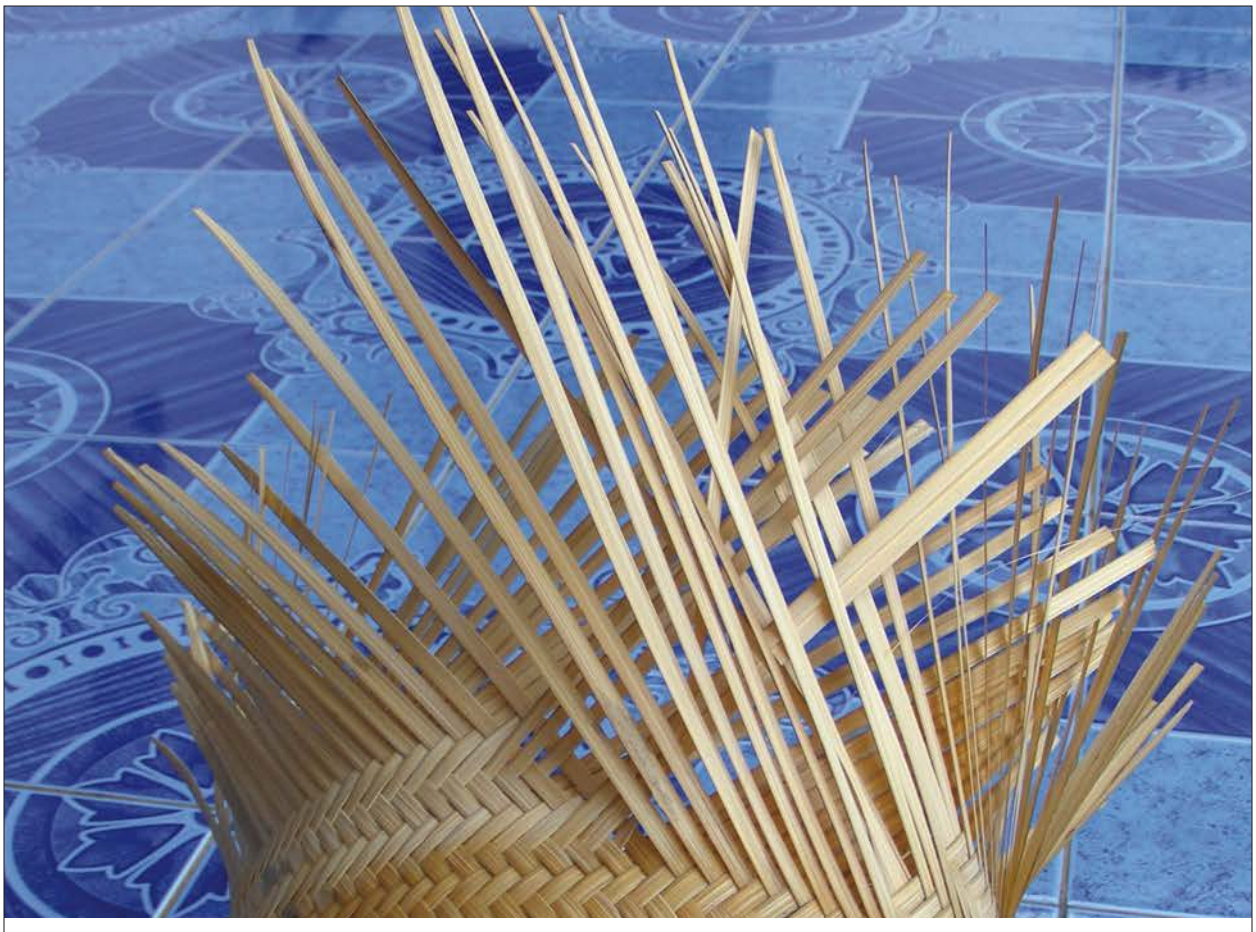

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# Assessment of the Quality Attributes of Information Sharing in Indian Manufacturing Organisations: A Case Study

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## ABSTRACT

Information Quality (IQ) is an important factor for successful implementation of information sharing in supply chain. The quality of information has become vulnerable with the growth of information system warehouses and the direct access of information from various sources. The stakeholders make decisions based on various information sources without formally judging the value and quality of information. The proposed study aimed at determining the attributes of information quality that significantly affect the performance of supply chain in Indian organizations. The Importance-Performance Analysis (IPA) has been used to examine quality parameters of information sharing system in a supply chain. IPA is capable to analyze the effectiveness of a factor to achieve a goal as well as on performance of information sharing system in supply chain. The analysis facilitates the supply chain managers to pin point the area of successes and improvement which in turn enables them to decide the ways of best utilization of available resources. A survey based on questionnaires have been used in this research to identify a range of quality factors that contribute to selected goals of information sharing as well as their contribution to the performance of supply chain. The gaps between importance and performance from both the perspectives have also been evaluated. IPA has been employed in this research to illustrate the importance and performance of quality attributes of information sharing may be assessed. The findings of this study may be useful to improve quality issues in information sharing system of the supply chain.

**Key words:** Information sharing, information quality, supply chain management

## INTRODUCTION

Information has become a critical component of business operations (Sen, 2001). Today's technology allows business to collect and analyze enormous volumes of information and manipulate it in different way to bring out benefits of information sharing in the business operations (Abbott, 2001). Managers make decisions based on information available to them and misinformed people tend to make poor decisions (Fisher and Kingma, 2001). Every business decision needs only high quality information and for this we need to have information that is delivered to the right person at the right time and place in supply chain. The major problems of modern business operation are, how to pick right information from its abundance, how to decide which information is correct and which one is useless and finally, how to assess the quality of information? Consequently there is

an increased demand on high quality information and information becomes a guarantee of success. Eppler and Hyams (2004) have suggested that organizations should and understand how to evaluate information and separate the quality information from the useless one so information quality assessment methods can help to manage these problems. Information quality measurement and assessment is based on the assumption that if a material product has quality characteristics and dimensions so an information has particular quality dimensions (Wang and Strong, 1996).

Information Quality (IQ) is an important factor for successful implementation of information sharing in supply chain. Supply chain management processes require managing of large amount of relevant information. These processes are information intensive and highly dependent on information quality. The success of a supply chain management system will depend upon the accuracy and quality of information that a chain member shares with its net work organizations. The quality of information has become vulnerable with the growth of information system warehouses and the direct access of information from various sources. The stakeholders make decisions based on the information received from various information sources without formally judging the value and quality of information.

The evaluation of quality factors of information sharing system is a critical issue for successful supply chain management. It is very important that supply chain professionals identify the key quality attributes that are important for the goals of information sharing in supply chain. Quality is a matter of perception and is often difficult to measure objectively. Like all other quality measures, it should be judged by the receiver. The present study aimed at determining the attributes of information quality that significantly affect the performance of supply chain in Indian organizations. The findings of this study may be useful to improve quality issues in information sharing system of the supply chain.

## MATERIALS AND METHODS

**Research design:** This study was conducted by using a two-step research methodology. First, a group list of all the relevant information quality attributes related to information sharing in supply chain were identified based on review of a literature (Su and Jin, 2007; Kargar *et al.*, 2007; Pipino *et al.*, 2002; Zhu and Gauch, 2000; Mattsson, 2002; Moberg *et al.*, 2002; Loshin, 2001). Based on literatures reviewed and interviews with academicians and industry executives 40 attributes of information quality were selected. A pretest was conducted among industry staff and supply chain managers to rate the importance of the 40 attributes and provide suggestions about the attributes used for the study. In this process 18 Critical Attributes of information quality selected for importance performance analysis. The list of attributes is given in Table 1. The definitions of these quality attributes have been adopted from the literature.

**Research framework:** A research framework (Fig. 1) was prepared to guide the research on the basis of research design.

**Sampling:** A sample of 250 executives was targeted, who were working in organizations that uses supply chain practices. The respondents were functional executives such as logistics manager,

Table 1: Definitions of information quality attribute

| Information quality attribute | Definition | Authors |
|---|---|---|
| Accessibility | The extent to which there is a continuous and unobstructed way to get to the information | Su *et al*. (2009) |
| Accuracy | The extent to which Information is correct, reliable and certified free of error | Kargar *et al*. (2007) |
| Appropriate amount | The extent to which the information volume is appropriate for the task at hand | Kahn *et al*. (2002) |
| Availability | The extent to which information is available, or easily and quickly retrievable | Kargar *et al*. (2007) |
| Believability | The extent to which the information is regarded as true and credible | Pipino *et al*. (2002) |
| Clarity | The extent to which the information understandable or comprehensible to the target group | Su *et al*. (2009) |
| Completeness | The extent to which information is not missing and is of sufficient breadth and depth for the task at hand | Kargar *et al*. (2007) |
| Concise | The extent to which information is compactly represented without being overwhelming | Kargar *et al*. (2007) |
| Currency | Currency can be measured as the time stamp of the last modification of the document | Zhu and Gauch (2000) |
| Ease of manipulation | The extent to which the information is easy to manipulate and apply to different task | Kahn *et al*. (2002) |
| Free of error | The extent to which the information is correct and reliable | Kahn *et al*. (2002) |
| Interpretability | Extent to which the information is in appropriate languages symbols, units and definitions | Kahn *et al*. (2002) |
| Relevancy | Extent to which the information is applicable and helpful for the task at hand | Kahn *et al*. (2002) |
| Reliability | The probability that the information being used is accurate, stable consistent and remains unchanged | Mattsson (2002) Moberg *et al*. (2002) |
| Security | The extent to which unauthorized access to information is restricted against loss appropriately to maintain its security | Su *et al*. (2009) |
| Timeliness | Timeliness can be measured as the time between when information is expected and when it is readily available for use | Loshin (2001) |
| Usefulness | The information is relevant to the task and sufficient to support decision making | English (2005) |

production manager and information technology manager chosen from different Indian manufacturing industries. The industries for sampling were selected from the directory of ISO 9000 companies.

**Survey instrument:** A closed-ended and self-administered questionnaire was designed based on the initial feedback received against a pilot questionnaire and subsequently personal interview held with academicians, experts and consultants. The respondents were asked to rate the perceived importance of these quality attributes by evaluating the statements, while the second section of the questionnaire was about the rating of the performance of these quality attributes in their organization and how they perceived them. The questionnaire was carefully structured and each quality attribute in the importance section was rated using a 5 point Likert scale ranging from 'least important (1) to most important (5). Similarly, each performance statement on the same attributes was rated from very poor (1) to excellent (5). Quality characteristics were listed in an alphabetical order to prevent their initial order from affecting respondent preference. The survey questionnaire did not include any negative questions for verification purposes for the sake of simplification and to reduce the total time taken to provide a complete response.

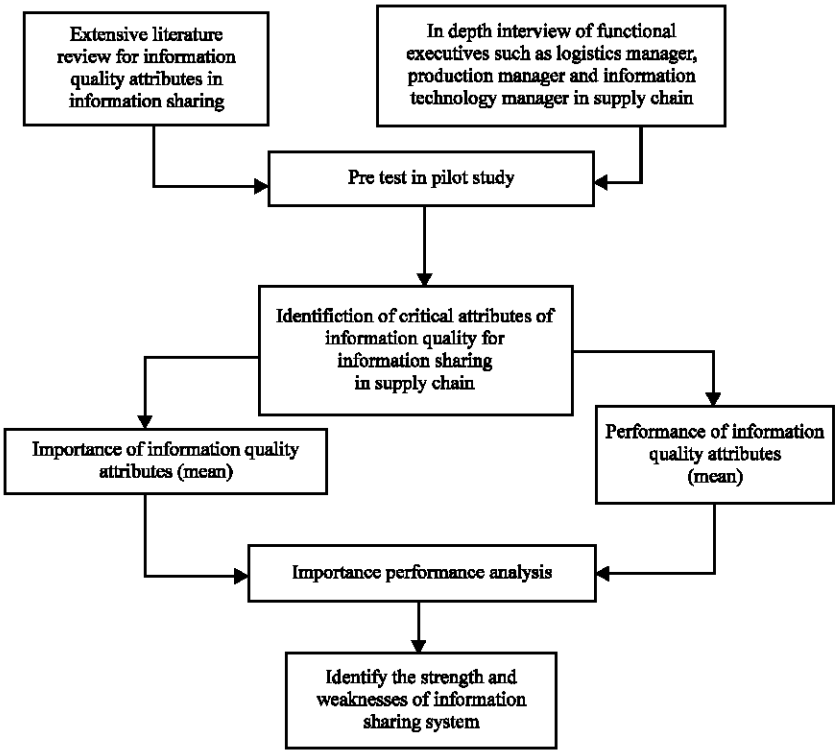


Fig. 1: Research framework

**Data collection:** The primary method of data collection for this study was considered the questionnaire survey. A survey allows us to reach a broad cross-section of the various groups of people (professionals, support staff, managers) who participate in information work and to develop a general sense of their perceptions and beliefs about how information is managed and used in the organization. The questionnaire used to record the responses of each respondent contained mainly close-ended question using a five-point Likert. Sekaran (2003) has suggested that the analysis samples should be at least 10 times the number of variables in a study. Thus, a sample of 180 respondents was selected for this study.

The overall response rate of was 23.45% of which 1.36% were unusable. In other words, a usable response rate of 22.08% is good for this type of survey given the complexity of the survey instrument. The response reflected industry interest in the subject matter. Relative to similar survey-based research, a usable rate of 22% is indeed very healthy.

**Data analysis:** Descriptive analysis such as frequency, mean and standard deviation were conducted. Cronbach's alpha was calculated to test the reliability of the importance and performance attributes of information quality attributes as perceived by respondents. A factor was considered significant if its Cronbach's alpha was 0.70 or above. Mean scores rating of perceived attributes of information quality attributes importance and performance were computed to access the importance of each item respectively. Then, the mean scores of the 18 information quality attributes were plotted on the IPA grid according to their perceived importance and the

performance levels as perceived by supply chain managers of different Indian manufacturing industries.

## IMPORTANCE-PERFORMANCE ANALYSIS (IPA) MODEL

Martilla and James (1977) have introduced Importance-Performance Analysis (IPA) model to study customer satisfaction as a function of expectations related to importance and performance. IPA has been considered to be an effective tool for understanding customer satisfaction and prioritizing service quality improvements. There are two methodological streams that are available in Literature for simultaneous consideration of Importance and Performance. The first methodology focuses on identifying performance gaps measured as performance minus importance (O'Neill *et al*., 2001). The other approach of IPA involves plotting mean ratings on each of these items in a two-dimensional grid to produce a four-quadrant matrix that identifies areas that needs improvement as well as areas of effective performance (Graf *et al*., 1992).

Importance-Performance maps are a matrix-based technique that analyses perceptions of importance and performance in a format which is very simple to interpret. It begins with the generation of an agreed list of elements on which evaluation is conducted. This list is critical for the analysis and is generally evolved through review of literature and interviews. A survey methodology is developed and administered to respondents using Likert scales and questionnaires. Based on survey data, the information of performance for any attribute is calculated by taking average value for that item and then the importance and performance of the identified attributes are plotted against each other. The typical four-quadrant matrix in IPA is shown in Fig. 2 and standardized importance-performance framework is shown in Fig. 3. Interpretations are made by drawing an iso-rating line from the origin, along which performance equals importance (Slack, 1994). The importance exceeds performance above this line and thus providing opportunity gaps for improvements and performance exceeds importance below this line suggesting satiated needs. Performance and importance scores provide more meaning when they are studied together. It is not enough to know which attribute was rated as the most important, or which one fared the best or worst. By mapping these scores against the iso-rating line supply chain managers can get an indication of whether the focus and resources are being deployed adequately or insufficiently.

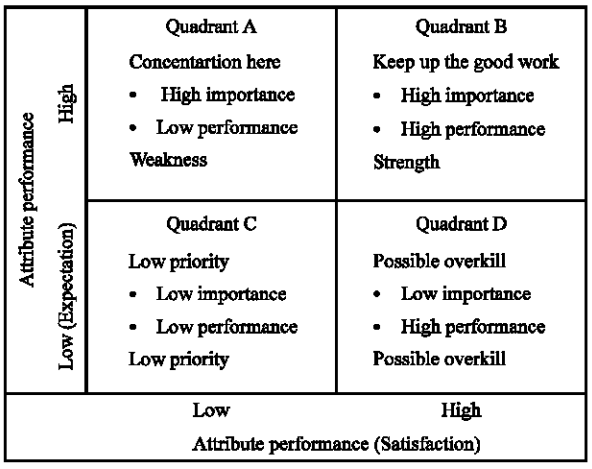


Fig. 2: Importance-performance matrix (Source: Chu and Choi, 2000)

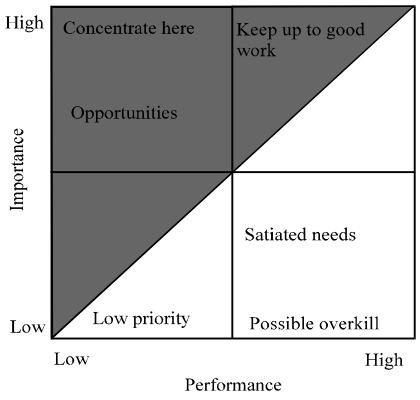


Fig. 3: A standard I-P map (Slack, 1994)

Table 2: Means and standard deviations in importance and performance ratings information quality attribute in Indian supply chain

| | Performance | | Importance | | |
|---|---|---|---|---|---|
| Information quality attribute | Mean (X) | SD | Mean (Y) | SD | Performance minus importance (X-Y) |
| Accessibility | 3.923 | 0.41 | 3.592 | 0.95 | 0.331 |
| Accuracy | 3.662 | 0.65 | 3.979 | 0.67 | -0.317 |
| Appropriate amount | 3.734 | 0.98 | 3.522 | 0.89 | 0.212 |
| Availability | 3.601 | 0.95 | 3.921 | 0.71 | -0.320 |
| Believability | 3.877 | 0.67 | 4.016 | 0.88 | -0.139 |
| Clarity | 3.857 | 0.89 | 3.810 | 0.75 | 0.047 |
| Completeness | 3.676 | 0.79 | 3.753 | 0.80 | -0.077 |
| Concise | 3.614 | 0.64 | 3.542 | 0.71 | 0.072 |
| Currency | 3.755 | 0.95 | 3.606 | 0.88 | 0.149 |
| Ease of manipulation | 3.311 | 0.71 | 3.342 | 0.82 | -0.031 |
| Free of error | 3.493 | 0.88 | 3.345 | 0.86 | 0.148 |
| Interpretability | 3.777 | 0.75 | 3.946 | 0.80 | -0.169 |
| Relevancy | 3.810 | 0.80 | 3.842 | 0.99 | -0.032 |
| Reliability | 3.804 | 0.94 | 3.760 | 0.85 | 0.044 |
| Security | 3.714 | 0.91 | 3.746 | 0.79 | -0.032 |
| Timeliness | 3.522 | 0.99 | 3.751 | 0.64 | -0.229 |
| Usefulness | 3.846 | 0.82 | 3.762 | 0.95 | 0.084 |
| Validity | 3.904 | 0.86 | 3.806 | 0.88 | 0.098 |

## RESULTS AND DISCUSSION

The results of survey in form of means and standard deviations of importance and performance ratings information quality attribute are given in Table 2.

The matrix can be utilized to bring together both importance and performance perspective for judging the relative improvement priorities which need to be applied to the competitive criteria. In a typical IPA, mean customer ratings of importance and performance across several attributes are plotted against each other and the resulting importance-performance (IP) space is divided into four quadrants. By examining the points in each quadrant, a manager may infer which attributes should be assigned the highest priorities for improvement (i.e., the 'concentrate here' quadrant) and the lowest priorities for improvement (i.e., the 'possible overkill' quadrant). Based on this the manager can then consider the costs of various improvements and develop an action plan depending upon the resources available.

Figure 4 shows the importance-performance grid for the attributes prepared by using the data obtained from the respondents. The grand means for the importance and performance items have been used as the dividing lines for the horizontal and vertical dimensions in the grid. The coordinates of any given point in the grid are derived from the mean values of importance and performance corresponding to that attribute.

It can be observed from and Fig. 5 the most important information quality dimension for information sharing in Indian manufacturing organizations as perceived by respondents is information believability. This means that the information shared should be true credible and

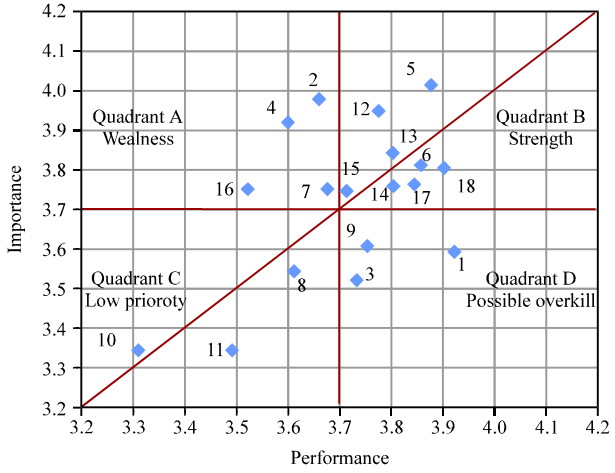


Fig. 4: Importance-performance model for the quality

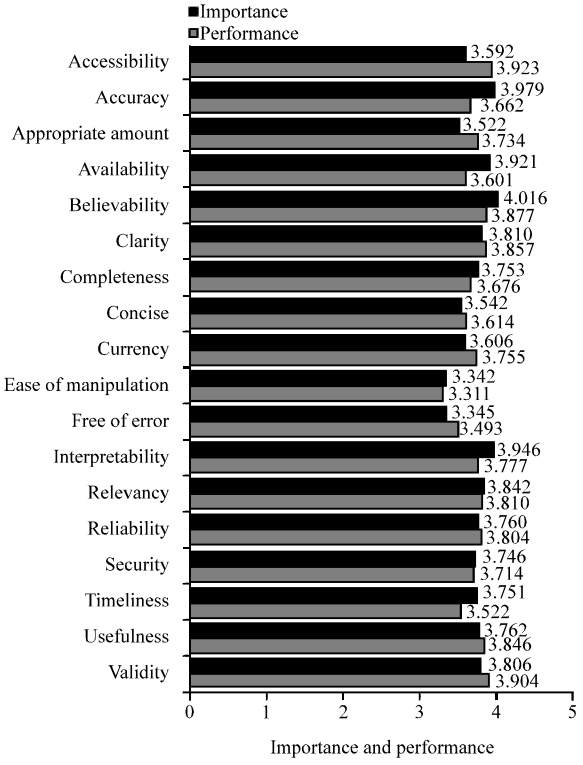


Fig. 5: Importance and performance of quality attributes of information sharing

believable. The second most important attribute is accuracy from the importance perspective list, which is indication of information preciseness and close enough to reality. Interpretability is third important attribute in the list. The fourth important attribute from analysis is the Availability of information. Relevancy is at fifth rank in the final list. The sixth rank in the list is taken by Clarity. Validity of information is ranked at seventh position. Usefulness is ranked at eighth position followed by Reliability and Completeness are placed at 9th and 10th rank respectively. Rest all other attributes of information quality are having very less score as compared to these top ten attributes

The overall purpose of this research was to develop a model for measuring state of information quality attributes in the supply chain of Indian manufacturing industry. The IPA has been used to divide the quality attributes into four categories according to their level of importance and performance as perceived by managers working in the organization of supply chain. Figure 3 shows the importance-performance grid for the attributes that were obtained from the survey data. The coordinates of any given point in the grid has been derived from the mean values of importance and performance corresponding to that attribute and each quality attribute can be assigned into one of the quadrants of the importance-performance matrix accordingly.

The grand means for the importance and performance items have been used as the dividing lines for the horizontal and vertical dimensions (Table 3). The gap analysis is used to identify the attributes of information quality exhibiting critical gaps between expected performance level (importance) and perceived level. The importance-performance map (Fig. 3) reveals that nine out of eighteen quality attributes of information sharing were performing below the end-users' expectations. The three variables with highest gap between importance and performance scores are availability, accuracy and timeliness. Mapping the mean scores for both data sets of importance and performance onto a scatter plot and analyzing the distance of the scores plotted against the iso-rating line gives much insight to guide the prioritization of resources and management intervention. The results of quadrant A in the Fig. 3 have revealed that the Indian Manufacturing

Table 3: Performance items

| Quadrant in IPM | Item | Quality attribute |
|---|---|---|
| Quadrant A: | 2 | Accuracy |
| Weakness | 4 | Availability |
| | 7 | Completeness |
| | 16 | Timeliness |
| Quadrant B: | 5 | Believability |
| Strength | 6 | Clarity |
| | 12 | Interpretability |
| | 13 | Relevancy |
| | 14 | Reliability |
| | 15 | Security |
| | 17 | Usefulness |
| | 18 | Validity |
| Quadrant C: | 8 | Concise |
| Low priority | 10 | Ease of manipulation |
| | 11 | Free of error |
| Quadrant D: | 1 | Accessibility |
| Possible overkill | 3 | Appropriate amount |
| | 9 | Currency |

Industry is not performing well enough on attributes such as Accuracy, Availability, Completeness and Timeliness. These attributes are perceived to be very important to respondents but performance levels are fairly low. The result indicates that these information quality attributes are the improvement areas on which the Indian manufacturing industry should pay more attention in order to improve overall satisfaction. The organizations should go through the causes and take corrective and preventive measures.

Further, the respondents have suggested as shown in the in quadrant D that the Indian Manufacturing Industry is paying attention more than the required with respect to three attributes; accessibility, appropriate amount and currency. This quadrant contains attributes of low importance but performance is relatively high that implies that the importance of these attributes are rated as lower than the performance. It also indicates that respondents are satisfied with the performance of these quality attributes in information sharing practices in supply chain and the any further efforts to improve the performance of these attributes of this quadrant are almost superfluous. It is suggested that supply chain managers should consider use of unnecessary energy and resources committed for these attributes to elsewhere.

Quadrant B contains eight attributes: Believability, clarity, interpretability, relevancy, reliability, security, usefulness and validity. These attributes are perceived to be very important to respondents and at the same time, the organization seems to have high levels of performance in these activities. This also suggests that these are the areas where the industry is doing just well and needs to keep up to strengthen them.

The quadrant C is a region of low priority that comprises of three attributes: Concise, Ease of manipulation and free of error. These attributes are rated as having low importance and low performance. Although, performance levels may be low in this cell, supply chain managers should not be overly concerned, since the attributes in this cell have not been perceived to be very important and require no additional action. This implies that relatively fewer resources should be deployed to the attributes of this low priority quadrant.

## CONCLUSION

This research has analyzed the peculiarities of the business information quality assessment. It defines leading information quality dimensions that are the basis for information quality assessment in manufacturing organizations. It reveals the importance of information quality in organizations sharing information in the supply chain. This study presents an information quality framework for analyzing the dimensions and attributes the of information quality those are found to be most important with context to information sharing in Indian manufacturing organizations.

In this study the IPA model has been employed to visualize the state of quality attributes of information sharing system. The four quadrants in IPA model-weakness, strength, low priority and possible overkill-provide a basis for assessing how well organizations develop sound and useful information sharing system in supply chains in Indian context and deliver dependable and usable information services to members. This study is found to be capable of identifying quality attributes those need more attention as compared to others. IPA is very systematic and simple technique that has been used to identify the strengths and weaknesses of information sharing system of supply chain. It involves evaluating different aspects of performance of these quality attributes in certain key areas and in terms of their importance as well as performance. It is believed that the model is useful to draw up management strategy, build mechanism for supply chain team members to share information effectively and improve the information sharing quality in the supply chain that can help managers pay particular attention to some factors if needed.

The present research work aims to show assessment of information quality management system in the supply chain Indian Manufacturing industries to meet the information consumer expectations and needs. This model might work like one of the tools for information quality assessment in the organizations. Such an assessment provides a baseline for determining what improvements should be made in information quality to meet the need of manufacturing organizations.

It would be useful to further study on this issue by comparing importance-performance profiles for these attributes from multi-year studies to analyze management actions in relation to the improvement of attributes of quality of information sharing in supply chain. The above model may also be used to compare information quality attributes across the different organizations.

The IPA methodology as a whole provides a practical IQ tool to organizations. It has been applied in various organizational settings, such as the financial, healthcare and tourism industries. The methodology is useful in identifying IQ problems, prioritizing areas for IQ improvement and monitoring IQ improvements over time. This work might be helpful as one of the tools for information quality assessment in the organizations.

The gap analysis techniques provide the tools by which organizations can understand their IQ deficiencies as compared to other organizations and to different stakeholders within one organization. Using these analysis techniques, organizations can benchmark their IQ and determine appropriate areas to focus improvement efforts.

## REFERENCES

Abbott, J., 2001. Data data everywhere- and not a byte of use?. Qual. Market Res., 4: 182-192.

Chu, R.K.S. and T. Choi, 2000. An importance-performance analysis of hotel selection factors in the Hong Kong hotel industry: A comparison of business and leisure travellers. Tourism Manage., 21: 363-377.

Eppler, M.J. and M.R. Hyams, 2004. Information quality in complex sales. Proceedings of the 9th International Conference on Information Quality, November 5-7, 2004, MIT Press, Boston, MA, USA., 389-401.

English, L.P., 2005. Information quality for business intelligence and data mining: Assuring quality for strategic information uses. White Parer, Information Impact International Inc. http://infoimpact.com/articles/IQBI&DataMining.pdf

Fisher, CW. and BR. Kingma, 2001. Criticality of data quality as exemplified in two disasters. Inf. Manage., 39: 109-116.

Graf, L.A., M. Hemmasi and W. Nielsen, 1992. Importance-satisfaction analysis: A diagnostic tool for organizational change. Leadersh. Organiz. Dev. J., 13: 8-12.

Kargar, M.J., A.A. Ramli, H. Ibrahim and S.B. Noor, 2007. Assessing quality of information on the web towards a comprehensive framework. Proceedings of the 14th IEEE International Conference on Internet Communication Technology (ICT/MICC), May 2007, IEEE: Malaysia.

Kahn, B.K., D.M. Strong and R.Y. Wang, 2002. Information quality benchmarks: Product and service performance. Commun. ACM., 45: 184-192.

Loshin, D., 2001. Enterprise Kowledge Management: The Data Quality Approach, Kaufmann, USA. Enterprise Kowledge Management: The Data Quality Approach. Kaufmann, USA.

Martilla, J.A. and J.C. James, 1977. Importance-performance analysis. J. Market., 41: 77-79.

Mattsson, S. A., 2002. Embracing Change-Management strategies in the E-Economy Era. Coronet Books Inc, USA.

Moberg, C.R., B.D. Cutler, A. Gross and T.W. Speh, 2002. Identifying antecedents of information exchange within supply chains. Int. J. Phys. Distrib. Logist. Manage., 32: 755-770.

O'Neill, M., C. Wright and F. Fitz, 2001. Quality evaluation in on-line service environments: An application of the importance-performance measurement technique. Managing Serv. Qual., 11: 402-417.

Pipino, L., Y.W. Lee and Y.W. Richard, 2002. Data quality assessment. Commun. ACM., 45: 211-218.

Sekaran, U., 2003. Research Methods for Business: A Skill Building Approach. 4th Edn., John Willey and Sons Ltd., New York.

Sen, K., 2001. Does the measure of information quality influence survival bias?. Int. J. Qual. Reliab. Manage., 18: 967-981.

Slack, N., 1994. The importance-performance matrix as a determinant of improvement priority. J. Operat. Prod. Manage., 14: 59-75.

Su, Y. and Z. Jin, 2007. Assuring information quality in knowledge intensive business services. Proceedings of the 3rd International Conference on Wireless Communications, Networking and Mobile Computing, September 21-25, 2007, Shanghai, China, pp: 3243-3246.

Su, Y., J. Peng and Z. Jin, 2009. Modeling information quality risk for data mining in data warehouses. Hum. Ecol. Risk Assess.: Int. J., 15: 332-350.

Wang, R.Y. and D.M. Strong, 1996. Beyond accuracy: What data quality means to data consumers. J. Manage. Info. Syst., 12: 5-34.

Zhu, X. and S. Gauch, 2000. Incorporating quality metrics in centralized/distributed information retrieval on the World Wide Web. Proceedings of the 23rd Annual International ACM SIGIR Conference on Research and Development in information Retrieval, July 24-28, 2000, Athens, Greece, pp: 288-295.