Critical Cultural Success Factors for Achieving High Quality Information in an Organization

Full Paper

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Abstract

While information and data quality practitioners are in general agreement that social, cultural, and organizational factors are the most important in determining the success or failure of an organization's data quality programs, there is little to no existing research quantifying these factors. In this research we build from both our previous research and others' to distill and clarify those cultural factors which are the Critical Cultural Success Factors (CCSFs) for successful Information and Data Quality programs in an organization. Using the Delphi method for gaining consensus from a group of experts, we distilled fourteen factors down to six and clarified the definitions of those six factors. We begin explaining how these CCSFs fit into Organizational Learning Theory and plan to ultimately define a new system dynamics model incorporating them so that organizations and information quality practitioners can positively affect the success of information and data quality programs.

Keywords:

Information Quality; Data Quality; Critical Success Factors; Critical Cultural Success Factors; Delphi method;

Introduction

Information Quality (IQ) principles have their roots in the quality management movement which was born in the 1930s. Walter Shewhart was working for Western Electric where his work in process variability led to his 1931 book critiquing the inspection-based approach to quality and began the modern era of quality management in manufacturing. Quality Management really took off after World War II when Edwards Deming worked with the Japanese to rebuild their industries and earn a reputation for high-quality products. In the early 1990s, American manufacturers, especially in the automobile industry, turned to Deming for help in resuscitating their industries (Smith 2011). A perusal of the references returned in a Google Scholar search for "data quality" shows early articles in the 1970s ("data quality" 2016); however, significant early concentrations are closer to the 1990s and early 2000s as industry began to improve the manufacturing process using quality management techniques.

In a 1992 book, Thomas Redman references the "quality revolution" in industry and highlights a need for similar attention to information quality (Redman 1992). He states three reasons why focus should be put on data:

1. Much data is of poor quality.
2. A business advantage can result from improved data quality.
3. Frequently, no one has responsibility for data quality.

He continues to make a case that existing quality methods must be evaluated and extended to be useful for information quality.

Since that time, much research has been done in the area of information quality; there are multiple annual conferences devoted to the subject ("DGIQ" 2017, "IAIDQ" 2017, "ICIQ" 2017); and there is an academic program with a Master of Science and PhD in Information Quality ("UALR" 2017).

Juran's original concept of quality as "fitness of use" (1998) continues to be a common definition applied to information quality (Otto 2013; Redman 2008; Wang and Strong 1996). Many have written on the need for quality information in an organization. Thomas Redman talks about data as a business asset, the hidden costs of poor data and the strategic advantages of good quality proprietary data (Redman 2008). Danette McGilvray speaks about the value of information and states "Every day human beings use information to make decisions, complete transactions, and carry out all the other activities that make a business run." (2008, p. 4) Huang, Lee and Wang discuss the implications of the Information Age and "A firm's basis for competition … has changed from tangible products to intangible information. … Quality information is increasingly recognized as the most valuable asset of the firm." (1999, p. 2)

With the explosion of data in more recent years and the use of the data frequently different than originally intended, it is more critical to ensure that data is fit for the eventual use. Ten years ago, Thomas Redman discussed this explosion in the increasing quantities of data due to global positioning systems, the human genome and radio frequency identification (2008). More currently we have data from wireless sensor networks, social media, the Internet of Things, and massive online consumer sales and the potential consequences of poor quality data can be significant. (Rao et al. 2015)

Many companies have "made and sustained order-of-magnitude improvements." (Redman 2013, p. 16) And while there may be many different reasons for both these successes and the related failures, most practitioners agree that it is rarely based on technological reasons but rather on a wide variety of social, political, and organizational issues (Williams et al. 2013). There are many of these issues and they likely interact with each other. There is no body of theory or practice to help those trying to lead information quality programs and their organizations to systematically understand these cultural issues, sort through their options, and craft a plan to address them.

Thomas Redman has said "Veterans also know that it is not the hard, technical issues that stymie an organization's efforts to better manage and utilize its data and information assets, but rather the soft organizational, political, and social issues" (2008, pp. 159–160). Doan et al. cite a similar issue with data integration, that many projects fail simply because the data owners do not want to cooperate (Doan et al. 2012). Most current IQ methodologies and frameworks now acknowledge and incorporate this reality, for example, the McGilvray Framework for IQ suggests that in addition to the what (i.e., data) and how (i.e., processes and technology) context, the who (people and organizations) must also be considered in order to effectively address IQ problems (McGilvray 2008). The impact of cultural issues on the success of IQ programs is now well recognized. For example, knowledge and skills in project and change management are seen as essential elements of IQ practice. New organizational positions, such as the Chief Data Officer, are evolving as data and data governance issues capture corporate attention (Lee et al. 2014). However, the research on social and political IQ issues has primarily been qualitative, based on what worked/did not work in a given organization or two. Just as defining data quality dimensions and formulating metrics to quantify the impact of poor data quality was a focus of early IQ research, a new round of research is needed to quantify and predict the true impact of social and political issues.

In 2013, we published a literature review of organizational models and archetypes to kick off our research into the cultural factors that affect the success of Information Quality programs to determine what existed that may prove useful (Williams et al. 2013). The work of Peter Senge and his associates provided the theory of Organizational Learning (1999). This is predicated with the premise that organizations are the products of the ways that people in them think and interact. And to positively change organizations, these people must be given the opportunity to change the ways they think and interact. Organizational learning calls for giving people the training and tools for discovering and studying these ways and hypothesizes how this affects the behavior and performance of the systems of which they are a part. With organizational learning, people will develop an enduring capability for change.

One of the key disciplines for discovering and studying the ways that people think and interact is taking a systems perspective, using systems thinking. Senge uses archetypes he calls "Growth Processes of

Profound Change" and "Limits to Growth" to illustrate how patterns of growth and limits come together in various combinations. (Senge et al. 1999)

There was work done by Claude Rapaille and Marilyn Zuckerman, in the 1980s, on an American archetype of quality (Zuckerman and Hatala 1992). While this work was done in the arena of manufacturing, it seems reasonable that cultural mindsets of quality should follow into information quality.

Our research is centered around the goal of creating a model, based on these archetypes and the theory of Organizational Learning, which will allow us to explain the impact of cultural issues on data and information quality. However, to do this we needed to have a better understanding of what the precise issues might be.

An article by Hongjiang Xu (2013) presents a research model for data quality in Information Systems using Critical Success Factors (CSFs). The 25 factors included in this research model had been derived from earlier research by Xu and are presented as specific to data quality in accounting information systems. We have chosen to use these 25 factors as the basis for our work in determining the CCSFs impacting most, if not all, Information and Data Quality programs. From these 25, we have extracted 14 factors as those based in the culture of an organization. In doing this, we eliminated Xu's factors that were technical in nature and those that were specific to accounting information systems.

These factors were first utilized for our work in which we surveyed graduates on the industry projects done as a requirement in a master's program in information quality (Williams et al. 2015). This work supported the empirical evidence that cultural issues clearly affect the success of information and data quality programs. The effect of these cultural issues is found in all industries that were surveyed.

Not long after this, Senge et al. introduced a model called organizational learning based on the idea that organizations are the products of the ways that the people in them think and interact (1999). They incorporate a number of positive and negative growth processes for change into reinforcing loops models of how change occurs.

Critical success factors have their origins in the "success factors" of Daniel (1961, p. 116). They were highlighted by Anthony, Dearden and Vancil in 1972 as "… key variables, … key success factors…" (1972, p. 138) as significant to profitability in an organization.

Rockart proposed critical success factors as a method for defining managerial information needs (Rockart 1979). He defines critical success factors as "the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization." (1979, p. 85) We believe that this definition can encompass quality data as a valuable asset that will also ensure successful competitive performance.

Critical success factors for total quality management were proposed by Porter and Parker after they considered multiple articles and case studies from the "quality gurus" (1993, p. 13). The factors identified included management behaviors, training, education, and employee involvement, very similar to some of the factors we propose to study.

Holland and Light suggest that using a critical success factors model can greatly enhance the volatile implementation of an Enterprise Resource Planning (ERP) system (1999). Their CSFs are grouped into Strategic and Tactical factors suggesting that having Critical Cultural Success Factors could be appropriate as another group.

Critical success factors for project management can be considered tied to the quality management of the project and thus help assure success of projects (Belassi and Tukel 1996). It stands to reason that critical success factors for quality would also help assure success of projects.

Data Collection and Findings

Bernice Brown provides a description of a research design variously called a Delphi-process, -technique, method as one that elicits the opinion of subject-matter experts working together to provide a single group response or result (1968). The process had been used as a way to research and provide results in the inexact sciences as early as 1959 (Helmer and Rescher 1959).

We chose to use this technique to finalize a list of CCSFs for the success of an Information Quality Project/Program.

Helmer and Rescher also report on the anonymity of this technique reducing the influence of factors such as the "bandwagon effect of majority opinion" and the "unwillingness to abandon publicly expressed opinions" (1959, p. 47).

We solicited a panel of 23 industry experts using personal contacts and flyers at well-attended academic and industry conferences. Of these 23 panel members, 57% (13) have earned the Information Quality Certified Professional certification from the International Association of Information and Data Quality (IAIDQ). IAIDQ reports that there are currently 46 professionals with this certification ("Register of Certified Professionals" 2017). The IQCP has been available for approximately six years.

The panel members averaged 19+ years in the field of Information and Data Quality. Seventeen (17) members were from the United States with the remaining six (6) from Australia, Great Britain, Russia and the Netherlands. Forty-one percent (41%) stated they worked in a business area (non-Information Technology) in industry. Twenty-three percent (23%) work in Information Technology and 32% identified as consultants. One member (4%) worked in academia.

The first round of the study presented panel members with definitions for Information Quality and other terms used in the questionnaire as follows:

- Information Quality - for this study, means accurate, timely, complete, and consistent data.
- Users - all users of the information in the area of the project or program. Could be internal and/or external to the organization.
- Top Management - executive or senior management, includes the highest management positions in the organization.
- Middle Management - is responsible for implementing the strategic decisions of top management. Middle managers make tactical/short-range decisions.
- Non-management employees - includes production, clerical and staff personnel.

They were also given a list of 14 Critical Success Factors derived from the list of 25 CSFs from work by Hongjiang Xu as discussed earlier(2013) and asked if they agreed with the definition or would like to make changes to it.

This round of the study also asked if there were other factors not covered and to enter them along with a short definition.

Participants were also asked to rank the 14 factors in order of importance. From the responses received on round one of this study, it was clear there were a variety of opinions on the provided definitions and on additional factors. The authors decided that it was premature to ask for these factors to be ranked and this portion of the questionnaire was not evaluated.

After all responses to this round were received, the information provided was aggregated into a single document and the authors worked to change the existing definitions to include all of the changes and comments that had been received. Aggregation was done by creating a new document which included the original factors and definitions and also the comments and suggestions from participants. The authors worked together to incorporate all comments and suggestions into the existing definitions.

Participants then received an email with a link to round two of the study. Round two contained the new definition for each factor incorporating the comments and suggestions from round one. It also contained the following definition for Organizational Culture:

> *The pattern of behavior encompassing the shared vision, values, norms, systems, symbols, language, assumptions, beliefs, commitments, and habits that shape the overall environment of the organization. This pattern of behavior impacts the organizational strategies, policies and overall approach to problem solving with or without regard to Information Quality.*

For each of these factors, participants were asked if they would like to see changes to the definition and if so, to include those changes. For each factor, they were also asked if they thought this factor should be ranked as a Critical Cultural Success Factor.

In addition to these factors, round two also included 11 potential CCSFs as suggested by participants in round one.

For each of these proposed CCSFs, participants were asked if they thought this should be a new CCSF or if they thought it was included in another CCSF. They were also asked if they thought this should be a ranked CCSF and if there should be any changes to the definitions.

There are several places in the literature where it is suggested that Critical Success Factors should be from three to six factors or variables that determine either success or failure (Anthony 1972; Daniel 1961; Dickinson et al. 1984; Leidecker and Bruno 1984). As it should happen, when the input from this round was received and aggregated and comments and suggestions were incorporated (in the same manner as in round one), a list of six CCSFs emerged.

These six CCSFs are:

- Executive Commitment to Information Quality
    - Active, continual and visible engagement by Executive/Senior management in gaining maximum value from information assets that goes beyond commitment. Leadership for information quality involves articulating direction for the Information Quality program, building a critical mass of organizational support, getting the right people in place, and doing whatever is necessary to advance the IQ agenda. This involves:
        - Understanding and personal conviction for the value of information and why IQ is important to the organization;
        - Ensuring a clear and shared vision and the development of a long-range strategic plan for IQ which is aligned to the core organizational strategies, goals, opportunities and priority programs;
        - Authorizing necessary funding and resources for organizational IQ initiatives; • Creating incentives and/or restructuring to maximize positive and minimize negative influences which will enable good IQ practices.
- Management Commitment to Information Quality
    - Management is accountable for gaining maximum value from information assets by ensuring that organizational operations and decision making necessary to implement the organization's IQ strategic plan are implemented and ensuring that information products meet expected standards for quality. They ensure that all employees understand and believe in the IQ-related roles, responsibilities, and practices for their respective organizations, remove roadblocks as needed, empower their people, and actively deliver against these commitments.
- Education, Training and Communication
    - Maximize the value of information assets by providing information stakeholders with the knowledge and skills they need to improve information quality through continuous and long-term education, task-specific training and clear depiction of organizational IQ initiatives relevant to key business performance objectives. All stakeholders should come to understand:
        - The manner in which information is a valuable asset to the organization;
        - The growing role that information plays in the sector, the industry, and the world;
        - A sense of urgency for getting information right and using it well; and
        - A commitment for encouraging the capacity for change.
- Appropriate Organizational Structure
    - An appropriate organizational model that establishes roles, responsibilities, duties, accountabilities, decision rights, rules of engagement, and communications related to IQ. The model includes:
        - The necessary roles at all levels: executive, senior, managerial, tactical, and operational; and
        - Cross-functional teams with a specific focus on IQ in addition to IQ-related roles that are part of existing operational teams.
    - The organizational model clearly defines for each information asset the persons responsible, accountable, consulted, and informed in the management of that

information asset. The model should also clearly communicate a vision for information quality that encourages a capacity for change by minimizing fear and maximizing business value.

- Focus on the value of information to the organization and the motivation for IQ
    - Understanding how IQ supports business needs (strategies, goals, issues, opportunities), and provides motivation for IQ to an organization. This motivation can be internal (e.g. improved operations) or external (e.g. better meeting consumer needs' and their information quality requirements). Focus on information value can:
        - Be internal (e.g. improved operations) or external (e.g. consumer needs' and their information quality requirements);
        - Provide a sufficient sense of urgency, priority, and perceived value to incentivize an organization, and its teams and individuals to take action related to information quality.
- Continuous Improvement
    - An organizational awareness of the need to analyze and correct the performance of data lifecycle processes in all stages: planning, development, operations and sustainment. Continuous improvement is evidenced by the existence of a robust change management process and also by the inclusion of change management or improvement in the operation budgets.

Participants were also asked to rank these six CCSFs in order of importance. There was also an option for participants to add any comments or other suggestions.

There were no comments received from this round that necessitated a further round of the study. The final ranking of the six CCSFs was:

1. Executive Commitment to Information Quality
2. Management Commitment to Information Quality
3. Education, Training, and Communication
4. Appropriate Organizational Structure
5. Focus on the value of information to the organization and the motivation for IQ
6. Continuous Improvement

Conclusions and Future Work

At the conclusion of this study, we had narrowed down our proposed CCSFs from fourteen to six. We also had agreed upon definitions for not only the CCSFs but also for Organizational Culture.

With these six CCSFs, we began the process of incorporating them into Senge's Organizational Learning balancing loops. As mentioned earlier, Senge uses reinforcing balancing loops to demonstrate how change and growth can occur in an organization. There are both positive and negative loops that can affect the process (Senge et al. 1999). Our initial system dynamics model is shown in figure 1. Our new CCSFs are shown in red while the original Senge loop variables are shown in black. This model shows only the positive loops. The central loop "R1" shows how the CCSF variable of Education, Training and Communications can increase Senge's original variable of Learning Capabilities which then increases the original variable of Personal Results. With this comes an increase in the original variable of Enthusiasm & Willingness to Commit and in turn a positive change in the original variable of Investment in Change Initiatives. Enthusiasm & Willingness to Commit is also affected by both the CCSF variable of Executive and Management Commitment to Information Quality and is also part of the second growth loop "R2" which is Networks of Committed People. As the Investment in Change Initiatives grows, the number of people involved will grow which increases the network and helps with diffusing the initiatives. The third growth loop "R3" is added when the increase in Learning Capabilities increases New Business Practices which are also affected by the remaining CCSFs – Appropriate Organizational Structure, Continuous Improvement and a Focus on the value of information to the organization and the motivation for IQ. The New Business Practices will have a positive impact on Business Results which will then increase Credibility and Enthusiasm & Willingness to Commit.

It is important to note, that at this time, only the positive causal loops for growth are included in Figure 1. There are also limits and challenges to growth which can be shown as causal loops as well.

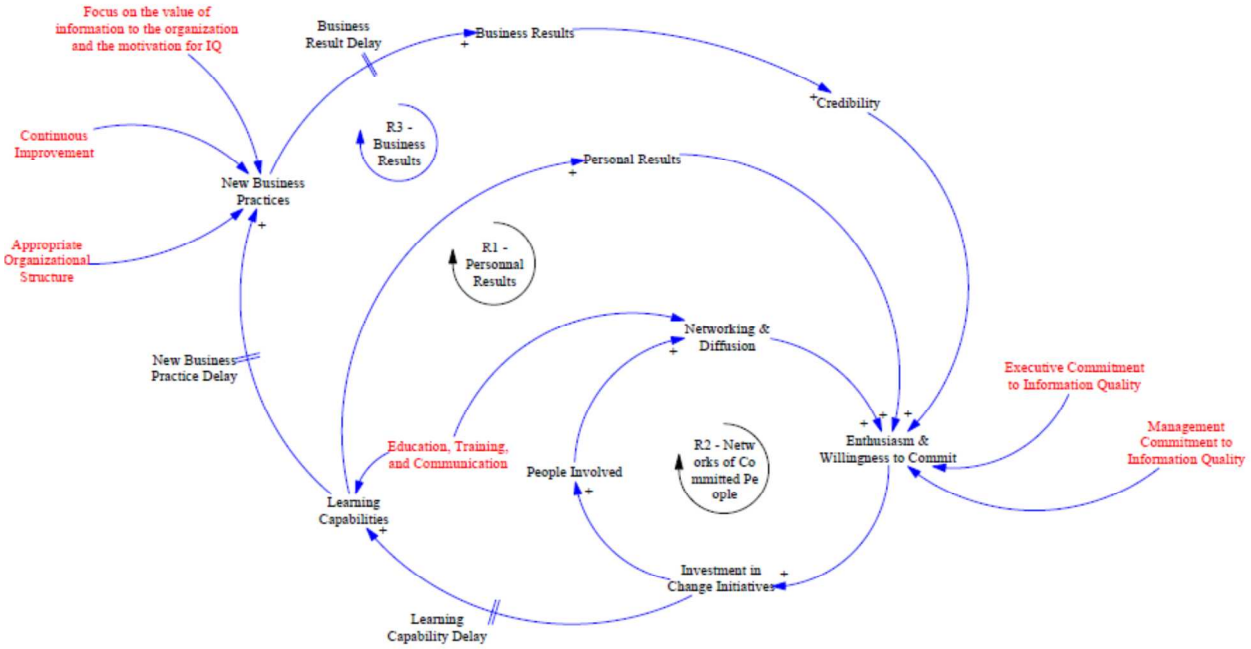

Figure 1. Initial Growth Model Featuring CCSFs

In the final round of the study, one of the participants stated "I really like how the factors have been refined and the definitions clarified. This is now a very useful and concise framework!"

We also had expert opinion as to how these six (6) factors should be ranked; although most of the experts also agreed that the importance of individual CCSFs varied between one situation and another. One participant stated "All of these are of similar importance."

We are excited with the results from this phase of our research and look forward to expanding upon it. We are currently discussing developing an Assessment Tool that can be used to gauge the level of the CCSFs in an organization and using it in a Pilot Study. While there are multiple frameworks for describing/assessing/managing data quality in an organization, we would like to develop a framework for doing the same with these CCSFs in an organization.

Our next steps will include enhancing the model with negative feedback loops and the cultural limits to the growth of quality in an organization's information.

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