

Examining the Influence of Relationship Quality on Data Warehouse Success

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Abstract—Increased organizational dependence on data warehouse (DW) systems drives management attention towards improving DW systems success. However, the successful implementation rate of DW systems is low and many firms did not achieve intended goals. A recent studies show that improves and evaluates DW success is one of the top concerns facing IT/DW executives. Existing information system (IS) research has studied DW success more from information quality and system quality. Researchers argue in this study that we should also take the relationship quality, which has significant research and practical implications in that it connects to IS success directly. As our first attempt, this study, referring to both IS and marketing literature, examines how communication, coordination, cooperation, commitment, and trust can be achieved to some degrees by high quality relationships between DW parties. The results of data analysis support that the contribution of DW success can improve by establishing a good relationship between DW parties.

Index Terms—Data warehouse, relationship quality, information system, business intelligent, decisions making, decisions support system.

I. INTRODUCTION

Today many organizations possess Information Technology (IT) infrastructures that provide limited data management, integration, and access. These organizations would be better served by IT infrastructures that offer appropriate data and tools to support decision makers. DW appeared in the early 90s as a decision support technology that could integrate data from multiple sources, and that had a subject orientation in the way data was organized and presented. Inmon [1] defined DW systems as “a subject-oriented, integrated, time-variant, non volatile collection of data in support of management decisions”.

Literature is rich with evidence that DW provides a unique opportunity to improve the IT infrastructure [2]. DW addresses data management, integration, and access issues by creating a repository of quality data that can be manipulated to meet changing business data along common business subjects or dimensions and let users navigate through attribute hierarchies. Users can drill down, across, or up level in each dimension [3].

DW is probably the most rapidly growing system area today. Thousands of companies have implemented or are in the process of implementing DW system. One study reported an average cost of \$2.2 million for a typical DW [4], while another study found that DW tools market repeated its 2004 performance in 2005 with an 11.3% growth rate to reach \$9.6

billion in revenue [5]. A more recent study placed the enterprise DW market will experience double-digit growth through 2008 [6]. Another study expected that DW market size is likely to approach \$7 billion in 2008 [7]. Organizations of any size should begin to assess their current level of investment in the analytic infrastructure [6].

However, DW systems are very expensive and highly risky, and once DW systems are implemented, management should evaluate whether it is successful. In fact, the use of DW has not always led to significant organizational improvements. In many cases, the estimation of DW systems success is very limited in meeting user’s expectations [2, 8-11]. Moreover, there have many reports on DW failure rates. The reported percentages vary based on the reporting agency but average between 20%-50% failure rates [12-14].

Furthermore, building DW is a complex process as designing DW requires techniques completely different from those adopted for operational information. In addition, DW systems integrate requirements, data and priorities of the organization and its multiple business units. Moreover, building DW requires an integration of many tasks, components, and coordination of efforts of many people [15]. The relationship between business objectives and technology has surfaced in DW implementation. Therefore, the existences of better quality of relationship between DW parties are absolutely necessary for achieving the business goals and reach success [16].

Based upon the above research background and motivation, researchers revise the traditional definition of relationship quality by including affective trust, commitment, communication, cooperation, and coordination as a components of measuring relationship quality in DW success area. The present study also develops a conceptual framework relating the relationship quality and DW success, specifically examining whether relationship quality have a significant positive association with DW success.

II. LITERATURE REVIEW

A. DW Success

The impacts resulting from DW systems are arguably difficult to measure and to determine success metrics [17-19]. DW system entails many users ranging from top executives to end users; many applications including data integration (i.e. ETL), data analysis (i.e. Cube), business intelligent, and data mining applications that span the organization; and a diversity of capabilities and functionalities. According to [2], “The success of data warehouses depends on the interaction of technology and social context”. Furthermore, Hwang and Xu [17] indicate that DW success is an important issue for both practice and research. Relatively few studies have been

conducted to assess DW practices in general and critical success factors in particular. Wixom and Watson [14] point out that DW have unique characteristics that may shift the importance of factors that apply to it. Moreover, Thomann and Wells [20] describe three types of success aspects as they related to DW as follows:

- 1) Economic success: is the ability of DW to provide information to those who need it, in order to have a positive impact on the business.
- 2) Political success: is the ability of the organization to provide awareness, access tools, knowledge, and skills for their users to use the functions offered by the DW system.
- 3) Technical success: is the ability of chosen appropriate technologies for DW tasks and applied it correctly.

On the other hand, many authors state that the success of DW can be achieved by obtaining the net benefits of it [14, 17, 21]. According to [22], DW benefits can include: better decision making, improved business processes, improved customer satisfaction, rapid response to organizational events, improved morale, and rapid response to market and technology trends. DW also offer benefits such as: cost savings from the consolidation of heterogeneous decision support platforms, improvements in the quality of data used to support decision-making, and productivity improvements resulting from redesigned of business processes [23]. In addition, DW provides the foundation for effective business intelligence solutions for companies seeking competitive advantage [2]. Furthermore, McFadden [24] argues that the benefits of DW involve the ability to improve data quality and leverage legacy systems. Other authors [19] conclude that the greatest benefits from DW occurs when use it to improve business processes, support decisions, support strategic business objectives, provide better information, and time saving for users. Kelly [25] also identifies six benefits of DW, they are: (1) improved customer service, (2) reduced risk, (3) increased opportunity between the organization and the customer, (4) improved IT system maturity, (5) reduced cost, and (6) improved strategic decision making. In addition, the findings from the survey study conducted by Garner [26] shows that the most benefits derived from implementing DW are: more facts for better decision making, broader information access and data discovery, corporate security and governance, better assessment of corporate performance, more complete view of the business, more complete view of each customer, accurate regulatory reporting, and supply chain optimization.

Frolick and Lindsey [27] consider several reasons caused failure across many of the organizations that implement DW. Some of the reasons are: weak sponsorship and management support, poor choice of technology, wrong or poorly analyzed project scope, data quality problems, problems with end-user access tools, insufficient funding, inadequate user involvement, unclear organizational politics, and turnover of organizational personnel

B. Relationship Quality

Lee and Kim [28] define the relationship quality as the overall evaluation of the effectiveness of a relationship indicate by the extent to which the parties in the relationship

meet mutual needs and expectations through mutual commitment, cooperation, and coordination. In addition, Sun et al. [29] acknowledge that the relationship quality is a key factor that connects IS factors and business profitability factors (such as commitment and trust).

The concept of relationship quality arises from theory and research in the field of relationship marketing [30, 31] in which the ultimate goal is to strengthen already strong relationships and to convert indifferent customers into loyal ones [32]. Palmatier et al. [33] stress the fact that relationship quality conceptualizes as a composite or multidimensional construct capturing the different but related facets of a relationship.

Although, previous researches [29, 34-39] discuss the concept of relationship quality in various research contexts, the definition of relationship quality differs from research project to research project. These authors also agree that the concept of relationship quality is a higher-order construct consisting of several distinct but related components or dimensions. An investigation of the extant literature indicates trust, commitment, communication, cultural, and user participation all positively impact the quality of the relationship [29, 38-45]. Organizations realize that the intangible aspects of a relationship may not be easily duplicated by the competition, and therefore may provide a unique competitive advantage [46]. Increasingly, companies are recognizing the value of establishing close relationships with customers as a means of increasing retention.

TABLE I: RELATIONSHIP QUALITY DIMENSIONS [28]

Dimensions	Definitions
Commitment	Degree of the pledge of relationship continuity between parties.
Communication	Degree of share or exchange of meaningful and timely information between parties.
Trust	Degree of confidence and willingness between parties.
Cooperation	Degree of working together by parties on complementary activities with the objective of achieving mutual benefits.
Coordination	Degree of coordinating action directed at mutual objectives to maintain stability between parties in a dynamic environment.

Moreover, various factors and dimensions are used to study relationship quality within IS research. Chang and Ku [47] argue that relationship quality is the overall appraisal of the strength of a relationship and the extent to which it meets the expectations and needs of the parties on the basis of successful or unsuccessful encounters. They used three variables (trust, commitment, and satisfaction) to measure relationship quality for customer relationship management (CRM) performance. Sun et al. [29] acknowledge that the relationship quality is a key factor that connects IS factors and business profitability factors (such as commitment and retention). Carr [48] mentions that the quality of relationship is the glue that binds IS users to IS departments through the success and failure of IS project. Carr also states satisfaction, trust, and commitment as a measurement variables for relationship quality between the IS users and IS department. According to Chakrabarty et al. [39], high relationship quality implies high levels of commitment, trust, cultural

similarity, communication, and balanced interdependence between IS outsourcing parties. Lee and Kim [28] present five relationship quality components affecting IS outsourcing success: commitment, trust, conflict, benefit and risk share, and business understanding. Roberts et al. [46] state four variables to measure relationship quality, they are: trust, commitment, satisfaction and affective conflict. Table I shows the definitions of relationship quality dimensions.

III. DIMENSIONS OF RELATIONSHIP QUALITY

A. Commitment

An investigation of the relationship quality literature shows a common theme cataloging commitment as a key factor in successful relationships [42]. Commitment reflects the parties view in order to sustain the relationship over time [49], and describes as “an enduring desire to remain in a valued relationship” [50] (p. 211). According to recent studies about relationship quality, commitment considers to be a major contributor to a successful relationship [29, 47, 48]. In the context of DW, Porter and Rome [51] contend that “building DW is extremely complex and takes commitment from both the information technology department and the business analysts of the organization” (p. 43). The amount of data available in companies is often overwhelming, and collecting, maintaining and analyzing the data requires significant organizational commitment [52]. In addition, consider the more sophisticated tools for developing DW system need a long-term commitment to utilize this technology. There is often an erosion of strong corporate commitment to mandate the use of these tools throughout the entire organization, and once this occurs, it is very difficult to justify the costs versus benefits [53].

Furthermore, the commitment of top management support is very important to pass over sudden barriers and complexities in DW project, as highlights by [9, 14, 19, 54]. Bhansali [16] argue that high level of commitment of senior managers and DW managers is critical to successful alignment and adoption of DW. Obtaining commitment to DW initiative at the right level and at the right time is vital during the initial step of the project. The use of metadata encourages developers and end-users to cooperate in the planning and to encourage commitment to all of the stakeholders of DW [55].

B. Trust

Zaheer, McEvily, and Perrone [56] define trust as the expectation that parties fulfill its obligations, act predictably, and behave fairly even when the possibility for opportunism is present. Findings at previous researches indicate the importance of trust in the success of relationships [28, 44, 47, 48, 57, 58]. According to Carr [48], trust provide the glue holding together the relationship between IS users and the IS department. In addition, Voss [57] and Daffy [58] emphasize the importance of the trust in developing a sustainable relationship among an organization, its users, and its business needs. Morgan and Hunt [42], argue that trust is a confidence in an exchange partner's reliability and integrity. The construct of trust particularly associates with the

development of interest in relationship marketing in general [38] and particularly in the context of IS [44, 48]. The lack of the trust in the IS context identifies as one of the major obstacles in the adoption and success of IS technologies [59].

Similar results are reported in DW research. Perkins [60] states the fact DW that contains trusted strategic information becomes a valuable enterprise resource for the decision makers' at all organizational levels. If its users discover that it contains bad data, DW will ignore and will fail. In the implementation of DW, executive sponsorship is characterized by the ability to build trust and consensus between DW parties [54]. Data driven decision-making involves collaborating and an assortment of skills the organization. Data analysis is one of the most important benefits of using DW. The capability to transform data from transactional to customer focused data is immeasurable. Business users need to trust the results of DW when they produce their reports [26]. According to [61], trust is an important factor since users need to have trust in providers in terms of the service as well as the confidentiality of data. As noted earlier, the data in DW collects from transactional systems in different departments or firms.

C. Communication

Anderson and Narus [62] define the communication as the proactive formal and informal exchange or sharing of useful and timely information between firms. This definition focuses on the effectiveness of information exchange, rather than amount or quantity. According to Kanar and Oz [63], communication is the number of people in the IT organization who have communicate to on any given warehouse subject. These subjects may include architecture, strategy, techniques, standards and guidelines, methodology, and tools [63]. Moreover, communication is an important aspect in the development and success of DW. Bhansali [16] acknowledges that “communication of the strategic direction between the business and DW managers is important for the strategic alignment of the data warehouse”. In order to make sure that the business rules of DW are correct, there must be communication between all development groups that supply data to the warehouse [64]. Further, Shin [18] outlines that DW architecture is a specification of formal processing and communication of a data warehousing environment. As mentioned by Mukherjee and Souza [54], top management needs to keep communication strong between DW parties and to continue supporting the concerns of those who now have a stake in DW system. As states recently, better communication capability between DW team will cause a positive impact on the successful implementation of DW [65].

D. Cooperation

Cooperation is a concept similar to coordination, but is a higher-level abstraction that more closely captures the nature of a relationship quality. Coordination describes the management of interdependent activities: cooperation indicates the participants' agreement and acknowledgement of what those activities are [44]. Cooperation is defined as the complementary activities undertaking by organizations in an interdependent relationship with the goal of achieving mutual

benefits [62]. Generally, DW research has shown cooperation to have positive impacts on implementation success. Quaddus and Intrapairot [66] argue that cooperation between IT departments and users will increase the diffusion of DW technology. DW literature also suggests that cooperation between departments in an organization has a large effect on the smooth flow of the required information and expertise among departments, which strongly influences the successful adoption and implementation of DW technology [9, 67]. Ganczarski [55] stated that, the process of designing and implementing DW demands new levels of cooperation among various business units. Moreover, cross-functional team cooperation and coordination is especially important in DW projects [68].

E. Coordination

In previous studies, coordination is considered to be an important factor in relationship success [28, 41, 44]. Goles and Chin [44] define coordination as “the process of managing interdependencies between entities to accomplish agreed-upon tasks”. In the context of DW, coordination of organizational resources should affect the successful adoption of DW technology [9]. In addition to this, the coordination of organizational resources can reduce unnecessary obstacles during the implementation process of DW by investing requested labors and capitals in the project [22]. According to AbuAli and AbuAddose [65], coordination and proper allocation of resources can help DW project teams to meet their project milestones and overcome organizational barriers.

IV. RESEARCH MODEL AND HYPOTHESIS

Previous studies [9, 16, 48] show that there is a need to study new factor such as relationship quality that could help firms to assess the success of their DW systems. Basically, most of the previous empirical studies [14, 17] related to DW success are associated with IS success factors (such as: information quality, system quality, and service quality). It found that there is no intensive examination of the interrelationships among the relationship quality factor and DW success. The research model of this study has two constructs as shown in Fig. 1. The model posits relationship quality as independent variable and DW success as a dependent variable. Relationship quality factor was adapted from IS success studies conducted by [39, 44]. While DW success factor was adapted from models developed by [14, 17] and other DW literature.

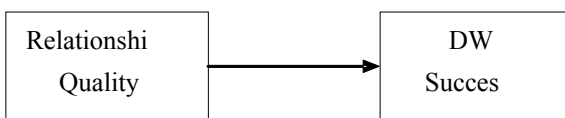


Fig 1. Research model

As mentioned earlier, the data in DW system is collected from transactional systems from different departments or firms. Therefore, the existences of better quality of relationship between these departments or firms are absolutely necessary for achieving the business goals and

reach success. In other words, managing the relationship of DW parties is critical for success of DW system in terms of commitment, trust, cooperation, coordination, and communication [9, 16, 22, 26, 55, 65]. Moreover, a good relationship between DW managers and business users could potentially reduce the time and effort which would lead to make decisions in a timely manner and with high accuracy [16]. Additionally, DW system is actually about tightly integrating different business functions, so the close cooperation, commitment, trust, and communication across disparate business functions would be a natural prerequisite in DW system success [9, 16, 26, 55].

Unfortunately, there is a scarcity of studies that examine the direct relationship between relationship quality and DW success. Chakrabarty et al. [39] indicates that relationship quality is significantly associated with user satisfaction in IS outsourcing success. In the context of e-commerce systems, Wu [45] considers relationship quality as an additional quality dimension to IS success model for DeLone and McLean through its impact on use and user satisfaction. Moreover, in a study of customer relationship management (CRM), Chang and Ku [47] contends that relationship quality is positively correlated with organizational performance. Generalizing the above discussion, this study suggests that relationship quality may have significant impacts on DW success. Thus, this study postulates the following hypothesis:

H1: Relationship quality is positively associated with DW success.

V. SAMPLE AND DATA COLLECTION

A field questionnaire-based survey was considered appropriate for data collection to ensure greater external validity and generalizability of the results. An initial version of the survey for measuring the study's constructs was developed based on IS and DW literature. Multiple indicator items were used to measure the constructs and, wherever available, scales used in prior empirical studies were adapted to suit the research context. The questionnaire was pre-tested with several experienced academics and DW specialists to increase the face validity of the research instrument. These people had knowledge in business, database, DW, and general information technology and similar backgrounds to the actual respondents. Respondents were asked to examine the wording of each scale item for clarity and meaning. The overall consensus of the respondent panel with respect to both the constructs and items suggested that the measurement scales had adequate face validity. The revised questionnaire was given to DW researchers for feedback and comments. Minor revisions to the phrasing of some statements emerged from these pilot-tests. These pre- and pilot-tests suggested a fair degree of initial content validity to the survey instrument.

A web-based questionnaire was developed to collect data from The Data Warehouse Institution (TDWI) members. TDWI is the premier provider of in-depth, high-quality education and research in the business intelligence (BI) and DW industry. In addition, TDWI had over 27,000 members around the world working in a variety of industries and they are different in terms of their experience levels such as DW specialists, DW administrators, DW managers, DW

consultants, and DW analysts. A web-based survey was mailed to 3000 of the most active members selected from TDWI membership list. A reminder email was sent to non-respondents four weeks after the initial mailing. The mailing resulted in a total response of 244 usable questionnaires, representing approximately an 8.1% response rate. Since the survey was unsolicited, fairly complex and resource constraints, researcher expected a low response rate.

The survey instrument contains three sections. In the first section (Section 1), the respondents are asked to fill-in some personal details such as: the respondents' location, position in the organization, experience in DW projects, status of DW project, and details about their organizations such as organization's primary industry. The remaining sections were concerned with statements relating to DW systems with items that measured on a seven-point Likert type scale, ranging from 'Strongly Disagree' to 'Strongly Agree'. In section 2, respondents are asked to provide their ideas on the statements regarding relationship quality between DW parties. This is followed by section 3 where the respondents are asked to provide their opinions on the statements relating to the success of DW.

The majority of respondents comes from USA, representing 33.6% (82 respondents), the second largest number of respondents comes from Canada which formed 27.0% (66 respondents), followed by Europe, 34 respondents (13.9%), Australia obtains 30 respondents (12.3%), Asia covered 14 respondents (5.7%), Middle East acquired 8 respondents (3.3%) and the smallest number of respondents comes from Africa and Central or South America of 2% (5 respondents for each). This confirms the robustness of the study results, where the majority of the respondents are from the developed countries in DW implementation. Meanwhile, it is observed that 51% of the respondents have been in their current position for more than 3 years, with approximately 27% had 3 years experience. The number of respondents who were relatively new to their current positions with less than 1-year experience is approximately 21% of the total responses. This gives the indication that the majority of respondents have sufficient experience to give their opinion about the study questionnaire.

In terms of DW project status, almost (51.2%) of respondents have at least one DW application either live, while close to 30.3% are still in development stage, 17.2% are still in planning stage and finally 1.2% of respondents have no any efforts made in their organizations to implement the DW. This result shows that more than 80% of respondents have implemented DW applications, meaning that they are able to assess the success or failure of DW applications. In terms of DW implementation scope, 50.4% of the respondents reported that the implementations are enterprise-wide, 24.6% departmental or multiple locations, 23.0% pilot only in a single department or location and 2.0% don't know about the DW scope in their organizations. In terms of organization's industry, the respondents represented wide range industries with largest participation (13.9%) drawn from financial services sector, 9.0% comes from healthcare sector, 8.6% comes from government/federal sectors, 7.0% comes from consulting/professional services sectors, 6.1% comes from education sector and the remaining

(55.3%) comes from the other industries. This result shows that the respondents are involved from several industries, which in turn help to generalize the findings of this research.

VI. HYPOTHESIS TESTING

Having established constructs validity and data collection, the next step is to test the hypothesized paths. As noted previously, two constructs have been identified to be included in the study. The constructs are relationship quality and DW success. Table II shows the results of the Pearson correlation analysis conducted on the relationship between relationship quality and DW success. The level of confidence can range from 0 to 100 percent. A 95 percent confidence is accepted level for most research, denoting the significance level as $p < 0.01$. As the results in Table II suggests, a significant positive relationship exists; therefore, there is a support for this hypothesis. H1 was supported at the 0.000 level of significance. The standardized correlation coefficient is 0.698. The results supported the hypothesis that providing a good quality of relationship between DW parties would contribute to the success of DW system. This indicates that a good communication, coordination, cooperation, commitment, and trust between DW parties could help in successful execution of DW system.

TABLE II: HYPOTHESIS (H1) CORRELATIONS

		DW Success
Relationship Quality	Pearson Correlation	0.698**
	Sig. (2-tailed)	0.000

Correlation is significant at the 0.01 level (2-tailed).

VII. DISCUSSION

In this study, researchers postulate that there are linkages between relationship quality and DW success. The hypothesized model is then empirically validated using data collected from a field survey of TDWI members. Moreover, this study contributes to DW success research by providing an understanding of the relationship quality factor to be considered in evaluating the success of DW systems. The finding of this study revealed that relationship quality factor had positive and significant impact on DW success construct at the 0.000 level of confidence with the 0.698 of correlation coefficient. This indicates that a good communication, coordination, cooperation, commitment, and trust between DW parties could help in successful execution of DW systems.

This result was supported by previous studies such as Wu [45] who found that relationship quality dimension is significantly associated with net benefits through its impact on use and user satisfaction in e-commerce systems. Chakrabarty et al. [39] also found that relationship quality is greatly and significantly associated with user satisfaction in IS outsourcing context. Besides that, Chang and Ku [47] found that relationship quality is strongly and positively associated with organizational performance in context of the implementation of CRM. In the context of DW, Bhansali [16] indicated that commitment, communication, and cooperation between the business users and DW managers are greatly

associated with the success of DW systems.

This finding is justified by the fact that quality of the relationship between DW parties could potentially reduce the time and effort, which in turn leads to make decisions in a timely manner and with high accuracy. Likewise, DW managers and business managers need to be jointly responsible for collaborate continuously through strong partnerships and appropriate allocation of resources. Added to this, the effective communication, coordination, and cooperation between DW parties will facilitates the identification of areas for development in DW with the best return on investments. Another possible explanation could be for the positive result is the successful communication, coordination, and cooperation between DW managers and business are absolutely help in avoiding paradoxical decisions.

VIII. CONCLUSION

A relationship quality dimensions for DW success has been identified, based on a review of DW literature. Literature found that commitment, trust, communication, cooperation, and coordination are the most important aspect of relationship quality. Moreover, based on the analysis results as reported in this paper, relationship quality was significantly and positively affects DW success. However, this research provides the basis for an initial evaluation of DW success measures and factors, and serves as a good starting point for further development.

The quality factors could be the trend in IS/DW success studies in the future, so more studies of this nature should be carried out. This research has illuminated many of the practical and theoretical issues of DW systems success. There are reasons to be positive and continue to pursue the success of DW systems. Therefore, the data warehouses' research community is invited to continue these initial investigations about the success of DW systems.

Finally, the tunnel vision seems to inhibit DW managers' ability to think creatively. Many DW managers, especially those with good experience, do not seem to be able to envision alternatives to accomplish DW objectives. Therefore, it appears nearly certain and plausible that the way DW systems success is implemented in the future will also change. This will require us to re-think what DW systems success "is" in the future before we have completely determined what DW systems success "is" now.

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