E-innovation: Information Quality Perspective

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Abstract
The paper employs a case study methodology and uses performance-importance analysis to determine the information quality dimensions that affect the e-innovation process. The selected case is a high technology organisation dealing with the design and manufacturing electronic equipments and tools used for medical test. The equipments designed by the organisation comprise components designed by other three high-tech organisations. Results indicate that timeliness interpretability, coherency and compatibility are the most critical (decisive) IQ dimensions affecting the e-innovation process.

Key Words
E-innovation, Information Quality, Performance-Importance Analysis

INTRODUCTION

Innovation focuses on creativity [1], novelty and newness [2]. It is the profitable exploitation of ideas [3] and a means to seize opportunity [4]. Damanpour [5] defines innovation as ``the generation, development, and adaptation of novel ideas on the part of the firm''. Nohria and Gulati [6] define innovation rather broadly to include any policy, structure, method or process, or any product or market opportunity that the manager of an innovating unit perceives to be new.

The current era is associated with widespread and successive waves of technology-driven innovations in information and communication technology (ICT). Technologies such as the Internet, electronic commerce, World Wide Web (www) and mobile commerce bring with them ubiquitous connectivity, real-time access and overwhelming volumes of data and information. Information is shared amongst various decision makers within organisations and between supply chain partners not only to benchmark, amend or formulate competitive strategies but also to control day-to-day operations and to solve problems on a real-time basis [7]. E-innovation is basically comprises innovation that enhance and improve the connectivity and other services of ICT.

E-innovation allows business to collect and analyse "enormous volumes of information and manipulate it in different ways to bring out otherwise unforseen areas of knowledge" [8]. Vast databases holding terabytes of data and information are becoming commonplace. In 1999, Bill Gates, the founder of Microsoft, states [9]:

> "*The most meaningful way to differentiate your company from your competitors, the best way to put distance between you and the crowd, is to do an outstanding job with information. How you can gather, manage and use information will determine whether you win or lose*".

The above statement implies there are some issues that traditional information management systems have not addressed. One critical issue in particular is the quality of information an organisation should gather, manage and use. The literature emphasises that enterprises have far more data than they can possibly use. Yet, at the same time, they do not have the data they actually need [8], [10]. However, the stored data and information may be obsolete, ambiguus, inaccurate or incomplete. In other words, enterprises have achieved 'quantity' of data and information but not necessarily the 'quality' of either [11]. There is strong evidence to suggest that IQ has become a critical concern of organisations [12], [13], [14], [15]. Firms become so critically dependent on information that IQ problems must be identified and treated as urgently as possible.

Needless to say that poor quality of information considerably affects innovation creativity, novelty, newness and implementation, i.e., the quality of innovation process. Literature deals with the importance of information to innovation process [2], [16]. Virtually, nothing that research on the effect of information quality (IQ) on e-innovation. This research is an attempt to fill this gap.

DIMENSIONS OF INFORMATION QUALITY

Individuals have different ways of considering the quality of information as they have different wants and needs and, hence, different quality standards which lead to a user-based quality perspective [17]. This perspective is based on the Juran definition of quality which defines quality as 'fitness for intended use'. Thus, information and data can be regarded as being of high quality if they are fit for their intended use in operations, decision making and planning [18]. Other related IQ perspectives are 'conformance to specifications' and 'meeting and exceeding consumer expectations' [17]. While these perspectives capture the essence of IQ, they are very broad definitions and are difficult to use in the measurement of quality. There is a need to identify the dimensions that can be used to measure IQ.

IQ is a multidimensional. This means that organisations must use multiple measures to evaluate the quality of their information or data. Several researchers have attempted to identify the IQ dimensions. Wang et al. [19] list twenty-six IQ dimensions, which in turn are classified into either internal view (design operation) or external view (use and value). Each of these classifications

is divided into two subcategories; data-related and system-related [15]. Wang and Strong [20] conducted an empirical two-phase sorting study and provide the most comprehensive list of IQ attributes. Their list comprises 118 attributes. The 118 attributes are reduced to 20 dimensions, which in turn are grouped into four categories: accuracy, relevancy, representation and accessibility. Wang and Strong [20] re-examine their four initial categories and relabelled the first two categories and the four categories become: intrinsic, contextual, representation, and accessibility. It should be noted here that Wang and Strong using the term DQ (rather than IQ) to represent both DQ and IQ. Table 1 defines the common IQ dimensions.

Table 1 Definitions of the common IQ dimensions used in literature. Adapted from several research works

Dimension	Definition
Accessibility	The degree to which information is available, easy obtainable or quickly retrievable when needed. Accessibility depends on the customer's circumstances.
Accuracy	The degree to which information represents real world state.
Amount of Information	This dimension measures the appropriateness of volume of information to the user or task at hand
Believability	This dimension measures the user assessment of trueness and credibility of information.
Coherency	This measures how information "hangs together" and provide one meaning to different users.
Compatibility	The level to which information can be combined with other information to form certain knowledge.
Completeness	The degree to which information is sufficient enough to depict every state of the task at hand or the represented system, that is, assesses the degree of missing information.
Conciseness of representation	The compactness of information representation.
Consistency of representation	The degree of similarity and compatibility of information representation format.
Ease of manipulation	The applicability of information to different tasks.
Ease of understanding	The degree of comprehension of information
Free-of-error	The degree to which information is correct. This dimension measures the number, percent or ratio of incorrect or unreliable information.
Interpretability	The appropriateness and clarity of information language and symbols to the user.
Objectivity	This dimension measures the information impartiality including information is unbiased and unprejudiced.
Relevancy	Relevancy indicates weather information addresses the customer's needs. It reflects the level of appropriateness of information to the task under consideration.
Reputation	The degree of respect and admiration of both information source and information content.
Security	It indicates the level of either restriction on access of information or appropriateness of information back-up - protecting information from disasters.

CASE STUDY

The selected case is a high technology organisation dealing with the design and manufacturing electronic equipments and tools used for medical test. The unit under consideration is the design section. This section comprises thirteen designers beside the head of the section. The equipments designed by this section comprise components designed by other three high-tech organisations. The quality of information flow within and between the design sections of the four organisations is vital to ensure the quality of decisions regarding designs (innovations), that is, innovation process. The case aims to determine the decisive dimensions of information quality that are critically affecting innovation process. It is clearly explained to the interviewees that they need to deal only with the innovation process and keep away from any other issues.

Semi-structured interviews were conducted with the employees of the design sections. The interviews are based on a questionnaire which aims to rate the expectation of the interviewee in relation to dimensions of IQ affecting innovation process and the perceptions of the interviewee about the performance of the dimension. Each question has two fields named as importance and performance. For the first field, the interviewee is asked to rate the expectation about critically or importance of the dimension on innovation process. The second field considers the interviewee's perception of the performance of the dimension. If a dimension is not applicable to the innovation process, the interviewee's is asked to tick N/A. In this research a 7-point Likert scale is chosen. A gap between the importance and performance of each dimension is calculated. An IQ dimension is critical when the expectation is that the dimension is very important. However, when a dimension is critical and performed very well, that is, the importance-performance gap is insignificant, the dimension is not decisive. A dimension is decisive only if it is satisfied the following two conditions:

1. It has a strong importance rate, that is, it is critical.
2. It has a significant performance-importance gap.

FINDINGS

The interviews and questionnaire results reveal the following (Table 2):

- A wide range of dimensions are considered critical dimensions with rating equal or higher than six (out of 7). These dimensions are accessibility, accuracy, believability, coherency, compatibility, completeness, interpretability, objectivity, relevancy, and timeliness. Among these dimensions, timeliness and accessibility are considered as the most critical dimensions.
- Despite the criticality of many IQ dimensions, the interviewees agree that there are no objective viable scales or metrics that measures these dimensions.
- The interviewees expressed that the existing information systems in their organisation provides to them a high performance of accessibility between the employees of their organisation as well as with other organisation. However, the interviewees raised a

concern that the available information may not up-to-date information. This concern considerably affects the innovation process.

- Though the dimensions accuracy and relevancy are critical dimensions but the interviewees believe that the information provided is accurate and relevant enough to progress the innovation. However, the interviewees raised the issues of interpretability and coherence. In many cases, the interviewees have faced problem in interpreting information created by others. In other cases, information may provide more than one meaning where they "hangs together". In limited cases, interviewees found difficulties to combine information to form certain knowledge.
- There are several recorded instances of designers asking for information which he/she believed existed but no information actually existed. Such an event considerably affects the progress of innovation process. This makes the performance of completeness is relatively low.
- Designers make decisions based on their assessment of trueness and credibility of information. Accordingly, the dimensions believability is a critical dimension but not a decisive dimension.
- Similar to believability, objectivity is a critical dimension affecting the innovation process but not a decisive dimension. A supporting argument was that having doubts about source of information, information impartiality, or on the trueness of information may unnecessarily disturb the innovation process.

Table 2 Gap analysis for IQ dimensions.

Dimension	I*	P*	Gap
Accessibility	6.63	6.49	0.14
Accuracy	6.53	6.42	0.11
Amount of information	5.65	5.60	0.05
Believability	6.08	5.98	0.10
Coherency	6.20	5.29	0.91
Compatibility	6.08	5.60	0.48
Completeness	6.43	5.88	0.55
Conciseness of representation	5.50	5.42	0.08
Consistency of representation	5.69	6.23	-0.54
Free-of-error	5.72	5.43	0.29
Interpretability	6.34	5.19	1.15
Objectivity	6.23	6.09	0.14
Relevancy	6,10	6.02	0.08
Security	4.81	6.61	-1.80
Timeliness	6.68	5.83	1.15

* 'I 'refers to "Importance" and 'P' refers to "Performance"

Results (Table 2) indicate that timeliness and accessibility are extremely critical dimensions (with rating > 6.60). However, only timeliness is a decisive dimension (gap = 1.15) affecting the innovation process. Other critical IQ dimensions (rating more than 6.00) are accuracy, believability, coherency, completeness, interpretability, objectivity, and relevancy. Among these dimensions, only three dimensions are decisive dimensions (gap more than 0.5); interpretability (gap = 1.15), coherency (gap = 0.91), and completeness (gap = 0.55). Other dimensions are considered less relevant to the innovation process. The dimensions amount of information, conciseness of representation, consistency of representation, free-of-errors and security are less relevant to innovation process. However, the existing information systems are very secure with performance equal to 6.61 and provide consistence representation.

CONCLUSION

This research discusses the importance of information quality to the success of innovation process. It explains the dimensions of information quality and aims to determine the decisive dimensions that affect the innovation process. The research argues that when a dimension is critical and performed very well, that is, the importance-performance gap is insignificant, the dimension is not decisive. A dimension is decisive only if it is satisfied the following two conditions:

- It has a strong importance rate, that is, it is critical.
- It has a significant performance-importance gap.

With the aid of a case study, the research finds that timeliness, interpretability, coherency and compatibility are the most decisive IQ dimensions affecting the e-innovation process.

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