] Center for Advanced Computing Technology, Faculty of Information and Communication Technology, University Technical Malaysia Melaka (UteM), Melaka, Malaysia
[c] Department of Information Systems, College of Information Technology, University of Bahrain, Bahrain
[d] Center for Teaching and Learning, Universiti Teknikal Melaka, 76100 Durian Tunggal, Melaka, Malaysia

ARTICLE INFO

Article history:
Available online 31 July 2017

Keywords:
Information security
Risk management
Information quality
Information Security Risk Management

ABSTRACT

Information security is becoming an important entity to most organizations due to current trends in information transfer through a borderless and vulnerable world. This gives more concerns and aware organization to apply information security risk management (ISRM) to develop effective and economically-viable control strategies. Even though there are numerous ISRM methods that are readily available, most of the ISRM methods prescribe a similar process that leads to establish a scope of the assessment, collecting information, producing intermediary information, and finally using the collected information to identify their security risks and provide a measured, analyzed security profile of critical information assets. Based on the "garbage in-garbage out" phenomenon, the success of ISRM planning tremendously depends on the quality of input information. However, with the amount, diversity and variety of information available, practitioners can easily deflects with grown information and becoming unmanageable. Therefore this paper contribute as a stepping stone to determine which IQ dimensions constitute the quality of the information throughout the process of gathering information during ISRM. Seems to accurately define the attributes of IQ dimensions, IQ needs to be assessed within the context of its generation. Thus, papers on IQ web were assessed and comparative analysis was conducted to identify the possible dimensions for ISRM. Then, online survey using likert structured questionnaire were distributed among a group of information security practitioners in Malaysia (N = 150). Partial least square (PLS) analysis revealed that dimension accuracy, amount of data, objective, completeness, reliability and verifiability are significantly influence the quality of information gathering for ISRM. These IQ dimensions can guide practitioners in the process of gathering quality and complete information in order to make a plan that leads to a clear direction, and ultimately help to make decisions that lead to success.

1. Introduction

Organizations are becoming progressively aware that information security is an important aspect of their businesses strategy. The concern aware organizations to apply information security risk management (ISRM) to identify the security risks in the organizations and provides a measured, analyzed security risk profile of the critical assets in order to build plans to treat the risks [30,50–52]. Nowadays, there are a number of different types of risk management methods, standards, guidelines and specifications that are available for assessing and managing risk management [13,42].

Most of the methods prescribe a similar process that leads to establishing a scope of the assessment, collecting information, producing intermediary information, and finally quantifying and sorting items such as assets, vulnerabilities, threats and risks, according to a set of parameters. All the ISRM methods only differ from each other in terms of the target community, details of the analytic process, as well as the information they prescribe [28].

Seems the goal of ISRM is basically the same, which is selecting effective preventive measures and combating information threat in an active fashion [11], organizations need to define appropriate controls for reducing or eliminating those risk by using the output

* Corresponding author.
E-mail addresses: shamala@uthm.edu.my (P. Shamala), rabiah@utem.edu.my (R. Ahmad), azolait@uob.edu.bh, alizolait@gmail.com (A. Zolait), muliati@utem.edu.my (M. Sedek).

http://dx.doi.org/10.1016/j.jisa.2017.07.004
2214-2126/

of the risk assessment. Therefore, information security department needs to complete all the required planning before starting the actual risk assessment. This because the success of the risk assessment fully depends on the information gathered in order to make concise and accurate security planning decisions.

Practically, practitioners systematically gather more information than the use, yet continue to ask for more in order to fulfill the requirements to be met before risk assessment is conducted. According to Kenett and Shmueli [25], basically, there are many different collection tools are available to use to collect information such as surveys, laboratory tests, field and computer experiments, simulations, web searches, observational studies, social network and more. This situation will lead practitioners to easily deflects with grown information and become unmanageable. Much of the information is gathered in a surveillance mode rather than in a decision mode. Furthermore, with the development of information technology [61], organizations tend to collect enormous of information and more complex information resources [33].

Hence practitioners are required to evaluate the collected information resources based on the user's perspective in order to eliminate all the "garbage" information. This is due to the quality of the output is extremely depends on the quality of the input information, known as the "garbage-in-garbage-out" phenomenon [6,7]. Furthermore, information is a critical resource for organization merely because the quality of information is one of the key determinants of the quality of their decisions and actions [54].

Although there is a wide range of active research and practice in IQ in other application areas [16], there is a need for further research incorporating IQ in ISRM field in order to successfully measure the quality of the information to be gathered in process of gathering and planning risk assessment. In the area of risk management, the concept of what dimensions constitutes IQ in risk management has not been addressed.

Therefore, this study strives to serve as a fundamental and stepping stone for triggering the attention of researchers and practitioners on the needs of integrating IQ dimension in the ISRM field. This paper seeks to contribute by determining which IQ dimensions constitute the quality of the information throughout the process of gathering information during ISRM. The analysis was conducted using PLS-SEM analysis technique. The determined dimensions can guide information security practitioners to do their own quality evaluations for ensuring the information gathered for ISRM is considered quality and can lead information security practitioners to make evidence-based decisions.

This paper is organized into several sections. The immediate section describes the importance of having ISRM and needs to integrate IQ in ISRM. Section 2 explaining related work for this study. Section 3 explained on research approach used in identifying possible IQ for ISRM. Section 4 explains the research method used followed by the results of the analyses conducted. Last but not least, Section 6 concludes the paper.

2. Related work

Generally, information practitioners should understand where, how, and how much information are needed to impact an organization's ability to successfully deliver its objectives. Because most modern organizations tend to collect increasing amount of data and more complex information resources [33]. Based on the "garbage in-garbage out" phenomenon, the success of ISRM planning tremendously depends on the quality of input information because the quality of information is one of the key determinants of practitioners decisions and actions. Studies also have shown that poor IQ can have a negative impact on operational and strategic management, which can require information rework, make significant process inefficiencies, spoil valuable resources, and lead to poorer decision making and lost future.

Moreover, most of the influential IQ research originated from information system research and the IQ research is divided into two research communities: databases and management [17,34]. As well, Zhu et al. [62] also have proven IQ research mostly focused on developing techniques for querying multiple data sources and building large data warehouses. According to Ge [16], although researchers have applied IQ to various organizational context, none of the studies applied the IQ in the ISRM field.

It has been proven by author Ge [16] by summarizing representative publications for each application context in IQ theory within the period of 1996 until 2006. Researchers only have applied IQ theory on database, information manufacturing system, accounting, marketing, data warehouse, decision making in the database, healthcare, enterprise resource planning, customer relationship management, finance, e-business, World Wide Web and supply chain management. Therefore there is a need for further research to identify and classify IQ dimensions in ISRM field.

Therefore, by examining what the basic IQ dimensions constitute quality in risk management will be good stepping stone to ensure the collected information using the ISRM's information collection structure [43,44] would encourage in making a plan that leads to a clear direction, and ultimately help to make decisions that lead to success.

2.1. Overview on IQ

Organizations and researchers striving towards to achieve the objective of IQ which is to determine the characteristics of information items that are important, or suitable for information consumers [10,59]. Based on the Juran (1992) as cited in [59], the definition of IQ has been defined as "fitness for use" and this definition is widely adopted in the quality literature [7,10,17,22,32,33,47,53–55,60,62]. Since Wang and Strong [59] define IQ as the information that is fitness for use by information consumers, only information consumer are ultimately responsible for judging whether or not the gathered information is successfully serving the purposes of customers for intended use.

According to Shankaranarayanan and Cai [47], quality of data is dependent on the purpose of the task. Therefore, in order to assess the status of organization's information, organizations need to develop comprehensive measures of the quality of their information and to benchmark their effort against that of other organizations [29].

There is an agreement amongst researchers and practitioners that IQ is a multi-dimensional concept in which each dimension represent a single aspect or construct of information items and is described by a set of features [4,10,40,58,59]. As users have different perceptions of IQ, they have to propose a flexible model that enable them to create and weight their own IQ dimensions and features [10].

However, most of these frameworks are ad hoc, intuitive, and incomplete and may not produce robust and systematic measurement models [39,54,58]. There seems to be a lack of methodologies that are general enough to be applied to most data quality situations, regardless of the type of organization [5,57]. Generally, IQ framework consists with varying attributed characteristics depending on an author's philosophical viewpoint [27]. A literature review shows that there is no general agreement on IQ dimensions [5]. Since there is no agreement on the set of the dimensions characterizing IQ, many proposals have been made, but no one has emerged as a standard [31].

Although, each new research carried out on the IQ field is forming a new framework, researchers used to bank on previous researchers' classifications as a reference for developing their new