THE IMPACT OF INFORMATION QUALITY AND ERGONOMICS ON SERVICE QUALITY IN THE BANKING INDUSTRY

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THE IMPACT OF INFORMATION QUALITY AND ERGONOMICS ON SERVICE QUALITY IN THE BANKING INDUSTRY

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This dissertation investigates the impact of information quality and ergonomics on service quality in the banking industry. A model postulating that process quality predicts product quality was proposed. In this study, the banking industry is the domain of interest. Two different large banks were selected, with five branches among them. First, service quality questionnaires were sent to 800 customers; the overall response rate was 468/800=59%. A non-difference score of SERVQUAL was used to assess the dimensions of service quality. Second, information quality questionnaires (Wang and Strong) and ergonomics questionnaires were sent to 278 employees of the banks; the overall response rate was 236/278 =84%. Both instruments were used to assess the underlying dimensions of information quality and ergonomics.

The result of the service quality analysis showed that reliability and responsiveness are the two most critical dimensions of service quality and they are directly related to the overall service quality.

The result of the information quality analysis showed that all of the information quality dimensions except accessibility were significantly different between banks, but they were the same for branches within each bank. Reputation, believability, value-

added, and relevancy had the highest score; completeness, access, and security had the lowest score for all the banks. In addition the result showed that accuracy and amount of information were related to overall service quality. Objectivity, timeliness, and believability were also related to the dimensions of service quality.

The results of ergonomics analysis showed that all of the dimensions of ergonomics (workstation, overall comfort, other, and environment) had a positive impact on overall service quality

To my beloved wife Katherine, and my daughter Jihan

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CHAPTER 1

INTRODOUCTION

1.1 Service Quality

Cronin and Taylor (1992) support the theory that service quality is an antecedent of customer satisfaction and that customer satisfaction exerts a stronger influence on future purchase intentions than does service quality. Customers do not necessarily purchase the highest quality service, but may also weigh convenience, price and availability factors (Cronin and Taylor, 1992). The customer's personal experiences with the service provider (i.e. courtesy, waiting time, empathy, responsiveness) also impact on customer satisfaction (Nowak, 1997).

Service jobs began exceeding manufacturing jobs in the US economy in 1956. Today, service jobs dominate most US business activity. Current Bureau of Labor Statistics information indicates that the service sector of the US economy accounts for more than 75 percent of US gross domestic product (GDP) and about 80 percent of all US jobs. The industrial age has been replaced by the information age. Super power economies are advancing with information and service sector growth. Developing economies are still dominated by smoke-stack manufacturing and agriculture.

The important question is not whether service is the industry of the future, but rather: ``Do US business people understand the principles and practices of service quality well enough to fend off foreign competitors?" Clearly, US business owners do not want

to find themselves once again in a position of playing catchup to other nations, as was the case with Japan's electronics and automobile manufacturing quality in the 1980s.

However, anecdotal and scientific evidence suggests US business people may be repeating history. For example, the American Society for Quality, Arthur Andersen, and the University of Michigan's Business School have created the American Customer Satisfaction Index (ACSI), which conducts interviews with over 50,000 consumers about satisfaction with some 200 companies in 35 industries. The ACSI report shows a consistent quarter-by-quarter decline in customer satisfaction since ACSI inception in 1994. Although a modest increase occurred in 1998 in the insurance industry, most other service categories like restaurant, hospital, and banking have continued to decline (Lovelock and Wright, 1999; Sweat and Hibbard, 1999).

1.2 Service Quality and Banking

Based on the ACSI data and other published studies, the banking industry may have some cause for concern. A survey of more than 800 bank customers indicated that the majority of bank customers believed that service had not improved over the past five years. Many customers believed that, in fact, customer service had gotten worse. Written complaints to banks were up 8.4 percent from the previous year, and bank customer satisfaction reports revealed that a quarter of all respondents found mistakes on their current accounts (Barret, 1997). On the other hand, credit unions have generally received high marks for customer service. Dubroff (1998) cites a Gallup survey, which indicates that credit unions were ranked number one in customer service among all financial

institutions for the 14th year in a row. Dubroff also argues that banks often argue the non-profit status of credit unions in an attempt to obscure the real issues like customer service.

There are many reasons for poor service quality across industries. One reason may be an inability to collect or use collected data. For example, in direct opposition to consumer opinion, bank executives perceived themselves and their companies to be doing an excellent job. For example, Allred and Addams (1999) asked executive officers at the top 100 US banks and credits unions about their customer service performance. The researchers found that bank executives gave themselves consistently higher marks than credit union executives in all surveyed areas of customer service. This apparent discrepancy of opinion creates questions about banking service information-gathering effectiveness.

1.3 Ergonomics and Service Quality

Both the customer and the service agent have contributions to the service delivery process by interacting with each other and exchanging information. Since the diversity of customers and their individual needs is expected (and is in fact what most of the service businesses are built on), the success of service tasks is heavily dependent upon the response to customer's needs. Because of its distinct nature based on front-line customer-interaction, customer service is typically a critical function/element of most service industries (or even manufacturing industries)(Chen, 2000). Thus the impact of ergonomics (noise, temperature, air quality, the glare of lighting, chair, and the machine

resource such as a computer) on quality of service in the banking industry is a very important consideration.

1.4 Quality Information System

Undoubtedly, today's organizations are operating and competing in the information age. A firm's basis for competition, therefore, has changed from tangible products to intangible information. A firm's information represents the firm's collective knowledge used to produce and deliver products and services to consumers. Quality information is increasingly recognized as the most valuable asset of the firm (Wang, 1996). Firms are grappling with the issue of how to capitalize on information and knowledge. Companies are striving, more than silently, to remedy business impacts rooted in poor quality information and knowledge.

The wealth of information is one of the most revolutionary phenomena that modern organizations have experienced. Firms have installed hundreds of millions of computers to collect, process, and utilize information from various information sources. This trend is continuing relentlessly with the rapid advancement of information technology. Huang (1999) had two propositions regarding quality information and knowledge. The first proposition is fundamental:

Proposition 1: Firms must create a reservoir of quality information.

Having access to quality information alone is not sufficient. Firms must create new knowledge from quality information and experiences. This knowledge, once captured,

must be disseminated throughout the firm to increase productivity and foster innovation. The second proposition, therefore, is an extension of the first.

Proposition 2: Firms must create a wealth of organizational knowledge.

Many best-practice reports witness that information technology alone is not the driver for knowledge management in companies today. Information and knowledge experienced by members of an organization should be the focus, not the system or technology per se. Technology and systems, however, are used as facilitators in the production, storage, and use of organizational knowledge.

1.4.1 Establish an Information Quality Program

To establish an information quality program, the information product manager can adopt classical TQM principles. In the manufacturing world, improvements in quality and customer service have resulted in significant reduction in the total cost of quality. Since most IT departments have few, if any, formal methods for information management, the opportunities to improve information quality management are numerous and the economic gain for so doing will be immense. Adapting the TQM literature, five tasks should be undertaken:

1. Articulate an IQ vision in business terms.
2. Establish central responsibility for IQ through the IPM (Information Product Manager)
3. Educate information product suppliers, manufacturers, and consumers
4. Teach new IQ skills
5. Institutionnalize continuos IQ improprement (Huang, 1999).

1.5 Research Objectives

The objectives of this dissertation are:

- To determine the impact of IQ (information quality) on quality of service in the banking industry.
- To determine the impact of ergonomics (noise, temperature, air quality, chair, the glair of lighting, and workstation such as a computer) on quality of service in the banking industry.

1.6 Structure of the Dissertation

The rest of this dissertation is divided into five chapters. The main body of this dissertation begins in Chapter 2 and provides a summary of the literature review of the service quality determinants, service quality and banking, information quality, and ergonomics & service quality. Chapter 3 provides the research rationale, description of a set of research hypotheses, statement of the problem, and data analysis. Chapter 4 provides a description of the study methodology, models and test of hypotheses. Chapter 5 provides a description of the study results. In the last chapter, discussions of the study results, test of hypotheses, overall discussions, directions for future research, conclusions, and recommendations from this dissertation research are listed.

CHAPTER 2

LITERATURE REVIEW

This chapter can be divided into six main sections: service quality, service quality and banking, information quality, information quality to deliver service quality, banking industry and information functions, and ergonomics & service quality.

2.1 Service Quality

2.1.1 Service Quality Determinants

Goods quality is tangible and can be measured by objective indicators like performance, features, and durability. Service quality, however, is intangible. Hence, the service quality literature defines service quality in terms of subjectivity, attitude, and perception. Zeithaml (1987) explains:

> Service quality is the consumer's judgment about an entity's overall excellence or superiority. It is a form of attitude, and results from a comparison of expectations to perceptions of performance received.

Lewis and Booms' (1983) definition clearly states:

> Service is a measure of how well the service level delivered matches customer expectations. Delivering quality service means conforming to customer expectation on a consistent basis.

Parasuraman *et al*., (1985) provided a list of determinants of service quality: access, communication, competence, courtesy, credibility, reliability, responsiveness, security, understanding and tangibles. The research team conducted a series of pilot studies and found a high degree of correlation between communication, competence,

courtesy, credibility and security. There is also a correlation between access and understanding. So they combined them into two broad dimensions of assurance and empathy, i.e. a total of five consolidated dimensions (Berry *et al.*, 1985):

Reliability: the ability to perform the promised service dependably and accurately.

Responsiveness: the willingness to help customers and provide prompt service,

Assurance: the knowledge and courtesy of employees and their ability to convey trust and confidence,

Empathy: the caring, individualized attention provided to customers, and

Tangibles: the appearance of physical facilities, equipment, personnel, and communication materials.

They then used the five dimensions, tangibles, reliability, responsiveness, assurance and empathy as the basis for their service quality measurement instrument. A 22-item instrument called SERVQUAL was originally used for assessing customer perceptions of service quality in service and retailing organizations in a study by Parasuraman (1994). For each item, a difference score Q (representing perceived quality along that item) was defined as Q= P – E, where P and E are the rating on the corresponding perception and expectation statements, respectively. In 1993, it was argued that "SERVQUAL failed to achieve discriminate validity from its component and the non-difference score measure did not exhibit these problems (Parasuraman, 1994). Moreover, it displayed better than discriminate and nomological validity properties. In sum, it was the preferred alternative"(Brown, 1993). Cronin and Taylor (1992, 1994) argue that measuring service quality using a performance- minus- expectations

(SERVQUAL) basis is inappropriate and suggest that performance-only (SERVPERF) measurement is a better method. However, Parasuraman, Zeithaml and Berry (1994) contend that the SERVQUAL scale using the expectations/performance gaps method is a much richer approach to measuring service quality and augment their earlier assertion (Parasuraman et al., 1985, 1988, 1993) that service quality is a multidimensional rather than a unidimensional construct.

Unfortunately, the conceptualization and measurement of service quality is not bereft of controversy. Although the debate on service quality began in 1985 in the marketing literature, it was given a major boost by Cronin and Taylor (1992). Subsequent work on service quality (Parasuraman *et al.*, 1993; Cronin and Taylor, 1994; Avkiran, 1994; Teas, 1994; Newman and Cowling, 1996; Yavas *et al.*, 1997) notwithstanding, the debate has not yet reached a point of resolution. In its wake, however, it has raised many issues for both academics and practitioners by providing important but somewhat conflicting insights into the conceptual, methodological, analytical and practical issues related to the service quality concept.

The five dimensions of service quality that were mentioned above according to Berry *et al.*, (1985), tangibles, reliability, responsiveness, assurance and empathy are the basis for this research. For this research, a non-difference score measure was used for each dimension of service quality. The non-difference score measure was used in this research in order to achieve discriminate validity from its component.

2.2 Literature Review in Service Quality and Banking

2.2.1 Service Quality and Banking

Johnston (1997) conducted a study to combine the classification of quality factors into satisfiers and dissatisfiers together with relative importance. Its purpose is to identify, through empirical research in the UK banking industry, the importance and effect of the determinants of service quality so that managers might be better armed to decide how to allocate limited resources to improve or stabilize service quality. This is summarized in terms of two research questions:

1. Which quality factors are the most important to the customer? and
2. Which quality factors are ones that tend to delight customers and which are those that tend to dissatisfy?

The classification scheme was explained to the customers and they were asked to rate, from 0 to 4, the relative importance of the 18 factors in terms of the service provided by their high street bank. The frequencies of mention, classified by their satisfying or dissatisfying effect, are normalized and summarized in Table 2.1. Each factor's average importance on a five-point scale (4=very important, 0=unimportant) are also shown in Table 2.1.

Table 2.1: Relative Effect on Satisfaction/Dissatisfaction and Importance

Factors	Satisfying	Dissatisfying	Importance
Commitment	100	0	3.2
Attentive/help	96	4	3.7
Friendliness	96	4	3.0
Care	81	19	2.6
Courtesy	77	23	3.3
Responsiveness	67	33	3.5
Flexibility	60	40	3.2
Competence	51	49	3.8
Comfort	50	50	1.7
Communication	49	51	3.6
Availability	42	58	3.3
Access	33	77	2.2
Cleanliness/tidy	17	83	2.2
Security	17	83	3.4
Reliability	15	85	3.6
Functionality	7	93	3.3
Integrity	0	100	3.6
Aesthetics	0	100	2.1

It is interesting to note that the main satisfiers, i.e. the factors that may delight customers, tend to be concerned more with the intangible nature of the service, commitment, attentiveness, friendliness, care and courtesy. The main sources of dissatisfaction appear to be cleanliness, aesthetics, integrity, functionality, reliability and security, which are associated with either the more tangible aspects of service or systemic issues. In terms of importance, the averages in the Table 2.1 show that all the factors were felt to be at least of some minor importance.

All the factors in Table 2.1 are generally embedded in five consolidated dimensions of service quality (Berry *et al.*, 1985), which was the basis of this research.

2.2.2 Case Study of a Bank

Najjar and Bishu (1998) conducted a study to identify underlying dimensions of bank quality and to assess consumers' perceptions of the importance of each of these dimensions. A sample of 200 customers was taken from a large regional bank to complete the survey, and their participation resulted in the identification of 15 characteristics of bank quality (see the Appendix).

A non-difference score measure was used to perform principal component analysis to identify underlying dimensions of the bank quality. The score for each dimension of service quality was computed by taking the average score in items making up the dimension, in this case 3 items per dimension. The questionnaire covered the five dimensions of service quality, including the overall rating of the bank, and used a seven-point Likert scale as shown in the appendix. Copies of the survey were placed by teller windows in a large regional bank and a total of 200 customers completed the survey.

Multivariate analysis (principal component) was performed to identify underlying dimensions of the variables in question (reliability, responsiveness, assurance, empathy, and tangible). Multiple regression analysis was performed to determine the relative importance of variables in influencing customers' overall quality perceptions (overall rating of the bank). Based on the results of statistical analysis, reliability and responsiveness were represented as the two most critical dimensions of service quality.

2.3 Literature Review in IQ (Information Quality)

2.3.1 Why is Process Quality Very Critical?

Poor data quality is pervasive and costly to industry. Redman reports that error rates of 1-5% are typical, with an estimated immediate cost of about 10% of revenue (Redman, 1996). Customers, suppliers, distributors, and employees are negatively impacted through poor service, billing errors, and inconvenience. Data quality problems are exacerbated in large organizational databases where data are collected from multiple data sources. Strong, Lee, and Wang (1996) caution that information-system professionals should seek not only to improve data accuracy, but should also consider data accessibility and data relevance as they relate to the context of the data consumers' tasks.

Businesses have implemented programs to improve data quality to enhance competitive advantage. AT&T used its data quality program to suggest opportunities to reengineer their billing system; as a result, billing errors were reduced by two orders of magnitude (Redman, 1996). Data warehouses are used by organizations to improve customer service and managerial decision-making. A major issue in building and maintaining a data warehouse is data quality. Typically, organizations will initially spend considerable time ensuring quality of data, but the focus on data quality gradually fades. Without proper data quality processes, the data warehouse will begin to accumulate "dirty data" (Garcia, 1997).

Data quality problems may cause serious financial problems for organizations. Data quality problems recently cost a fiber-optics manufacturer $500,000 when a mislabeled shipment caused the wrong cable to be laid along the bottom of a lake, caused a brokerage firm to lose $500 million when a dealer entered an incorrect exchange rate, and caused the U.S. government to lose over $2 billion in federal loan monies (Firth 1996). Organizations increasingly rely on their information systems to integrate and support their business processes (Wang and Kon 1993). These information systems and the quality of the data they contain affect customer's perceptions of the quality of purchased products and services (Wang and Strong 1996).

2.3.2 Information Qyality Dimensions

Wang and Strong (1996) in their previous research determined the essential dimensions of IQ for delivering high quality information (see Table 2.2). Huang, Lee, and Wang (1999) conducted a series of comprehensive empirical studies and developed a framework with four IQ categories (Table 2.2)

Table 2.2: Category and IQ Dimensions

IQ Category	IQ Dimensions
Intrinsic IQ	Accuracy, objectivity, believability, reputation
Contextual IQ	Relevancy, value-added, timeliness, completeness, Amount of information
Representational IQ	Interpretability, ease of understanding, ease of manipulation, concise Representation, consistent representation
Accessibility IQ	Access, security

Huang, Lee, and Wang (1999) observed that dimensions seem to form several natural families, or categories, as shown in Table 2.2.

1. Intrinsic IQ denotes that information has quality in its own right.
2. Contextual IQ highlights the requirement that IQ must be considered with the context of the task at hand.
3. Representational IQ and
4. Accessibility IQ represents the importance of the role of systems

Definitions of dimensions are shown in Table 2.3 (Wang and Strong, 1996):

Table 2.3: Dimensions of Information Quality

Dimensions	Definitions
Accessibility	the extent to which information is available, or easily and quickly retrievable
Amount of Information	the extent to which the volume of information is appropriate Information for the task at hand
Believability	the extent to which information is regarded as true and credible
Completeness	the extent to which information is not missing and is of sufficient breadth and depth for the task at hand
Concise Representation	the extent to which information is compactly represented
Consistent Representation	the extent to which information is presented in the same format
Ease of Manipulation	the extent to which information is easy to manipulate and apply to different tasks
Free-of-Error (Accuracy)	the extent to which information is correct and reliable
Interpretability	the extent to which information is in appropriate languages, symbols, and units, and the definitions are clear
Objectivity	the extent to which information is unbiased, unprejudiced, and impartial
Relevancy	the extent to which information is applicable and helpful for the task at hand
Reputation	the extent to which information is highly regarded in terms of its source or content
Security	the extent to which access to information is restricted appropriately to maintain its security
Timeliness	the extent to which the information is sufficiently up-to-date for the task at hand
Understandability	the extent to which information is easily comprehended
Value-Added	the extent to which information is beneficial and provides advantages from its use

2.3.3 Dimensional IQ Assessment

Based on the 16 IQ dimensions (Wang and Strong, 1996) presented in Table 2.3, a set of questions can be generated to determine the perception of the state of IQ in an organization. Such a questionnaire has been developed based on the cumulative research conducted at MIT's TDQM (Total Data Quality Management) program (CRG, 1997). A complete copy of this questionnaire is shown in the appendix. Each question is rated using a Likert-type scale on a scale of 0 to 10 where 0 indicates "not at all" and 10, "completely." This questionnaire has been used effectively in both public and private sectors.

Information quality (IQ) is an inexact science in terms of assessment and benchmarks. Although various aspects of quality and information have been investigated, there is still a critical need for a methodology that assesses how well organizations develop information products and deliver information services to consumers. Benchmarks developed from such a methodology can help compare information quality across organizations, and provide a baseline for assessing IQ improvements (Kahn *et al.*, 2002).

2.4 Identifying the information requirements to deliver quality service

In the following sections the service-delivery process is broken into input, process and output stages and the information requirements are specified for each stage (Berkley and Gupta, 1995).

2.4.1 Input Information

The input function in services includes forecasting customer demands so that necessary service capacities can be planned. Once customers arrive, expected services must be specified by questioning customers or by relying on service histories or observations of market trends. Next, service standards are set by stating customer service expectations in a way that is meaningful to employees. Finally, customers participating in the service-delivery process must be supplied all necessary instructions.

- *Demands and capacities:* Most service firms have rush or peak periods and are not able to provide quality service unless they plan and prepare for these times. Unlike manufacturers, service firms cannot itemize their products as a hedge against fluctuations in demand. At any given time a service may have excess demand or excess capacity and service quality can suffer in both cases. Armed with the proper information, service firms may be able to adjust capacity to match fluctuating demand levels.
- *Service specification:* In services, information must be secured from the buyer to specify the expected service. For example, hospital patients must report chief health complaints and restaurant patrons must submit their orders. This input function is important because the more complete the information, the easier it will be to perform the other process functions. Customers also need to be made aware of the various services available and the likely costs of each alternative. Such information ensures that the needs and expectations of the customer are fulfilled and the organization's

time and resources are not wasted in dealing with customers whose needs and expectations it cannot, or should not, fulfill (Johnston, 1989).

Research suggests that customers associate risk more with the purchase of services than with goods (Guseman, 1981) and customers for services often feel they have less information about services than about goods (Weinberger and Brown, 1977). Fear is created by uncertainty and lack of information. Often there is uncertainty as to exactly what services will be performed, how much time the service will require, the expected outcome and the total cost. Consequently, service firms may be able to reduce customer fear and improve perceived service quality by providing customers with a complete service specification before service commences. For example, automobile body shops almost always leave people queasy. Customers, fearful of being ripped off, worry that repairing a little dent in a bumper will put a big dent in their wallets. To alleviate customer fear, Automatic Data Processing developed a pen-based estimating system that allows body shop employees automatically to generate a complete parts-and-labor estimate (Wexler, 1993).

Service errors are often caused by a misspecification of the service. For example, Federal Express found that most of its routing mistakes are caused by wrong ZIP codes, wrong street addresses and even wrong names. Often, a package misadventure begins when a clerk misreads a customer's handwriting. To improve service specification, Federal Express has introduced new self-serve kiosks, called FEDEX Online, using bank automatic teller machine (ATM) technology. Each kiosk has a touch-screen video display for customers to price packages and print their own

address labels (Ramirez, 1993). Major ocean shipping companies now use a Windows-based electronic data interchange software package called *Ocean* for customers to book and confirm their own orders. Ocean is expected to reduce data errors because the information keyed in by customers feeds directly into the carriers' systems (Radosevich, 1993a).

- *Service history:* Service requires a long memory. With a computerized customer database, a firm can attach a detailed personal service history to the names of its customers. A record of each new service transaction can then be added to existing customer files. These updates help sketch an increasingly detailed profile of each customer's preferences and expectations and create opportunities for more personalized and enhanced service. For example, Marriott's guest recognition system allows personnel to call up information about guests who have stayed at a Marriott hotel before. Marriott's system can predict that a particular guest will want a non-smoking room, a king-size bed, an iron and a hair dryer (Pike, 1990).

  An information system that allows customer files to be called up at many different locations would allow the firm to direct customers to different company stores providing individual sales or services of special customer interest. This in turn will help build a customer-company relationship that is stronger and more valuable than a simple customer-store or customer-employee relationship.

- *Market trends:* Customer service expectations are a moving target. To deliver superior service, a company must monitor customer expectations and customer response to the services it offers. While market research can be used to determine

customer expectations, often the required information can be obtained at a significantly lower cost by listening to customers and employees. Most good service providers have a communication process to ensure that customer suggestions and requests are communicated up and down the organization to the people who need this information (Wilderom, 1991).

- *Service standards:* Service quality standards are customer expectations stated in a way that is meaningful to employees. For example, the standard that customer should not stand in line for more than two minutes is more meaningful than the standard of "giving prompt service". Service standards should also be flexible enough to allow employee creativity. For instance, suppose a restaurant has a standard that the customer must be seated within 15 minutes of his or her reservation time. If a waiter meets the standard but senses that a customer feels the service has been slow, he should be allowed to give the customer a free dessert anyway. Well-conceived and clearly communicated standards clarify the service task, convey a sense of priority and provide benchmarks against which employees can judge their own performance and managers can judge the employees' and organization's performance. Service standards also help ensure consistency and uniformity. Without standards, customers might get good service one day at one location and poor service the next day at another location.
- *Customer instructions:* In many services the customer plays a role as partial employee. A high disposition to participate can stem from the need for the customer to provide information for service specification and problem solving throughout

service production. After the service is specified, many customers prefer an active to a passive role in service delivery, particularly when taking it offers the potential for more control or for time or cost savings. For example, customers pump gasoline, bus tables in fast-food restaurants and direct-dial long distance telephone calls. In other cases, customer participation may improve accessibility (e.g. 24-hour automatic teller machines) and accuracy (e.g. salad bar selections). Studies of consumer choice between self-service and more traditional approaches to receiving service show that the dimensions of time and control are crucial. Many prefer self-service because it offers consumers more control over the service-delivery process (Langeard *et al*., 1981).

Satisfactory customer performance can be ensured only when the individual has a thorough understanding of what the job entails and what is expected. Service managers must realize that not all customers know what to do, where to go and how to behave. As such, mechanisms and procedures need to be in place to provide customers with the information they require, rather than leaving them to find their own way (Johnston, 1989). Uninformed customers may be obstacles to delivering quality service if employees must recite the same instructions to customers time and time again or if most customers are confused by what they have to do. Moreover, customers generally try to facilitate their service, and their satisfaction is tied to the feeling of having acted appropriately. Thus, an important question in information management is how best to convey to customers the appropriate role behaviors.

For traditional merchants, service means having salespeople who personally take care of individual customers. But new retailers, such as Wal-Mart and Toys R Us, employ very few salespeople. Service to them means that customers do not need a salesperson, do not have to spend time trying to find one, and do not have to ask. It means that customers know where goods are, in what colors and sizes and at what price. It means providing information (Drucker, 1993).

2.4.2 Process Information

Process information is information required by employees or customers while the service actually is being delivered . To begin, service providers must possess or have access to the knowledge required to perform the service. If service delivery times are long, order-processing systems may be used to track customers or provide information on job status. Finally, quality control systems collect process data with the objective of taking corrective actions before problems are created.

- *Knowledge:* Service providers must possess the required skills and knowledge to perform service. Greater knowledge allows frontline service workers the better to help their customers and makes them capable of important judgments on matters that previously would have been handled by managers. Because employees can experience intense frustration when facing a customer and not having the answers, knowledge also supports employee job satisfaction, motivation and confidence in dealing with customers.

Knowledge databases allow relatively inexperienced people to perform very sophisticated tasks quickly. Whereas service providers, unaided by databases, are limited to their own knowledge, those with access to fast-response decision-support systems effectively possess the knowledge of many. This is particularly important when service firms rely on entry-level, part-time or relatively inexperienced workers. Information systems can also be used to reduce the knowledge required to deliver customized services and to improve service consistency.

Quality in services depends heavily on the ability of employees to share their knowledge. Service expertise can be captured in either expert systems or group conferencing systems that provide electronic bulletin boards for sharing problems and ideas. For example, Black & Decker assembled information on some 4,000 current and discontinued power tools and accessories to create a computer database. This database contains solutions to problems with all products, so that callers do not have to wait on hold for, say, the circular-saw specialist. Now, any customer service staffer can answer the question (Bulkeley, 1993).

Many professional service firms now find the core of their distinctive competence to lie in the accumulated knowledge in their databases and the capacity of their members to access and build solutions on these databases. For example, American Home Shield, a company providing service contracts for electrical, plumbing and heating systems in individual homes, has used the database it

constructed to improve its service and learn as much as anyone about the performance patterns of equipment supplied by major manufacturers (Heskett, 1986).

- *Job status:* The longer it takes for service delivery to be completed, the more likely it is that customers will require information on work-in-progress (such as estimated completion times and projected costs). For example, Federal Express uses package barcodes that are scanned six times during the shipping process to maintain real-time records on package location. Recognizing customer concerns about whether the package actually arrived on time, there is a money-back guarantee if a package cannot be located within 30 minutes of a customer call. Many firms have developed customer information systems that allow customers direct access to production and shipping files. These systems reduce customer uncertainty and allow customers to measure firm performance.

  Using information systems to increase communications has the potential to significantly improve customer service. In Birmingham, UK, navigational satellites are used to track the position of city buses. Display terminals installed at each stop show passengers exactly when the next bus is due to arrive (Heichler, 1993). Frequent airline passengers expect occasional delays. What upsets these passengers is the lack of explanation and apology for delays. To be more responsive, Northwest Airlines passes information from its flight monitoring system to coordinators located in each airport who make sure passengers know the reasons for delay.

- *Security:* Parasuraman *et al.*, (1985) identified security as one of the dimensions of service quality. Security is freedom from danger, risk or doubt. It includes physical

safety, financial security and confidentiality. Hospitals ensure security with monitoring systems that provide a continuous record of patient status and notify staff when medications must be administered. To ensure patrons' physical safety, some homeless shelters maintain dossiers and incident reports on troublemakers. Those patrons who repeatedly cause trouble are refused shelter (Dahl, 1992).

Guaranteeing financial security requires measures to prevent unauthorized account withdrawals or credit card use. Credit card companies use customer account histories, statistical criteria and computer programs based on neural networks to flag unusual activity. The underlying premise is that good customers are creatures of habit, so significant departure from their usual behavior may mean a thief at work. In a similar way, cellular telephone companies use monitoring systems to detect anomalies in calling patterns and potential cellular fraud before legitimate customers receive bloated bills (Adelson, 1993).

- *Quality control:* Quality control consists of collecting data, monitoring (comparing the existing state with the service standard) and corrective action. The objective is to make corrections to the process before problems are created and customers complain. Many service problems can be identified before customers experience them. Consider patients who arrive at their doctor's office on time only to be told the doctor is running an hour late, or airline passengers who, on arrival at the airport, are informed that their flight was cancelled hours earlier. In situations like these, management could anticipate customer frustration and take steps to alleviate it, including calling customers to warn them of the problem.

Quality control begins with data collection to determine the current state of the process. This information is then compared to the service standard to determine if corrective action is required. When service standards are subjective (e.g. courteous service) or when the data are qualitative (e.g. employee behavior, customer treatment, customer reaction), quality data are ordinarily collected by direct management observation. On the other hand, objective performance data, such as customer waiting and service times or system response times, can be collected and processed by information systems. At the First National Bank of Chicago an electronic queuing system called Camtron measures the length of time customers wait in line through an infrared sensor and displays it for both customers and employees to see (Berry and Cooper, 1992). At Red Lobster restaurants, waiting-on staff enters food orders into an order processing system. Kitchen staff input the time the order was ready (standard preparation time is ten minutes) and waiting-on staff input the time the order was served (service standard is three minutes after order was ready). Any deviations from the standards are flagged by the order processing system. If an order is late, dining room managers are able to identify it and explain the delay to the waiting customer.

Offering service through several outlets increases the convenience of access for customers, but may raise problems of quality control and consistency of service. Large franchise operators, such as McDonald's, Pizza Hut and Mrs. Field's Cookies, address this problem through strict application of service standards and real-time performance measurement systems. These chains' control systems are so precise that their

headquarters can tell in minutes when something goes wrong in a decentralized unit, and often precisely what the problem is (Berkley and Gupta, 1995).

2.4.3 Output Information

Output quality measures provide ending information on which to judge the extent to which service met customer expectations. Generally, service quality measurement has lagged behind product quality measurement because services are often produced and consumed simultaneously and services are intangible – there is no physical product to inspect. Consequently, many service organizations are unaware of the level of service they provide and of how Information customers perceive their service. Naturally, if the service level is not assessed, there is no way it can be improved.

Output quality measures can be internal or external. Internal measures include objective measures, such as average cycle time or average customer waiting time, that can be compared against performance standards. Internal performance measures can also include subjective employee assessments of quality. External measures, on the other hand, are customer assessments of service quality. To obtain a balanced and realistic picture, service firms need to obtain service quality measures from both internal and external sources.

- *Internal quality measures:* Service standards specify what should be done, but not necessarily what is done. Assuming that service standards are based on customer expectations, the next step is to measure actual performance. This information should then be provided to the people with the most influence over actual performance – the

performers themselves. Service employees who are good at what they do generally want to be measured on how well they are doing. To affect performance, employees must know what the measures are, what levels of performance are acceptable, what the performance measures mean and how they as individuals can effect those measures.

Employees who speak to, write to and face customers daily are valuable assets to a company in measuring and evaluating service quality. These employees are often the first to know when a service is not well received by customers or is not well executed by the company. Under the right conditions, they can show management how to improve the company's service. Frontline employees must be trained to find out what customers like and do not like, and this information must be communicated up and down the organization. Surveys are one method of obtaining employee input as an internal measurement of actual service delivery. Surveys also have value in identifying those areas where employees feel they are blocked by company policies from delivering superior service to customers, awkward procedures and system restrictions (Wilderom, 1991).

Research has shown that service employees treat customers similarly to the way in which they, as employees, are treated by management (Kelley, 1987). If employees are cold or cramped, if they work in dirty conditions, or if they generally feel like second-class citizens, chances are they are not likely to deliver first-class treatment to customers. Service-oriented companies recognize the connection between employee satisfaction and customer satisfaction, and measure both regularly.

As with customers, it is not what management *does* that is important, it is what employees *perceive* that counts. If management does not conduct employee surveys, it could be deluded into thinking everything is fine.

- *External quality measures:* The best judges of whether service delivery actually is meeting or exceeding customer expectations are, of course, customers. Unfortunately, one of the chief ailments afflicting service companies today is the lack of systems adequate for collecting and acting on customer data. Most services depend solely on customers' complaints to stay in touch. The problem is that complaints are a woefully inadequate source of information. Only 4 per cent of customers with problems actually complain. The other 96 per cent stay dissatisfied, telling an average of nine to ten other people of their dissatisfaction (Zeithaml *et al.*, 1990). Those firms which initiate customer surveys frequently collect the wrong information. Typically, customers are polled to calculate "service satisfaction" scores (the percentage of customers rating a service as excellent, good, fair or poor). But this approach provides little usable data about customers' perceptions of actual service quality and little guidance about improving performance. To understand customers' views of service sufficiently, companies must understand their service at a much finer level of detail (Coyne, 1989).

A simple method to measure customer reaction is to ask selected customers to audit actual service delivery. Auditing systems include comment or rating cards available at service-delivery points, postcard style questionnaires mailed to recent customers, routine telephone research, and service delivery personnel asking for

comments and ratings and recording them in front of customers. Regardless of the form of the data, customer satisfaction tracking systems should tabulate the information quickly and distribute it to the employees responsible for the service being measured.

To obtain effective customer feedback, service firms must make it easy for customers to comment. Marriott's Fairfield Inn hotel chain obtains customer feedback using a simple personal computer-driven checkout game called *Scorecard*. The game requires only 15 seconds to play, and encourages guests to provide feedback on the cleanliness of their rooms, the level of hospitality at check-in and check-out, and the overall value of their experience. In contrast to the more traditional – "Will you let me (Bill Marriott) know?" – Marriott hotel room questionnaire, which provides under a 5 per cent response rate, Fairfield Inn's customer feedback rate is around 50 per cent. This is essential, because responses keyed to specific check-in and check-out times and room assignments provide daily customer feedback by employees. The data are accumulated at each inn weekly, posted monthly and used as part of a quarterly performance review for every employee (Ray, 1989).

- *Complaints and compliments:* Customer complaints provide valuable information regarding service quality problems. A problem resolution situation should be viewed as an opportunity to learn how to improve service. The greatest risk is that customers will not bother to complain, but will simply generate negative word-of-mouth advertising and take their business elsewhere. Service firms should welcome complaints and make it easy for customers to complain. For example, British Airways

has installed what it calls VideoPoint booths at Heathrow Airport in London so travelers can videotape their reactions on arrival. Customer service representatives then view the tapes and respond (Hart *et al.*, 1990).

The closer to the point of service delivery, that a complaint can be made, the better. Experience in many companies indicates that it takes longer to handle an escalated complaint at the head office than it does at the point of service. Once a complaint is lodged, fast response is the key. Customers should not have to wait weeks to get an answer or to get a problem resolved. At Coca-Cola complaints are logged into a complaint handling system and shared with all departments for analysis of likely causes and appropriate corrective action. As soon as the investigation is complete and an effective corrective action has been found, the customer receives a complete report of the root cause and the actions taken, usually within 48 hours (Brown, 1992).

Successful service firms track complaints by type (e.g. poor employee attitude, slow service), by frequency and by department. This is done because many service problems are not so obvious and, without adequate tracking systems, often go undetected. For example, one company's audit report showed that a major account holder had called each month for 16 months to report billing errors. The bills were wrong each month for exactly the same reason, and the company happily altered all 16 bills (Lash, 1989). Some service companies also use complainant satisfaction tracking systems to measure the success of their complaint handling systems. These systems generally send customers who have complained a postage-paid reply card for

evaluating the way their complaints were handled. Customer replies can then be tabulated by individual customer service representative, by location or by teams of com-plaint handling personnel.

Customer feedback is not all bad. Service firms also receive compliments. Customer compliments provide an opportunity to increase employee motivation and improve service quality. Unfortunately, many companies do not have an organized system for routing compliments back to employees. This is particularly true for geographically widespread organizations where a compliment might be received in Singapore about service delivered in Paris. Verbal compliments should be recorded (the format is not important) and, with written comments, passed on to all employees who contributed to the service complimented and to their immediate supervisors. Typically, the effort and money spent on using compliments to motivate and encourage superior performance are returned many times over.

- *Service recovery:* The best service is preventive rather than reactive. But, despite one's best efforts, mistakes are a crucial part of every service. Even the best service companies cannot prevent the occasional late flight, burned steak or missed delivery. The fact is, in services – often those delivered in the customer's presence – errors are inevitable. But dissatisfied customers are not. A good service recovery can turn angry, frustrated customers into loyal customers. Good recoveries can, in fact, create more goodwill than if things had gone smoothly in the first place (Hart *et al.*, 1990).

Service failures are best resolved when and where they happen, before they become costly to resolve and before they create lost revenue. To resolve problems

when they occur, frontline personnel must be trained and encouraged to use their judgment. Employees need enough data to solve problems and make decisions while the customer is still present. Service recovery management begins with customer values – the expected value of future profits lost when a customer departs unhappy. With customer values, managers know how much they can justify spending to retain unhappy customers. Service firms often underestimate these values and therefore undermanage ways of avoiding customer losses. In many cases (such as billing problems), recovery efforts require customer account histories and data from several company departments. If problems are to be solved on the customer's first call, this information must be readily available to customer service personnel. For example, image processing of credit card slips at American Express allows customer service representatives to find image records of customer transactions in seconds. At Cigna Corporation, customer service representatives use Windows-based visualization software to toggle between systems in other departments to gather account information (Hoffman, 1993).

To prevent problems recurring, and to prevent weak recovery efforts that fail the customer twice, some firms use recovery-tracking systems that capture information pertaining to each instance of recovery service. This information is available so that all employees who deal with a particular customer will know what occurred, what recovery methods were used and what commitments were made. For instance, if a restaurant *maître d'hôtel* seats a patron with a reservation very late and promises a free dessert, the waiting-on staff should not later add this dessert to the

customer's bill. To ensure accurate data, customer service representatives should be able to input information directly into the recovery tracking system. Direct access also facilitates retrieval of information helpful to recovery efforts.

- *Customer defections:* Measuring service quality objectively through conformance to standards and subjectively through customer surveys is not enough. These techniques miss former customers who have left over the company's handling of an irregular situation. Identifying defecting or lost customers and measuring defection rates can provide a way to measure and improve service quality. The idea is to identify those customers who stopped doing business with the firm, then find out why. Defections can then direct managers' attention to the specific things that are driving customers away.

To measure defections one must have a defections scanning system to identify customers who have ended their relationship with the firm. If service or billing histories of customers are available, defections are easily identified by scanning the dates of last account activity. Alternatively, many service firms, such as airlines, hotels, restaurants, rental car agencies, retail stores and even grocery stores, now have membership programs and customer databases. Often, customers are given a membership card that entitles them to discounts, and all subsequent purchases are logged against the card number. These databases then provide service managers with an easy way to identify inactive customers and, often, clues as to why customers are no longer buying.

In the conclusion of this section, the product quality depends on process quality (information quality) and this model is a basis of this research to determine the effect of process quality on product quality in the banking.

2.5 Banking Industry and Information Functions

2.5.1 Internal and External changes

Over the past two decades, changes in the retail banking industry caused what some call "the most serious bank crisis since the Great Depression" (Furash, 1993). Internal and external changes are altering the fundamental nature of banking and bank strategies in many industrialized parts of the world, including the USA (Berger *et al.*, 1995), Canada (Drew, 1995), Europe (Canals, 1993), and Australia (Broadbent and Weill, 1991). Unfortunately, most banks are uncertain how to deal with these changes. Some analysts argue that the current merger and acquisition strategy is only a short-term solution and that, when it comes to real survival strategies, banks are "clueless" (Pare, 1995). In fact, if industry analysts are correct, these changes may mean the end of traditional banking as we know it. As Furash (1993, p. 20) put it: "Banking is essential to a modern economy. Banks are not. If some other entity performs the functions of banking faster, smarter, or cheaper, it will replace banks."

While the overall market continues *to* grow, retail banking in the USA and other countries continue to lose considerable market share (Berger et al). For example, the highest revenue segment of the retail banking market, those households with over $1 million in investible net worth excluding houses, grew by 13 percent in 1994. However,

retail banking's share of that market segment dropped by 33 percent during the same period (Palmer and Scheide, 1995). This statistic is even more unnerving when considered with its counterpart: 50 percent of a bank's value typically comes from the top 3-5 percent of its customers, while 60-80 percent of its costs come from the bottom 20 percent (Bird, 1997). What this means is that not only are banks losing customers to competitors, but they are losing their most profitable customers while being left with their most costly customers. Furthermore, as technology continues to drive down costs, it becomes easier for new competitors to enter the market and target the top customers of the banks with better prices (Nelson, 1999).

What are banks to do? To address these issues banks must become better at attracting and retaining top customers. Industry publications from 1970 onward provide little evidence of banks having information systems capable of supporting the needs of marketing. At the same time, other companies or industries have had demonstrable success in developing effective marketing information systems (Blattberg *et al.*, 1994), with Sainsburys and Tesco in the UK and companies such as USAA in the USA being outstanding examples within the financial services industry. The apparent failure of most banks to successfully integrate marketing and information services suggests that bank managers are not effectively managing the interface between the two functional areas (Nelson, 1999).

2.5.2 Banking and IT

The financial services industry is the largest consumer of IT in the USA, exceeding even the government (Expert Choice, 1996). Today banks spend nearly 20 percent of their noninterest expense money on information technology (Expert Choice, 1996). Technological innovations reduced both geographic and economic barriers to competition, and created an added dimension of uncertainty within the industry (Greenspan, 1997). Automated teller machines (ATMs) significantly reduced geographic barriers and helped banks better serve their customers. Other advances facilitated an increase in the number of products that banks provide, most of which are "systems-dependent," which means they are "fundamentally different from older, traditional products" and are "all vitally linked to systems technology" (Steiner and Teixeira, 1990, p. 23). Increasingly, banking products are information products. However, information technology is not providing most banks or their customers what they need: value-rich content, rather than speed of transaction processing (Bird, 1997). As Furash (1996, p. 13) notes:

> Technology is neither the master nor the magic bullet of banking's future. Yes, its opportunities are driving the future of financial services. Yes, non-bank competitors are using it to simulate and replace traditional banking services - particularly payments systems. But in and of itself, technology is not the problem, nor is it the panacea to banking's competitive dilemma.

Unfortunately, non-banks have often been better at taking advantage of new technologies to capture market shares from retail banks (Berger *et al.*, 1995). Banks must learn to manage technology and the fundamental changes it has on the industry. One area

of opportunity for banks is the use of technology to improve customer relationships and marketing effectiveness (Bird, 1997). However, often banks have been unable to effectively link their information services and marketing activities due to a poor interface between the two functional areas.

2.5.3 The Marketing and Information Services Interface

Improving the marketing and information services interface is an important issue for bank managers. There is increasing evidence that effective use of information technology to support marketing improves marketing's performance and improves competitive positioning (Blattberg *et al.*, 1994). This appears to be particularly true within "information intensive" or "technology intensive" industries such as banking (Bettis and Hitt, 1995). Interface management is the process of communication and cooperation between two or more functional areas. Effective interface relationships "facilitate product management; augment diffusion of innovations; and assist in the implementation of business strategies" (Sashittal and Wilemon, 1994, p. 693). Rockart and Short (1989) argue that improving the effectiveness of cross-functional interfaces is more critical to responding to environmental pressures successfully than is optimizing operations within a department.

In a study conducted among bank marketers, Easingwood and Arnott (1991) found that "relations with the data processing (information services) department" ranked fourth in terms of its "current effect on performance" and "scope for improvement". Interestingly, the marketing managers ranked the same topic as 14th in priority for

research or attention because "they think improvements are not easily made in this area" (Easingwood and Arnott, 1991, p. 12). Thus, while marketing managers in the financial services industry believe that progress will be slow in this area, it is clear that they believe improving the marketing and information services interface is an important issue for the industry.

Although there are studies in the academic literature that address changes both internal and external to banks, it appears that few studies directly examine the interface between the information services and marketing functions. Much of the marketing literature in this area concentrates on traditional interface relationships, such as the interface between the marketing and R&D functions (Sashittal and Wilemon, 1994). A similar problem exists within the MIS literature, which focuses primarily on vertical integration, or the alignment of information technology plans with particular business strategies (Nelson, 1999).

Finally, it is important to emphasize that for some time, other industries have been effective at implementing programs to gather and use customer information for marketing purposes. There is ample evidence that it is increasingly important for organizations to make effective use of IT to support marketing management, particularly in competitive or rapidly changing environments (Marshall and LaMotte, 1992). If other industries, such as consumer-packaged goods, have successfully used IT to support marketing and build customer relationships for years, why have most banks been less successful at developing effective marketing information systems (Nelson, 1999)?

In the conclusion of this section, the product quality depends on process quality (information quality) and this model is a basis of this research to determine the effect of process quality on product quality in the baking.

2.6 Literature Review: Ergonomics and Service Quality

The CAMSE Framework is based on a customer service framework proposed by Chen and Drury (1997). As shown in Figure 2.1, these five basic components in customer service are: customer, agent, machine, support, and environment. Customer service can be seen as the sequence of activities through which a customer (C) interacts with a service system on order to fulfill their needs for service. In must service systems, the customer-contact employee, or the service agent (A), is the primary interface that represents the service system and interacts with the customer. During any customer service encounter, the service agent often also needs to operate a set of machines (M), mostly computer-based to find information (such as availability or price) regarding the potential service requested as well as to perform service transactions. Their service agent may also interact with support personnel (S) such as technical support or managerial support to facility at the service process.

Furthermore, the component interactions and their performance in this CAMS system are in fact influenced by the environmental component (E). The environment factors are physical surroundings, atmosphere, communication media, or event the policies /rules/practices that m ay affect the operations of the basic CAMS system.

Therefore, a complete customer service framework should not only be composed of the four basic system components (CAMS) but also include the environment component (E).

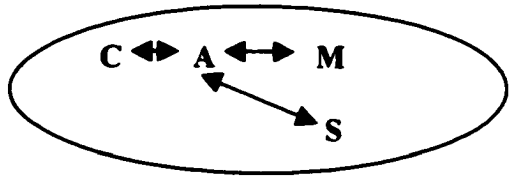

Fig. 2.1: CAMSE Frameworks

2.6.1 An Ergonomics Approach Toward Service Quality in the Banking Industry

In the previous chapter the characteristics of service quality were discussed and further it was examined that the customer participation and customer-employee interactions are essential to customer service. It is not difficult to see that the customer and the contact personnel are two important entities of any service system. Several survey-based studies of service satisfaction also suggest that the human interaction component of service delivery is essential to the determination of customer satisfaction.

Very limited effort, however, has been directed towards providing useful information for redesigning service processes/operations for better quality in the banking industry. In order to understand how service takes place in customer service settings, human factors principles was used to develop a framework for service quality. Therefore, the effect of work comfort on service quality needs to be tested in order to provide suggestions for system improvement from a human factors perspective.

In the conclusion of this section, the product quality depends on process quality (Ergonomics) and this model is a basis of this research to determine the effect of process quality on product quality in the banking.

In the final conclusion of the literature review is that, the product quality depends on process quality (information quality and ergonomics) and these two models are the basis of this research to determine the effect of process quality on product quality in the banking.

CHAPTER 3

RESEARCH RATIONALE

This chapter presents the rationale behind this research. The chapter is divided into four main sections. The first section presents the main conclusions drawn from the literature. The second section provides the rationale for this research. The third section provides the statement of the problem. The fourth section provides the hypotheses of this research.

3.1 Conclusions Drawn from the Literature

Most of the research studies conducted over the past few decades that were presented in Chapter 2 dealt with service quality improvement, different types of measurement to improve service quality, quality information improvement, and ergonomics issues in the organizations. As businesses, and particularly the banking industry, shifts toward e-commerce and a 24-7 economy, the need for current, accurate, quality information is urgent for enterprising competitors. Identifying the types of data required to serve ever more demanding and less patient consumers is the key to survival in the modern economy. The intangible product of excellent service that is both expected and demanded by consumers is the key to loyalty to the business, and will be the driving factor in business growth and development.

Defining information requirements is perhaps the most neglected aspect of the information management process. One explanation is that the high cost of implementing information technology generally focuses management's attention on the technology

(hardware and software) and preempts discussion of issues concerned with the information itself. Because of the failure to focus on information issues, few organizations know what information they have or need (McGee and Prusak, 1993).

3.1.1 Why is Process Quality Very Critical in any Organization?

Poor information quality is pervasive and costly to industry. Redman reports that error rates of 1-5% are typical, with an estimated immediate cost of about 10% of revenue (Redman, 1996). Customers, suppliers, distributors, and employees are negatively impacted through poor service, billing errors, and inconvenience. Data quality problems are exacerbated in large organizational databases where data are collected from multiple data sources.

According to Brkley (1995), in high customer-contact services, a firm's ability to deliver quality service depends on its capacity to collect, process and distribute information. The input function in services includes assessing customer expectations, specifying the expected service and setting corresponding service standards. Good service providers have communication processes to facilitate the collection of customer data, suggestions, requests and transactions into customer databases. These databases can then be used to construct detailed customer profiles, eliminate service-specification errors, speed service and improve service consistency.

Process information is that information required by employees or customers while the service is actually being delivered. First, service providers must possess the required knowledge to perform the service. For many service firms, much of this knowledge can

be accumulated in databases and distributed using decision support systems. To control service operations, managers need systems to collect, process and distribute information on actual business performance. Customer tracking and order processing systems use transaction data to maintain real-time records of customer and job status while also ensuring customer security. Quality control systems compare process data and service standards to determine if corrective actions are required. The objective is to make corrections before problems are created and customers complain. Output information is used to determine whether customer expectations are met.

3.2 Research Rationale

Based on the discussions provided in the previous two sections, the following conclusions were drawn to establish the research rationale:

1. There has been a great deal of research to study the effect of new technology (voice mail, internet banking, ATMs, EFT . . .) on both internal and external service quality. On the other hand, no attention has been given in the academic and trade literature to identify the information requirements and information quality needed to deliver quality service.
2. There has not been any research to relate the information quality (process quality) to the service quality (product quality) in any organization especially in the banking industry.
3. Very limited effort, moreover, has been directed towards providing useful information for redesigning service processes/operations for better quality in

the banking industry. In order to understand how service takes place in customer service settings, the ergonomics principle will be used to develop a framework for service quality. Therefore, the effect of ergonomics (process quality) on service quality (product quality) needs to be tested in order to provide suggestions for system improvement from the ergonomics perspective.

3.3 Statement of the Problem

In manufacturing, consumers judge the quality by evaluating the product manufactured. In contrast, service customers judge service quality by experiencing the service delivery processes as well as the outcome. That is, the service process itself is actually a part of the "product". This process character of service was first recognized and developed by marketing researchers (Eiglier *et al.*, 1977). Bitner (1993) also identified process as one of the major forms of service evidence experienced by the customer, along with people and physical evidence. Therefore much tighter production plans are needed to assure service quality.

The ACSI (American Consumer Satisfaction Index) report shows a consistent quarter-by-quarter decline in customer satisfaction since ACSI inception in 1994. Although a modest increase occurred in 1998 in the insurance industry, most other service categories like restaurant, hospital, and banking have continued to decline. Based on the ACSI data and other published studies, the banking industry may have some cause

for concern. A survey of more than 800 bank customers indicated that the majority of bank customers believed that service had not improved over the past five years. Many customers believed that, in fact, customer service had got worse. Written complaints to banks were up 8.4 percent from the previous year, and bank customer satisfaction reports revealed that a quarter of all respondents found mistakes on their current accounts (Barret, 1997).

The banking industry is finally waking up to the concept of improving service quality that leads to customer satisfaction. Customer satisfaction is the outcome of service quality, which depends on the process quality. There has not been any research to relate the process quality (Information quality and Ergonomics) to the service quality in any organization especially in the banking industry. Thus the objective of this research is to investigate the impact of the process quality on product quality.

3.4 Models and Hypotheses

Figure 3.1 can depict the overall conceptual IQ and service quality model.

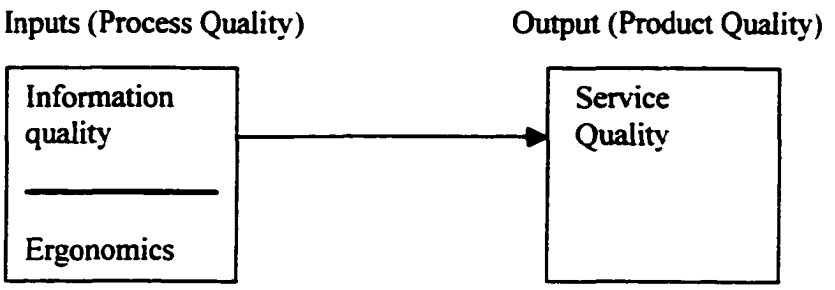

Fig.3.1: Overall Conceptual IQ and Service Quality Model

The hypothesis in this study will examine:

1. The impact of IQ (information quality) on quality of service in the banking industry.

Hence, it is hypothesized that:

H1: Information quality has a direct positive effect on quality of banking service.

2. The impact of ergonomics (noise, temperature, air quality, chair, the glair of lighting, and workstation) on quality of service in the banking industry.

Hence, it is hypothesized that:

H2: Ergonomics have a direct positive effect on quality of baking service.

3. The impact of dimensions of service quality on overall service quality.

Hence, it is hypothesized that:

H3: Service quality dimensions have direct positive effect on overall quality of banking service.

4.The impact of ergonomics dimensions on overall work comfort in the baking industry.

Hence, it is hypothesized that:

H4: Ergonomics dimensions have direct positive effect on overall work comfort in the banking industry.

5. The differences of mean score for dimensions of service quality between banks and the branches.

Hence, it is hypothesized that:

H5: The mean score for dimensions of service quality for banks and branches are the same.

6. The differences of mean score for dimensions of information quality between banks and the branches.

Hence, it is hypothesized that:

H6: The mean score for dimensions of information quality for banks and branches are the same.

7. The differences of mean score for dimensions of ergonomics between banks and the branches.

Hence, it is hypothesized that:

H7: The mean score for dimensions of ergonomics for banks and branches are the same.

Chapter 4

METHODOLOGY

This chapter provides the population under study and data analysis techniques.

4.1 Population Under Study

4.1.1 Service Quality Study

Two different large regional banks in Nebraska were selected (Bank A with 3 branches and Bank B with 2 branches). To get the cooperation of the management and marketing department the research study was discussed and they were informed regarding the objective of this research and how it would be beneficial to them and to the organization. A Sample of 800 customers was randomly selected from five branches and the service quality questionnaires were sent to them by mail. The service quality questionnaire is shown in the appendix. The overall response rate was 468 / 800 = 59% and the following table shows the breakdown of sample sizes and response rates for the banks and the branches:

Table 4.1: Customers Response Rate

Banks	Number of contacted customers	Number of Respondents	Response Rate
A1	160	92	58%
A2	160	81	51%
A3	160	73	47%
B1	160	117	73%
B2	160	105	66%

A 22-item instrument called SERVQUAL was originally used for assessing customer perceptions of service quality in service and retailing organizations in a study by Parasuraman (1993). For each item, a difference score Q (representing perceived quality along that item) was defined as Q= P – E, where P and E are the rating on the corresponding perception and expectation statements, respectively. In 1993, it was argued that "SERVQUAL failed to achieve discriminate validity from its component and the non-difference score measure did not exhibit these problems (Brown 1993).

For this research, a non-difference score measure was used and score for each dimension of service quality was computed by taking the average score in items making up the dimension, in this case 3 items per dimension. The questionnaire was developed to identify underlying dimensions of bank quality and to assess consumers' perceptions of the importance of each of these dimensions. The questionnaire covered the five dimensions of service quality, including the overall service quality of the bank. Each question is rated using a Likert-type scale on a scale of 0 to 10 where 0 indicates "poor" and 10, "excellent." This questionnaire has been used effectively in both public and private sectors.

4.1.2 Information Quality Study

Two different large regional banks in Nebraska were selected to visit and personal interviews were conducted to get the cooperation of employees who use information to serve internal or external customers. All the employees were approached to solicit responses for the questionnaire. Employees were informed regarding the objective of this

research and how it would be beneficial to them and to the organization. The IQ (information quality) questionnaires (Wang and Strong, 1996) were sent to 278 employees of the banks that use information to serve internal or external customers. The information quality questionnaire is shown in the Appendix. The overall response rate was 236 / 278 = 84% and the following table shows the breakdown of sample sizes and response rates for the banks and the branches:

Table 4.2: Employees Response Rate

Banks	Number of contacted customers	Number of Respondents	Response Rate
A1	60	53	88%
A2	53	42	79%
A3	42	38	90%
B1	67	55	82%
B2	56	48	85%

Each question is rated using a Likert-type scale on a scale of 0 to 10 where 0 indicates "not at all" and 10. "completely." This questionnaire has been used effectively in both public and private sectors.

4.1.3 Ergonomics Study

The ergonomics questionnaire was sent along with the information quality questionnaires to the employees of the banks. The ergonomics questionnaire is shown in the Appendix. The overall response rate and the breakdown of sample sizes and response rates for the banks and the branches is the same as information quality questionnaire as

shown in Table 4.2. Each question is rated using a Likert-type scale on a scale of 0 to 10 where 0 indicates "poor" and 10, "excellent." This questionnaire has been used effectively in both public and private sectors.

4.2 Data Analysis techniques

Data analysis were conducted using SAS statistical package in nine stages:

- Descriptive statistics: Descriptive statistics (tabular and graphical) was used for the dimensions of service quality, information quality and ergonomics to compare and interpret means and standard deviations as a preliminary analysis.
- ANOVA (General Linear Models): ANOVA (General Linear Models) using nested design was conducted for the dimensions of service quality, information quality and ergonomics to find the differences of rating between banks and within the branches and also to identify and to assess the dimensions of service quality, information quality, and ergonomics.
- Regression Analysis (Service Quality): Stepwise regression analysis was developed for model building with overall service quality as a dependent variable and five dimensions of service quality (reliability responsiveness, assurance, empathy, and tangible) as independent variables. This analysis was performed for all the banks, bank A, bank B, and each branch to see the relationship between the overall service quality and the other five dimensions.
- Regression Analysis (Ergonomics): Stepwise regression analysis was developed for model building with overall work comfort as a dependent variable and four

dimensions of ergonomics (chair, environment, other, and workstation) as independent variables. This analysis was performed for all the banks, bank A, bank B, and each branch to see the relationship between the overall work comfort ant the other four dimensions of ergonomics.

- Regression (Service Quality vs. Information Quality): Stepwise regression analysis was developed for model building with overall service quality and five dimensions of service quality (reliability, responsiveness, assurance, empathy, and tangible) as six dependent variables and sixteen dimensions of information quality (accessibility, accuracy, amount of information, believability, completeness, concise representation, consistent representation, ease of manipulation, ease of understanding, interpretability, objectivity, reputation, security, timeliness, and value added) as independent variables. This analysis was performed for all the banks, bank A, bank B, and each branch to see the impact of sixteen dimensions of information quality on overall service quality ant the other five dimensions of service quality.
- Regression (Service Quality vs. Ergonomics): Stepwise regression analysis was developed for model building with overall service quality and five dimensions of service quality (reliability, responsiveness, assurance, empathy, and tangible) as six dependent variables and five dimensions of ergonomics (chair, environment, other, and workstation, overall comfort) as independent variables. This analysis was performed for all the banks, bank A, bank B, and each branch to see the impact of work comfort and ergonomic issues on overall service quality ant the other five dimensions of service quality.

- Regression (Service Quality vs. Information Quality and Ergonomics): Stepwise regression analysis was developed for model building with overall service quality and five dimensions of service quality (reliability, responsiveness, assurance, empathy, and tangible) as dependent variables and twenty one dimensions of information quality and ergonomics (accessibility, accuracy, amount of information, believability, completeness, concise representation, consistent representation, ease of manipulation, ease of understanding, interpretability, objectivity, reputation, security, timeliness, value added, chair, environment, other, workstation, and overall comfort) as independent variables. This analysis was performed only for all the banks to see the impact of work comfort (ergonomic issues) and information quality on overall service quality and the other five dimensions of service quality.
- Factor Analysis: Factor analysis was conducted to reduce the number of dimensions and variables associated with service quality, information quality and ergonomics for all the banks using principal component analysis.
- Regression Analysis Using Factor Scores: The selected factors from the result of Factor Analysis were chosen as independent variables and regression analysis was performed again with the same dependent variable as before, but only for all the banks.

Chapter 5

RESULTS

This chapter provides a description of the study results. The chapter is divided into four main sections. The first section provides descriptive statistics (tabular and graphical) for the dimensions of service quality, information quality and ergonomics. The second section provides the results of ANOVA (General Linear Models) for the same dimensions to see the differences between banks and within the branches within the bank. The third section provides the results of Multivariate Regression analysis to establish a relationship between the dimensions of service quality, information quality, and ergonomics variables. The fourth section provides the results of factor analysis to reduce the number of dimensions and variables associated with service quality, information quality and ergonomics.

5.1 Descriptive Statistics

5.1.1 Service Quality

As shown in Fig. 5.1 and Table 5.1, responsiveness, reliability, and overall service quality respectively are the most important dimensions of service quality for all the banks based on the mean values. The descriptive statistics for banks A, B, and branches are shown in the Appendix.

Table 5.1: Service Quality (All Banks)

Dimensions	Mean	Std Dev	Co.Varia.
Resp	7.8625	0.8576	0.1091
Reli	7.8219	0.8389	0.1073
Over	7.7543	0.8390	0.1082
Assu	7.6702	0.7472	0.0974
Emp	7.6474	1.1382	0.1488
Tang	6.9637	0.8537	0.1226

Note: The criteria was to choose the top two

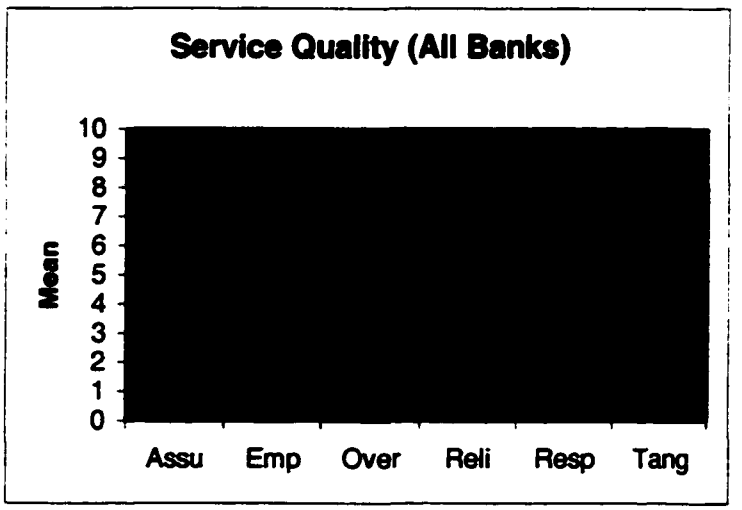

Fig.5.1: Service Quality (All Banks)

5.1.2 Information Quality

As shown in Fig 5.2 and Table 5.2, reputation, believability, and value-added respectively are the most important dimensions of information quality for all the banks based on the mean values. The descriptive statistics for banks A, B, and branches are shown in the Appendix.

Table 5.2: Information Quality (All Banks)

Dimensions	Mean	Std Dev	Co.Varia.	Dimensios	Mean	Std Dev	Co.Varia.
Reput.	9.3463	0.4086	0.0437	Cons.Rp	8.5173	0.4243	0.0498
Belie.	9.2542	0.4151	0.0449	Eas.Man	8.3161	0.3489	0.0420
value	9.1915	0.3119	0.0339	Eas.Un.	8.2618	0.3573	0.0432
Relev.	9.1728	0.3304	0.0360	timel.	8.2237	0.3229	0.0393
Amoun.	9.0233	0.4080	0.0452	Interp.	8.1762	0.3840	0.4080
Conc.Rep	9.0180	0.4507	0.050	**Com.**	8.1413	0.4143	0.0470
Obje.	8.9073	0.5031	0.0565	**Acce.**	7.6699	0.5579	0.0727
Accur.	8.7762	0.5523	0.0629	**Secu.**	6.8538	0.5242	0.076

Note: The criteria was to choose the top three

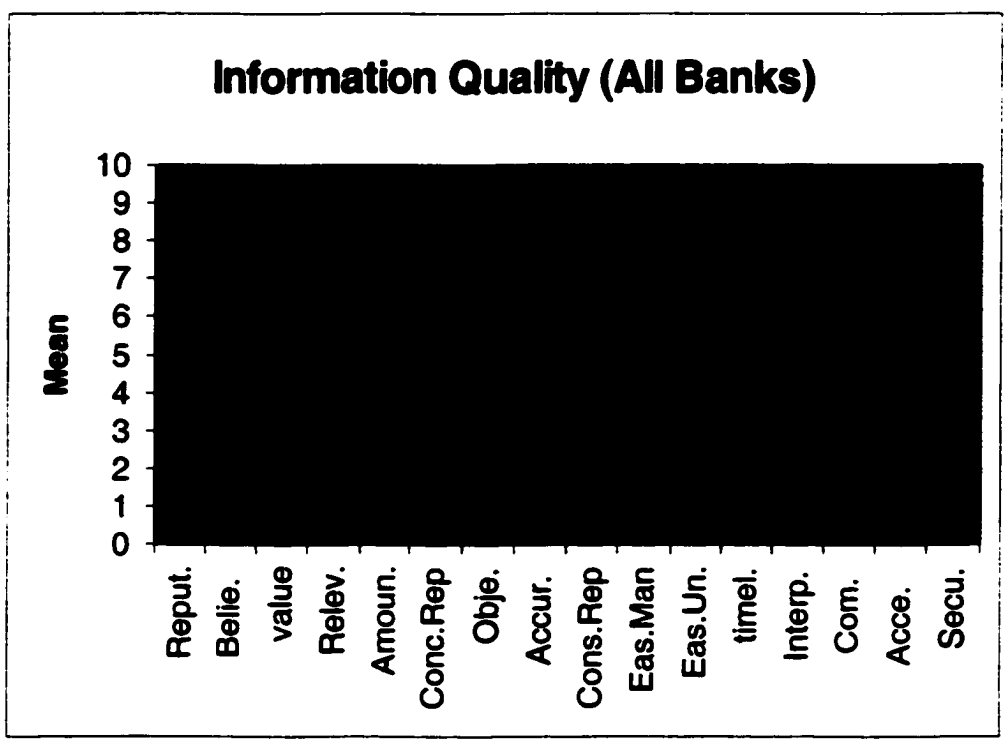

Fig.5.2: Information Quality (All Banks)

5.1.3 Ergonomics

As shown in Fig 5.3 and Table 5.3, chair, environment, and overall work comfort, respectively are the most important ergonomic variables for all the banks based on the mean values. The descriptive statistics for banks A, B, and branches are shown in the Appendix.

Table 5.3: Ergonomics (All Banks)

Dimensions	Mean	Std	Co.Varia.
Chair	8.1762	0.4457	0.0545
Envir.	7.6624	0.6021	0.0786
O.all	7.3644	0.7845	0.1065
Other	6.9728	0.6447	0.0925
WorkSt	6.2850	0.8529	0.1357

Note: The criteria was to choose the top three

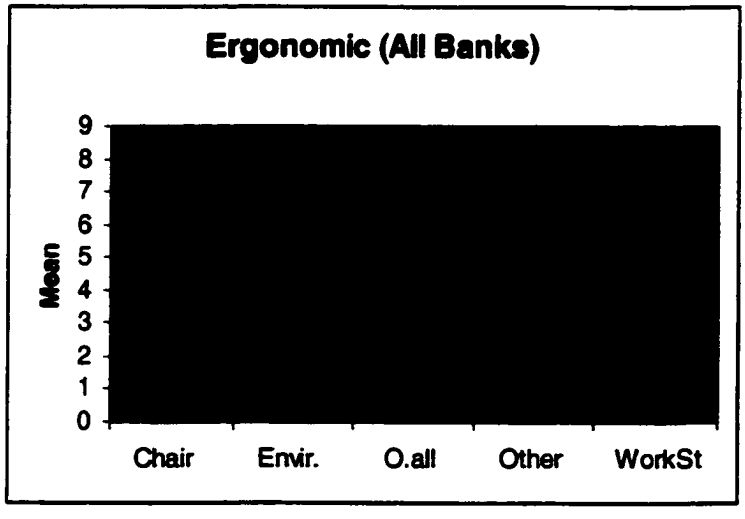

Fig. 5.3: Ergonomic (All Banks)

5.2 The General Linear Models

5.2.1 Service Quality

The general linear models procedure of ANOVA was used to see the differences of dimensions of service quality between banks and among the branches. The branches were nested within the banks. The level of significance was established at the 0.05. The following table shows the ANOVA summary.

Table 5.4: ANOVA Table for Service Quality

Variables	Main Effects	P.Value	Pair wise Comparison of Banks and Branches
Assurance	Branch (Banks) Banks	0.2881 0.0001	 A>B
Empathy	Branch (Banks) Banks	0.0001 0.0001	None of the branches are the same A> B
Overall	Branch (Banks) Banks	0.8087 0.0001	 A>B
Reliability	Branch (Banks) Banks	0.4271 0.0001	 A>B
Responsiveness	Branch (Banks) Banks	0.0087 0.0001	A1=A2, A1=A3, B1=B2 A >B
Tangible	Branch (Banks) Banks	0.0001 0.0001	B1=B2 A> B

Note: A>B means bank A has a higher mean value than bank B for a given dimension.

- Reliability: Table 5.4 shows that the reliability dimension for bank A is significantly different from bank B, but all the branches within each bank are the same in terms of the reliability dimension. Also Fig. 5.4 shows that bank A has a higher mean value for reliability dimension than bank B.

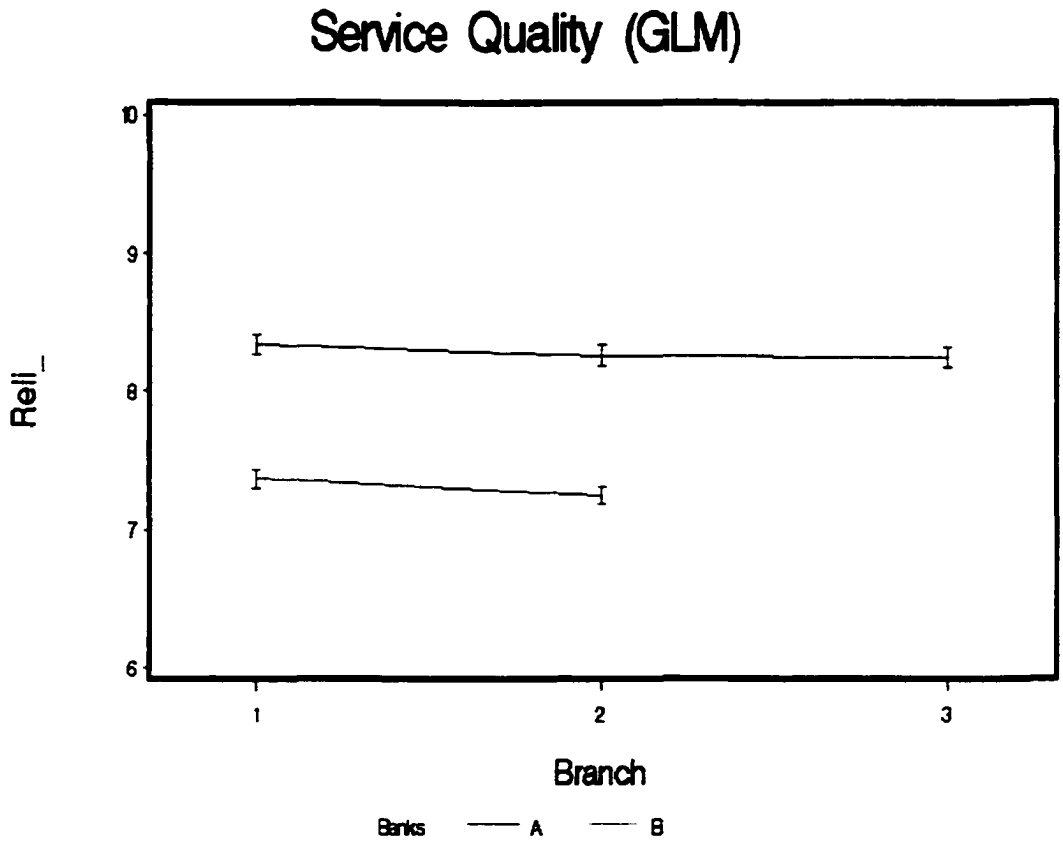

Fig. 5.4: Effect of Reliability on Service Quality

- Responsiveness: Table 5.4 shows that this dimension of service quality for bank A is significantly different from bank B, but all the branches within each bank are the same in terms of responsiveness dimension except branches 2 and 3 within bank A. Also Fig. 5.5 shows that bank A has a higher mean value for this dimension than bank B. Also Fig. 5.5 shows that bank A has a higher mean value for this dimension than bank B. Branch 3 within bank A have a higher mean value than branches 1and 2 (with branch 2 the lowest). Branch 2 within bank B has a higher mean value than branch 1.

Fig.5.5: Effect of Responsiveness on Service Quality

- Assurance: Table 5.4 shows that this dimension of service quality for bank A is significantly different from bank B, but all the branches within each bank are the same in terms of assurance dimension. Also Fig. 5.6 shows that bank A has a higher mean value for this dimension than bank B.

Fig. 5.6: Effect of Assurance on Service Quality

- Empathy: Table 5.4 shows that the two banks and all the branches differ in this dimension of service quality. Also Fig. 5.7 shows that bank A has a higher mean value for this dimension than bank B. Branch 3 within bank A has a higher mean value than branches 1 and 2 (with branch 1 the lowest). Branch 2 within bank B has a higher mean value than branch 1.

Fig.5.7: Effect of Empathy on Service Quality

- Tangible: Table 5.4 shows that the two banks differ in this dimension of service quality. Only branches 1 and 2 within bank B are the same in terms of tangible dimension. Also Fig. 5.8 shows that bank A has a higher mean value for this dimension than bank B. Branches 2 and 3 within bank A has a higher mean value than branch 1(with branch 1 the lowest). The mean values for this dimension for both branches within bank B are almost the same.

Fig.5.8: Effect of Tangibility on Service Quality

- Overall service quality: Table 5.4 shows that the two banks differ in this dimension of service quality, but all the branches within each bank are the same in terms of overall service quality dimension. Also Fig. 5.9 shows that bank A has a higher mean value for this dimension than bank B. All the Branches within bank A have almost the same mean values.

Fig. 5.9: Effect of Overall Service Quality on Service Quality

5.2.2 Information Quality

The general linear models procedure was used to see the differences between dimensions of information quality between banks and among the branches. The branches were nested within the banks. The level of significance was established at the 0.05. The following results based on the ANOVA table were found as shown in Table 5. 5.

Table 5.5: ANOVA Table for Information Quality

Variables	Main Effects	P.Value	Pair wise Comparison of Banks and Branches
Accessibility	Branch (Banks) Banks	0.0001 0.1119	A2=A3, B1=B2
Accuracy	Branch (Banks) Banks	0.7074 0.0001	A>B
Amount of Information	Branch (Banks) Banks	0.7362 0.0001	A> B
Believability	Branch (Banks) Banks	0.3254 0.0001	A> B
Completeness	Branch (Banks) Banks	0.9561 0.0001	A>B
Concise Representation	Branch (Banks) Banks	0.8846 0.0001	A> B
Consistent Representation	Branch (Banks) Banks	0.9480 0.0001	B>A
Ease of Manipulation	Branch (Banks) Banks	0.9909 0.0001	A> B
Ease of Understanding	Branch (Banks) Banks	0.9465 0.0001	A> B
Interpretability	Branch (Banks) Banks	0.8179 0.0001	A> B
Objectivity	Branch (Banks) Banks	0.9666 0.0001	A>B
Relevancy	Branch (Banks) Banks	0.0163 0.0001	A2=A3, B1=B2 A> B
Reputation	Branch (Banks) Banks	0.9575 0.0001	A> B
Security	Branch (Banks) Banks	0.9887 0.0443	A>B
Timeliness	Branch (Banks) Banks	0.7437 0.0001	A> B
Value Added	Branch (Banks) Banks	0.0018 0.0001	A2=A3, B1=B2 A>B

Note: A>B means bank A has a higher mean value than bank B for a given dimension

- Accessibility: Table 5.5 shows that the two banks do not differ in this dimension of information quality. Branches 2 and 3 within bank A and branches 1 and 2 within bank B are the same in terms of accessibility dimension. Fig. 5.10 shows that branch1 within bank A has a higher mean value than all the branches within bank A and B

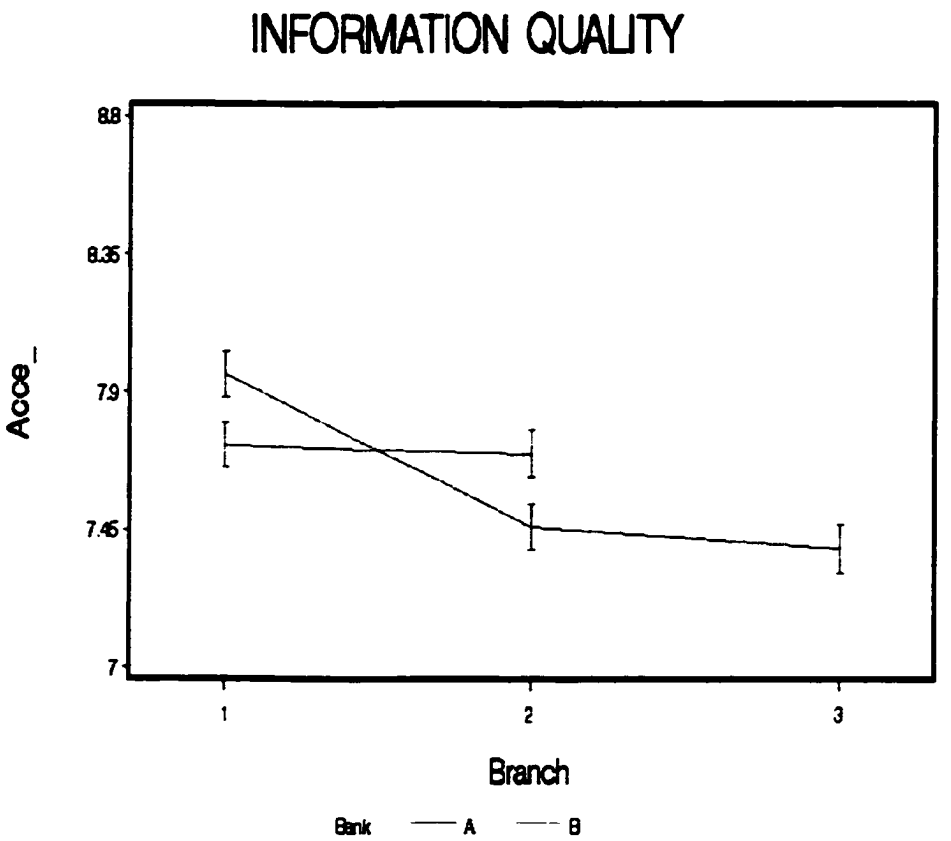

Fig. 5.10: Effect of Accessibility on Information Quality

- Accuracy: Table 5.5shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of accuracy dimension. Also Fig. 5.11shows that bank A has a higher mean value for

this dimension than bank B. Branch 3 within bank A has a higher mean value than branches 1 and 2(with branch 1 the lowest). Branch 2 within bank B has higher mean value than branch 1.

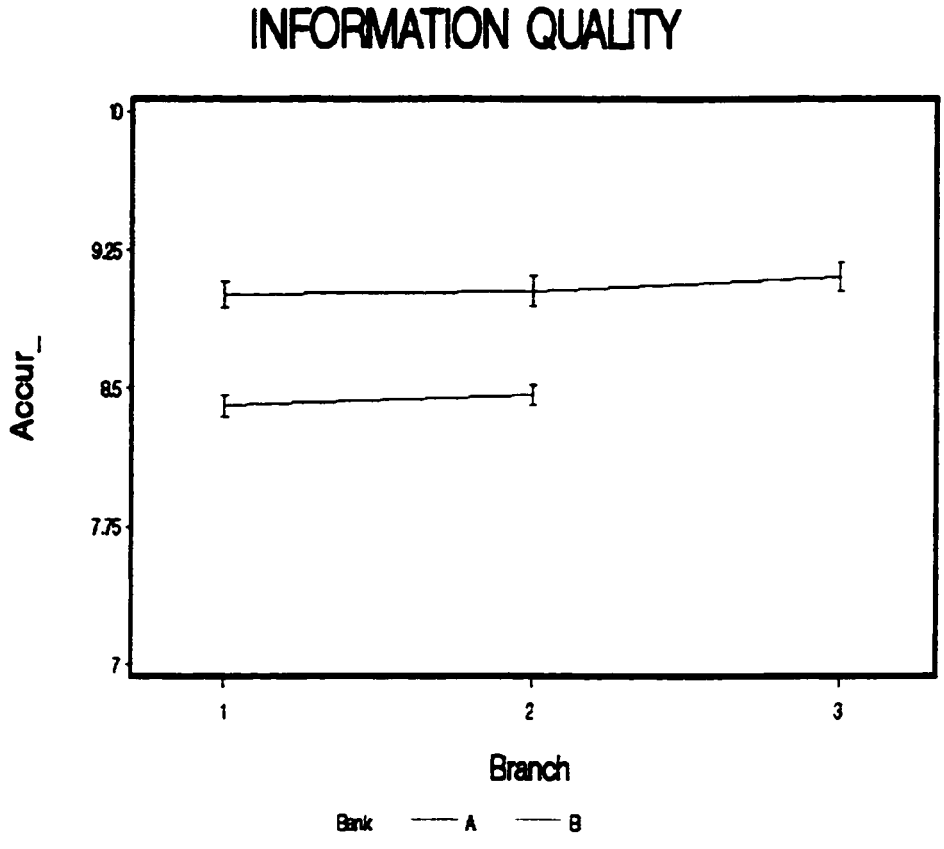

Fig.5.11: Effect of Accuracy on Information Quality

- Amount of information: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of amount of information dimension. Also Fig. 5.12 shows that bank A has a higher mean value for this dimension than bank B. Branches 1 and

3 within bank A have a higher mean value than branch 2. Branch 2 within bank B has higher mean value than branch 1.

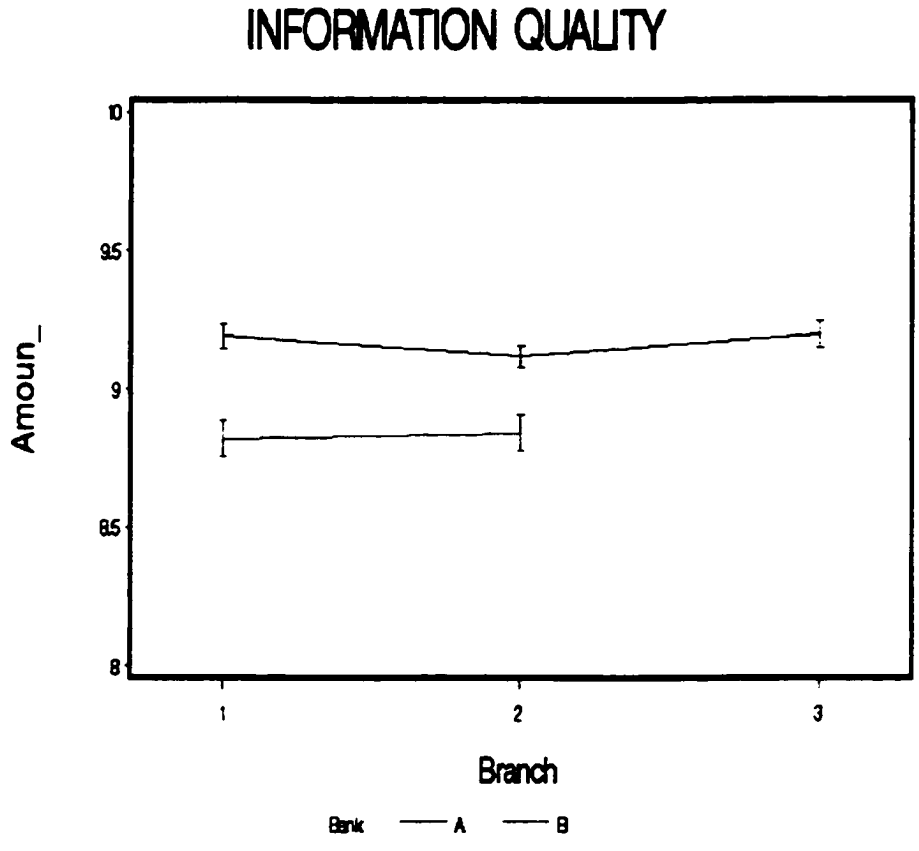

Fig.5.12: Effect of Amount of Information on Information Quality

- Believability: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of believability dimension. Also Fig. 5.13 shows that bank A has a higher mean value for this dimension than bank B. Branch 3 within bank A has a higher mean value than branches 1 and 2. Branch 2 within bank B has higher mean value than branch 1.

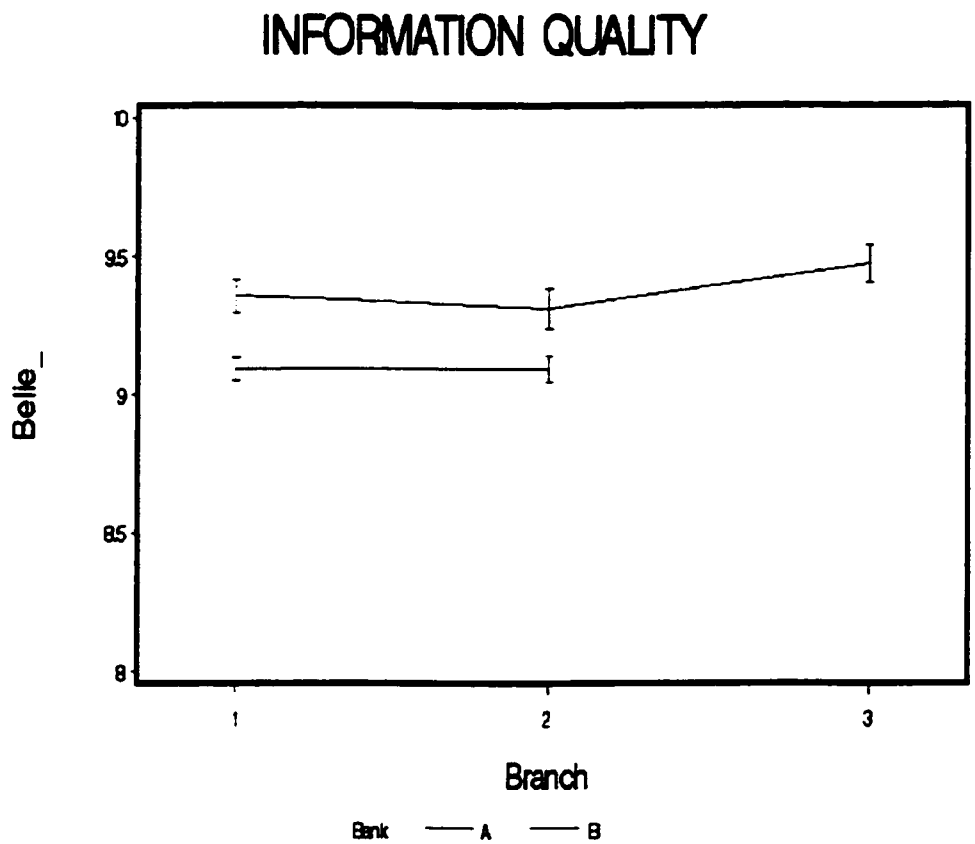

Fig.5.13: Effect of Believability on Information Quality

- Completeness: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of completeness dimension. Also Fig. 5.14 shows that bank A has a higher mean value for this dimension than bank B. Branch 2 within bank A has a higher mean value than branches 1 and 3. Branches 1 and 2 within bank B have almost the same mean value for this dimension.

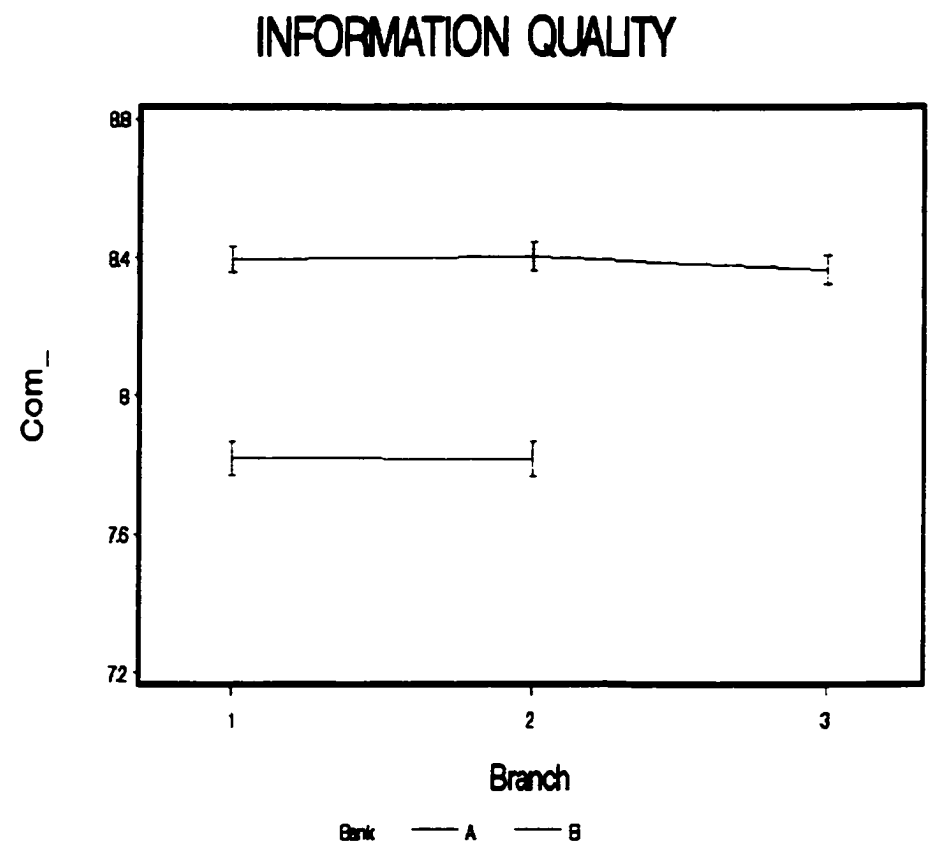

Fig. 5.14: Effect of Completeness on Information Quality

- Concise Representation: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of concise representation dimension. Also Fig. 5.15 shows that bank A has a higher mean value for this dimension than bank B. Branch 3 within bank A has a higher mean value than branches 1and 2(with branch 2 the lowest). Branches1 and 2 within bank B have almost the same mean value for this dimension.

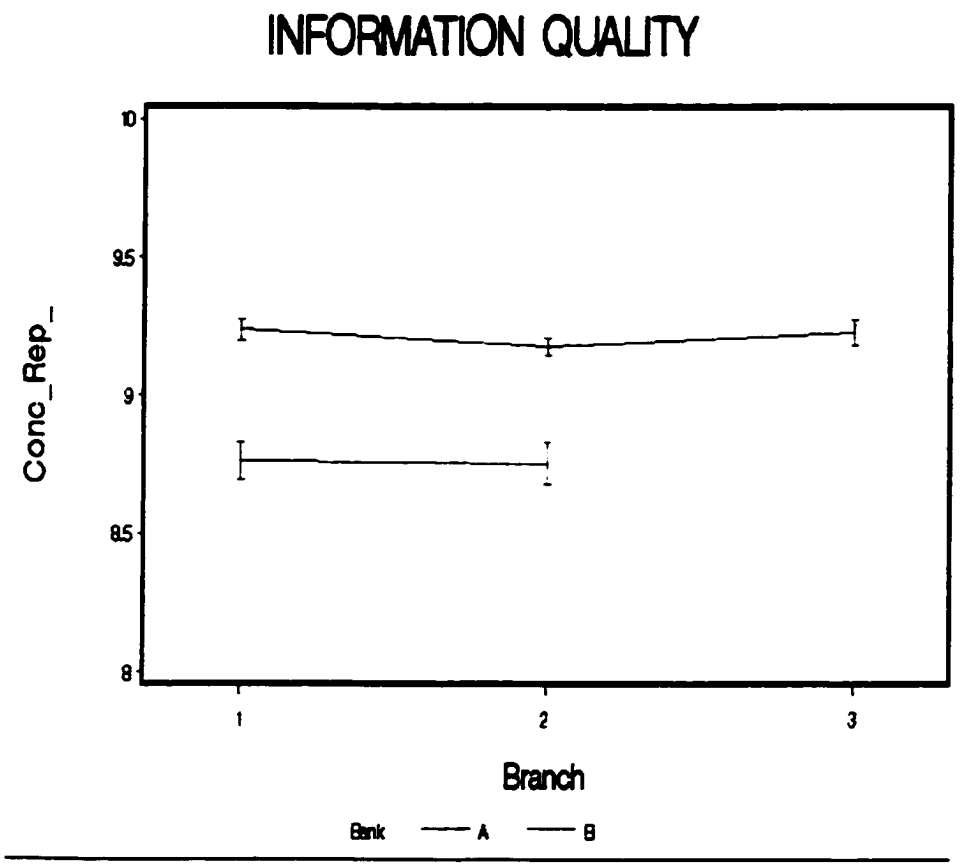

Fig.5.15: Effect of Concise Representation on Information Quality

- Consistent Representation: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of consistent representation dimension. Also Fig. 5.16 shows that bank B has a higher mean value for this dimension than bank A. Branch 1 within bank A has a higher mean value than branches 2 and 3. Branch 1 within bank B has a higher mean value than branch B for this dimension.

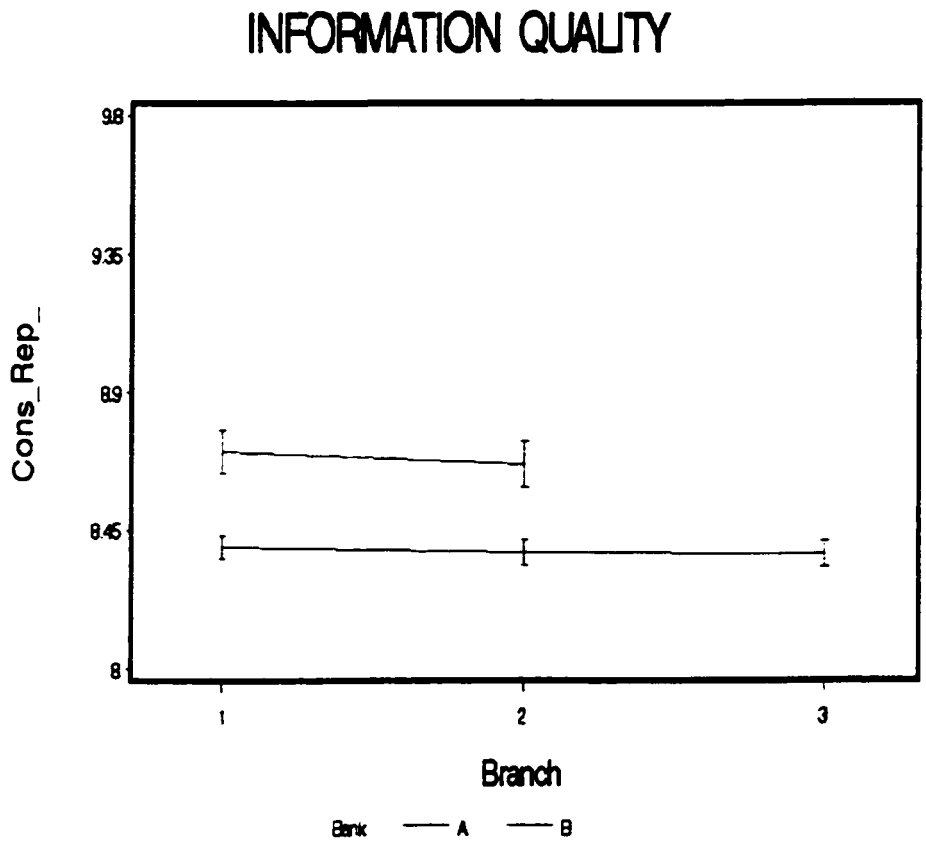

Fig.5.16: Effect of Consistent Representation on Information Quality

- Ease of Manipulation: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of ease of manipulation dimension. Also Fig. 5.17 shows that bank A has a higher mean value for this dimension than bank B. All the branches within bank A and B have almost the same mean value for this dimension.

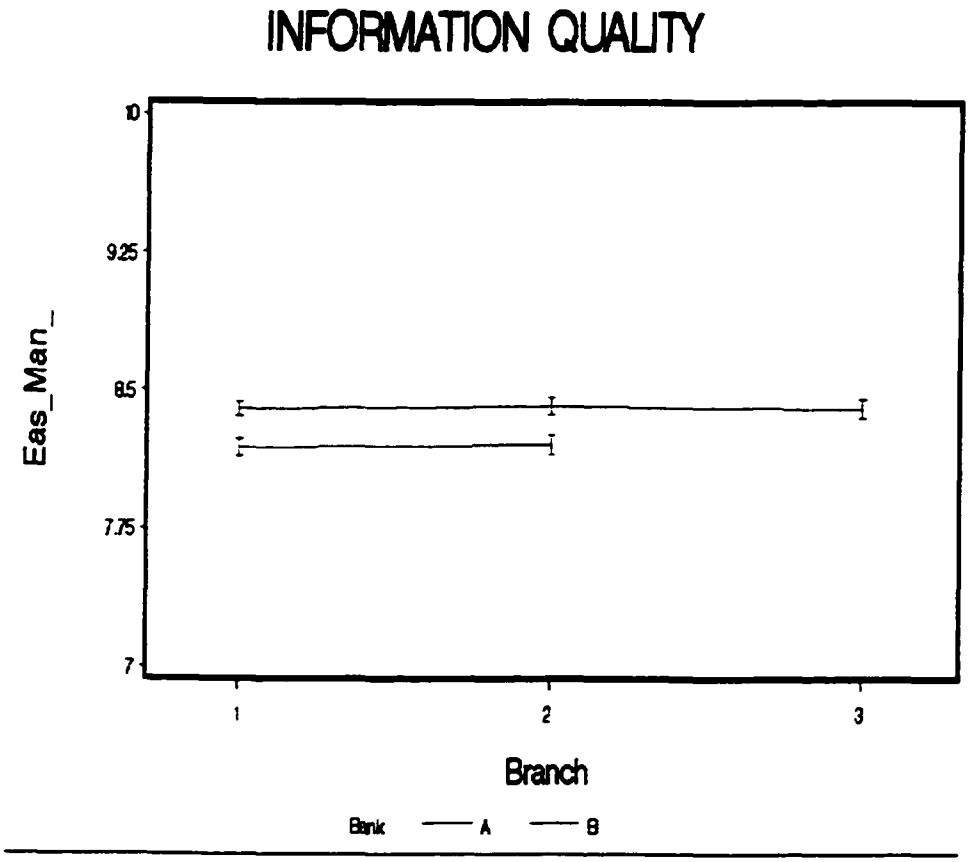

Fig.5.17: Effect of Ease of Manipulation on Information Quality

- Ease of Understanding: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of ease of understanding dimension. Also Fig. 5.18 shows that all the branches within bank A and B have almost the same mean value for this dimension. bank A has a higher mean value for this dimension than bank B.

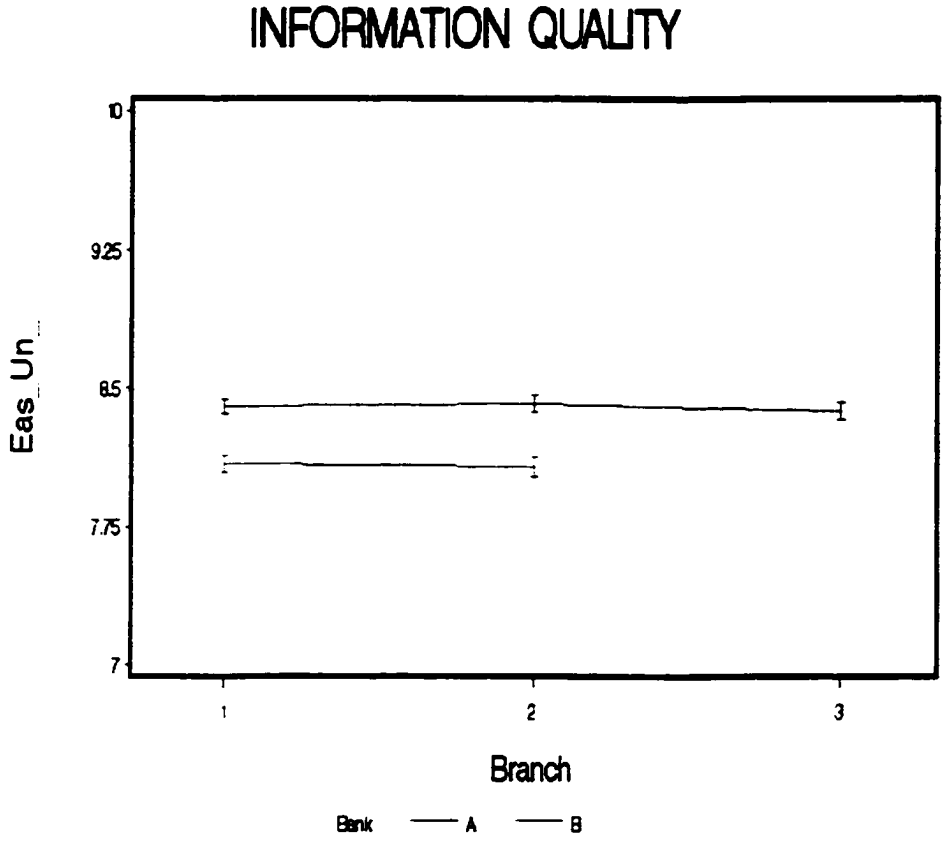

Fig.5.18: Effect of Ease of Understanding on Information Quality

- Interpretability: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of interpretability dimension. Also Fig. 5.19 shows that bank A has a higher mean value for this dimension than bank B. All the branches within bank A have almost the same mean value for this dimension. Branch 1 within bank B has a higher mean value than branch 2 for this dimension.

Fig.5.19: Effect of Interpretability on Information Quality

- Objectivity: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of objectivity dimension. Also Fig. 20 shows that bank A has a higher mean value for this dimension than bank B. Branch 3 within bank A has a higher mean value than branches 1 and 2 for this dimension. Branch 2 within bank B has a higher mean value than branch 1 for this dimension.

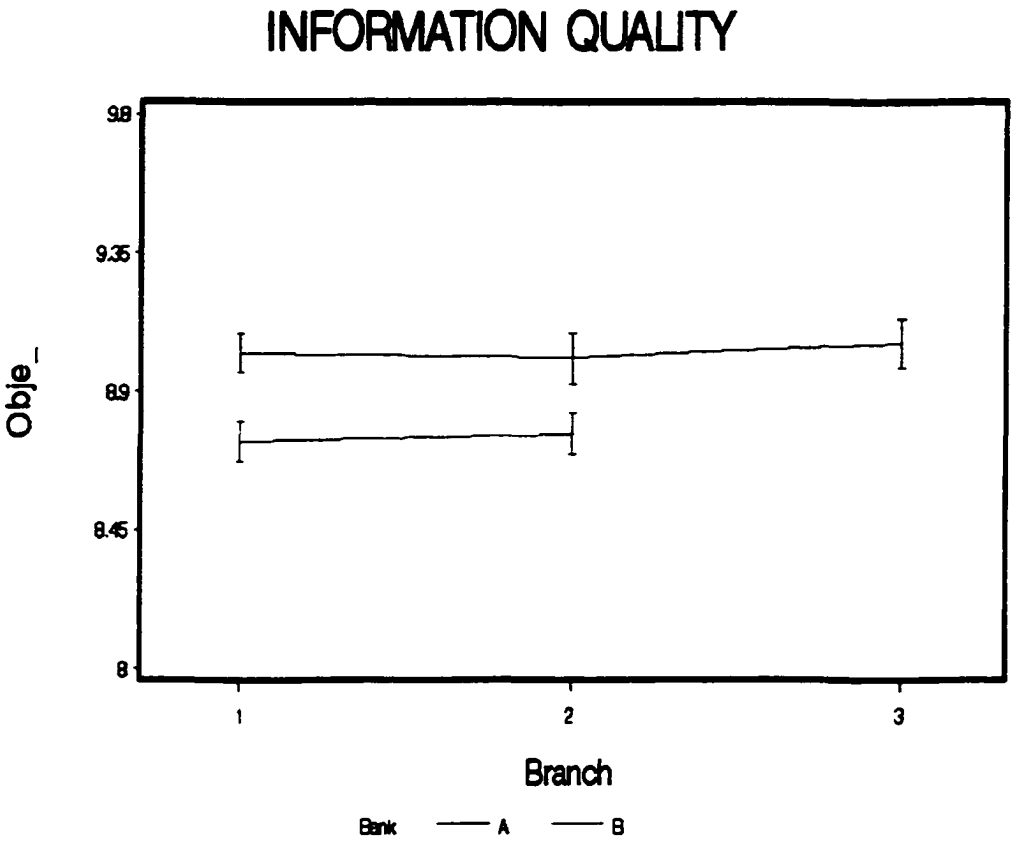

Fig.5.20: Effect of Objectivity on Information Quality

- Relevancy: Table 5.5 shows that the two banks differ in this dimension of information quality. Branches 2 and 3 within bank A and branches 1 and 2 within bank B are the same in terms of relevancy dimension. Also Fig. 5.21 shows that bank A has a higher mean value for this dimension than bank B. Branch 2 within bank A has a higher mean value than branches 1 and 3 (with branch 1 the lowest) for this dimension. Branch 1 within bank B has a higher mean value than branch 2 for this dimension.

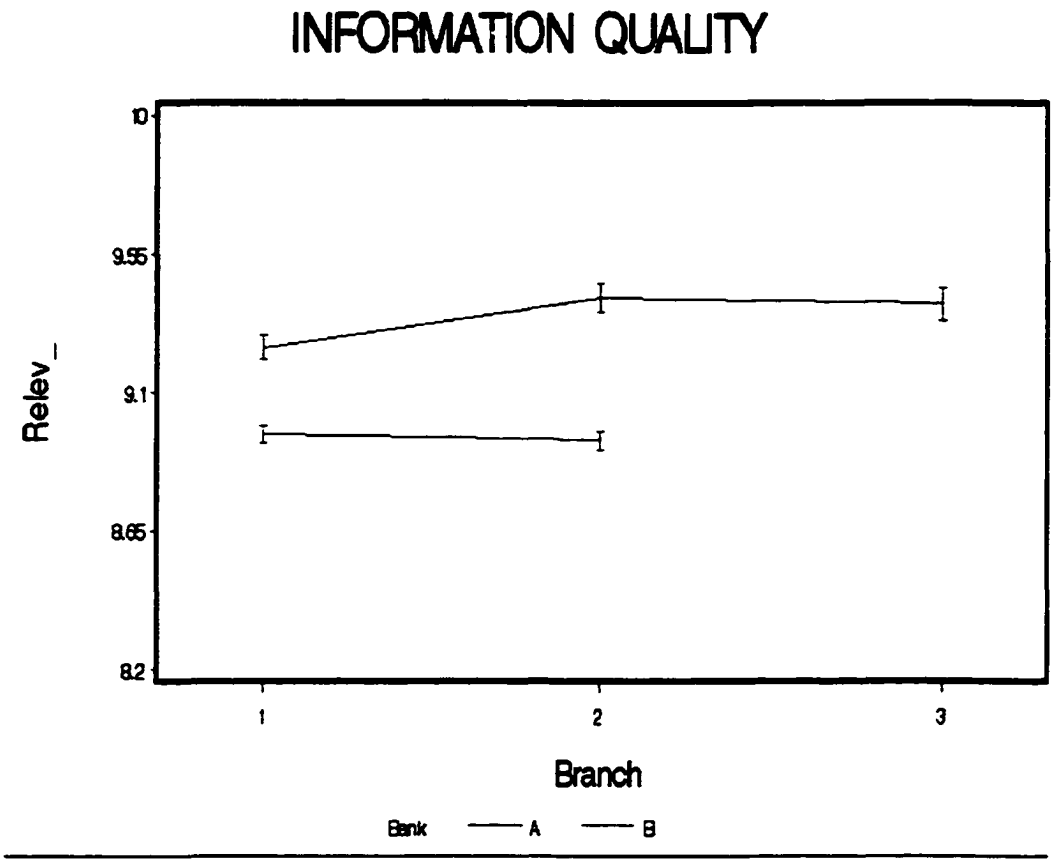

Fig.5.21: Effect of Objectivity on Information Quality

- Reputation: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of reputation dimension. Also Fig. 5.22 shows that bank A has a higher mean value for this dimension than bank B. Branches 1 and 2 within bank A have a higher mean value than branch 3 for this dimension. Branch 2 within bank B has a higher mean value than branch 1 for this dimension.

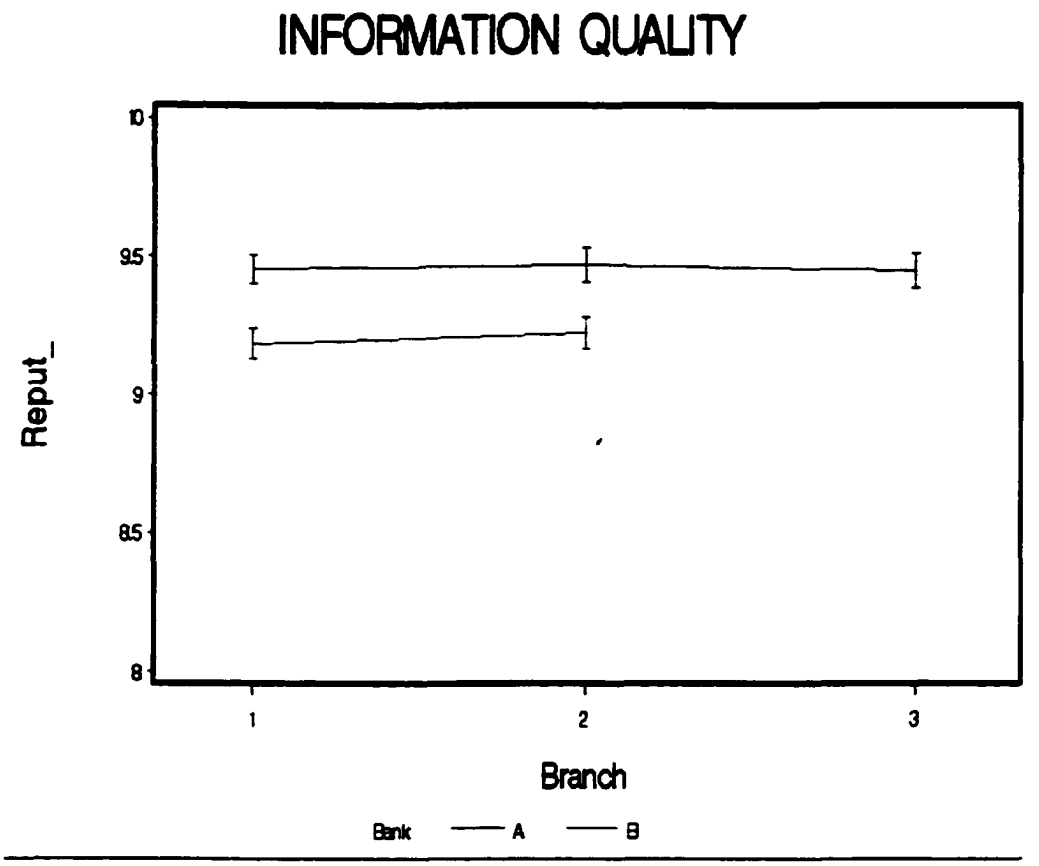

Fig.5.22: Effect of Reputation on Information Quality

- Security: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of security dimension. Also Fig. 5.23 shows that bank A has a higher mean value for this dimension than bank B. All the branches within banks A and B have almost the same mean value for this dimension.

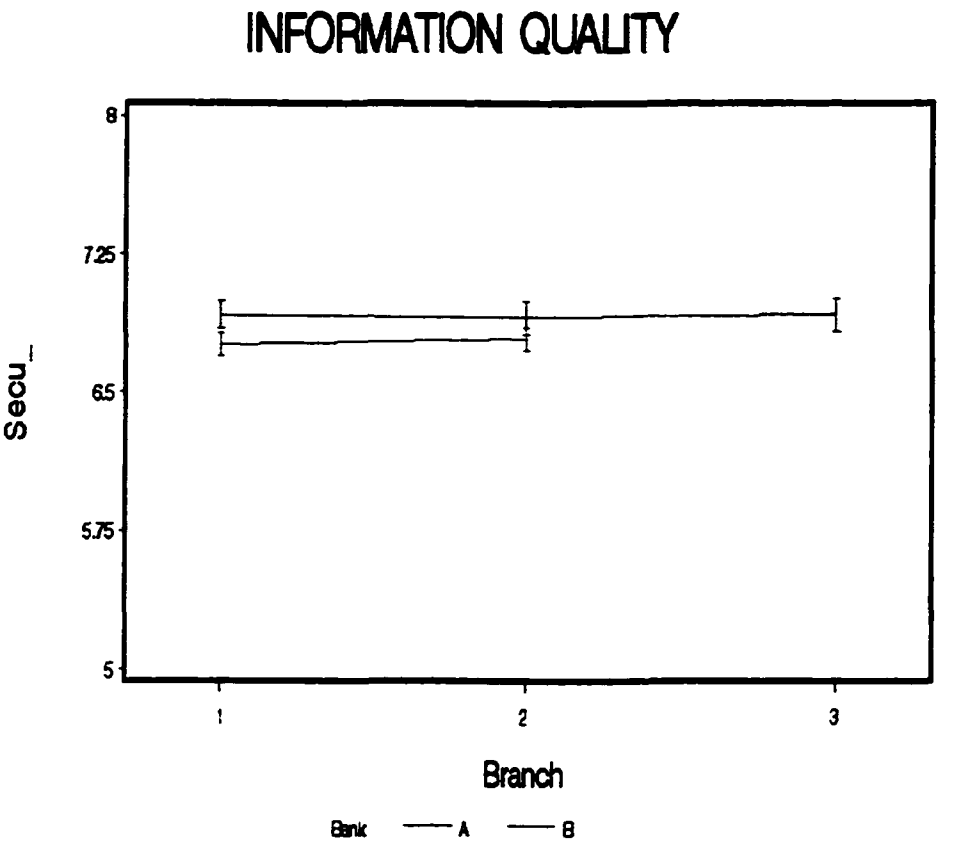

Fig.5.23: Effect of Security on Information Quality

- Timeliness: Table 5.5 shows that the two banks differ in this dimension of information quality, but all the branches within each bank are the same in terms of timeliness dimension. Also Fig.5.24 shows that bank A has a higher mean value for this dimension than bank B. All the branches within banks A and B have almost the same mean value for this dimension.

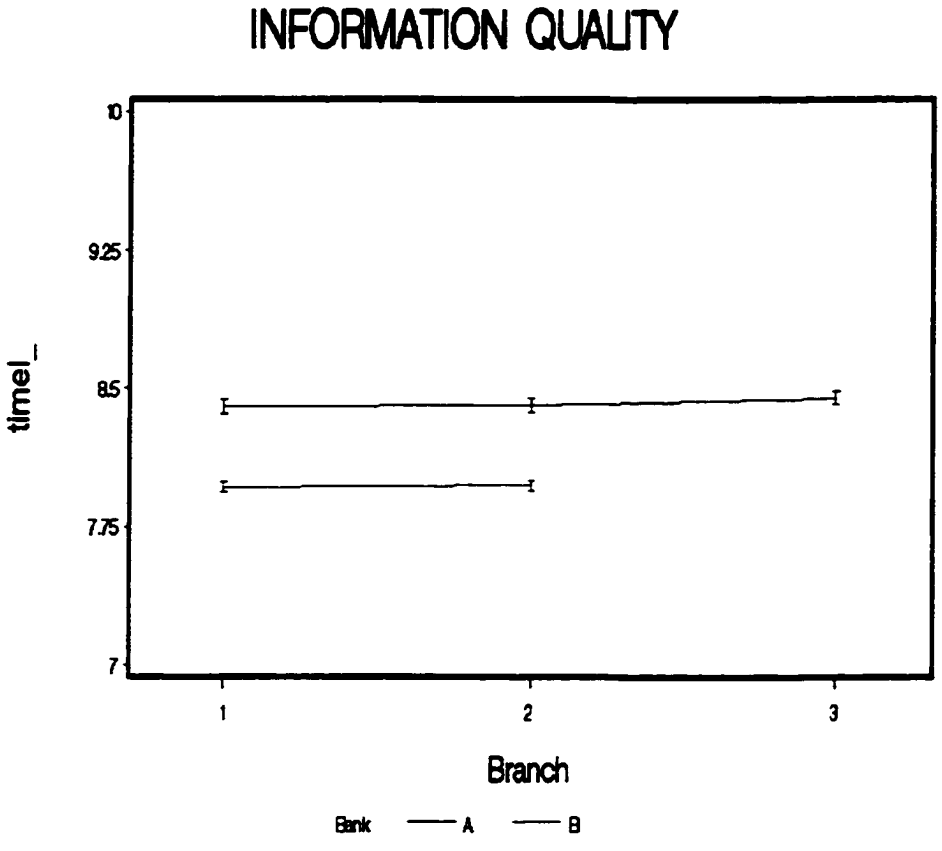

Fig.5.24: Effect of Timeliness on Information Quality

- Value Added: Table 5.5 shows that the two banks differ in this dimension of information quality. Also branch 2 and 3 within bank A and branches 1 and 2 within bank B are the same in terms of value added dimension. Also Fig. 5.25 shows that bank A has a higher mean value for this dimension than bank B. Branches 2 and 3 within bank A have higher mean value than branch 1 for this dimension. Branch 1 within bank B has a higher mean value than branch 2 for this dimension.

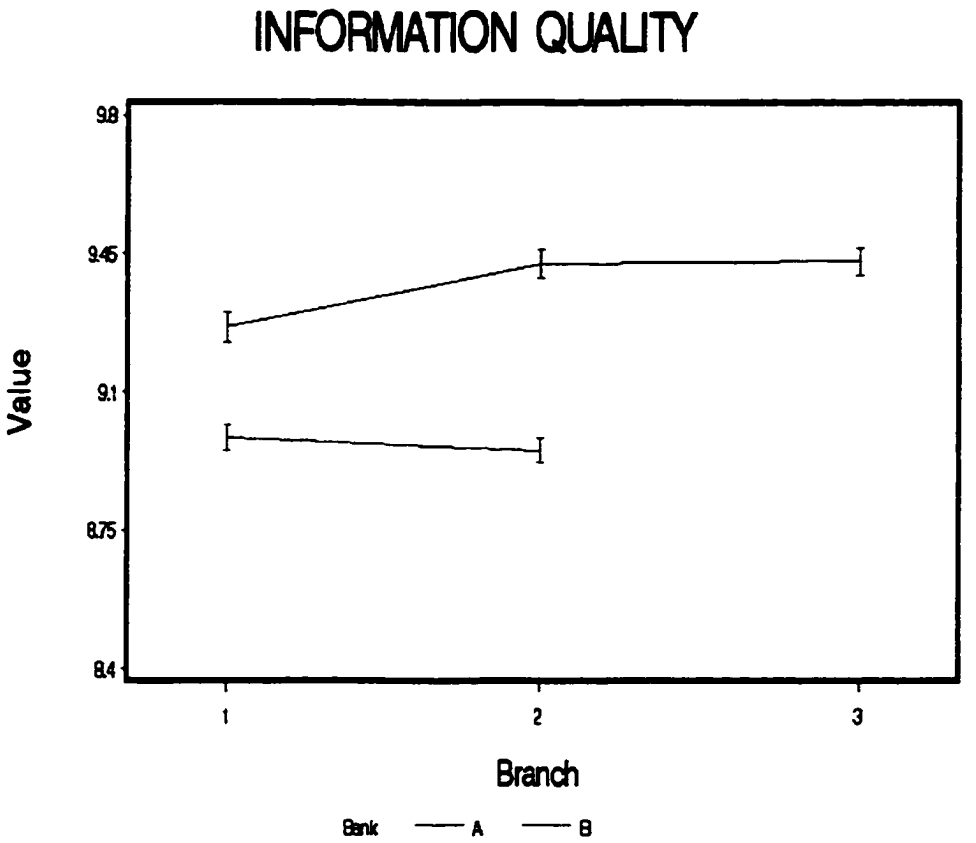

Fig.5.25: Effect of Value Added on Information Quality

5.2.3 Ergonomics

The general linear models procedure was used to see the differences of dimensions of ergonomic between banks and among the branches. The branches were nested within the banks. The level of significance was established at the 0.05. The following results based on the ANOVA table were found as shown in Table 5.6.

Table 5.6: ANOVA Table for Ergonomics

Variables	Main Effects	P.Value	Pair wise Comparison of Banks and Branches
Chair	Branch (Banks) Banks	0.93611 0.0018	 A>B
Environment	Branch (Banks) Banks	0.0016 0.3819	A1=B2, A2=A3, A2=B1, A3=B1, B1=B2
Overall	Branch (Banks) Banks	0.0001 0.0001	A2=A3, B1=B2 B>A
Other	Branch (Banks) Banks	0.9685 0.0001	 B>A
Workstation	Branch (Banks) Banks	0.0001 0.0001	A2=A3, B1=B2 B>A

Note: A>B means bank A has a higher mean value than bank B for a given dimension

- Chair: Table 5.6 shows that the two banks differ in this ergonomic dimension, but all the branches within each bank are the same in terms of chair dimension. Also Fig.5.26 shows that bank B has a higher mean value for this dimension than bank A. Branch 2 within bank A has a higher mean value than branches 1 and 3 for this dimension. Branch 1 within bank B has a higher mean value than branch 2 for this dimension.

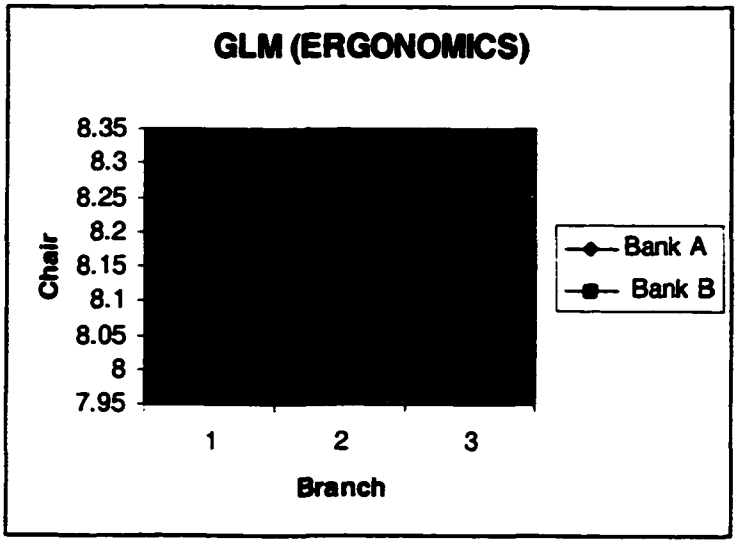

Fig. 5.26: Effect of Chair on Ergonomics

- Environment: Table 5.6 shows that the two banks do not differ in this ergonomic dimension. All the branches within each bank are the same except branches 1 & 2, and branches 1 & 3 within bank A in terms of environment dimension. Also Fig. 5.27 shows that branch 1 within bank A has a higher mean value for this dimension than all the branches within banks A and B. Branch 2 within bank B has a higher mean value than branch 1 for this dimension. Branches 1 and 2 within bank B have higher mean values than branches 2 and 3 within bank A for this dimension.

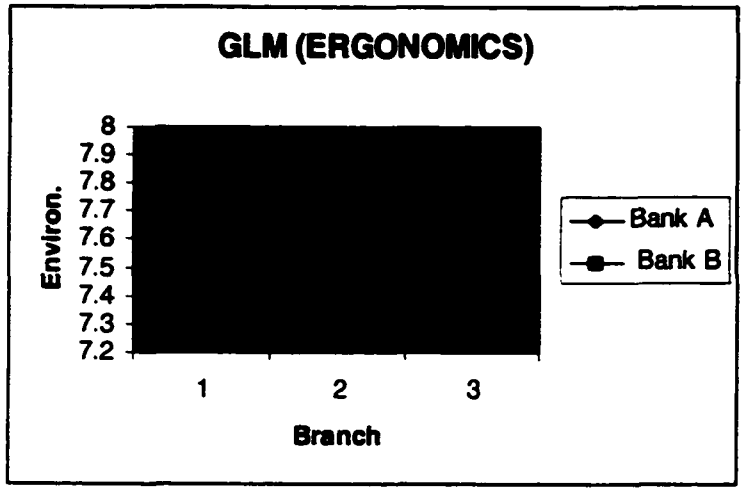

Fig.5.27: Effect of Environment on Ergonomics

- Other: Table 5.6 shows that the two banks differ in this ergonomic dimension, but all the branches within each bank are the same in terms of other dimension. Also Fig.5.28 shows that bank B has a higher mean value for this dimension than bank A. Branch 3 within bank A has a higher mean value than branches 1 and 2 for this dimension. Branch 2 within bank B has a higher mean value than branch 1 for this dimension.

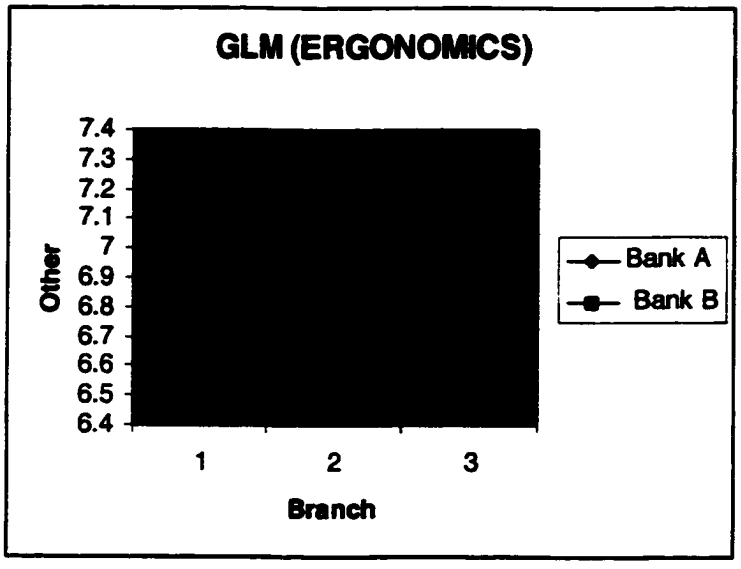

Fig. 5.28: Effect of Other on Ergonomics

- Workstation: Table 5.6 shows that the two banks and all the branches differ in this ergonomic dimension except branches 2 and 3 within bank A, and branch 1 and 2 within bank B in terms of workstation dimension. Also Fig. 5.29 shows that bank B has a higher mean value for this dimension than bank A. Branch 1 within bank A has a higher mean value than branches 2 and 3 for this dimension. Branches 1 and 2 within bank B have almost the same mean value for this dimension.

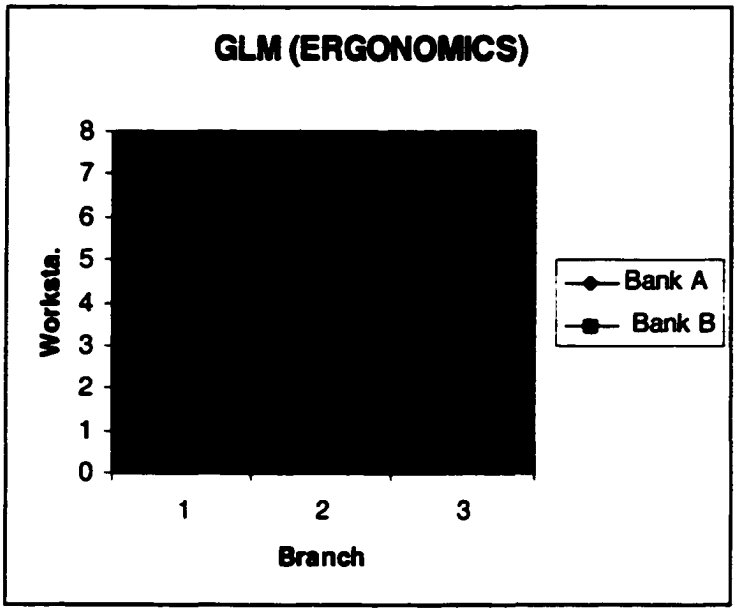

Fig. 5.29: Effect of Workstation on Ergonomics

- Overall Comfort: Table 5.6 shows that the two banks and all the branches differ in this ergonomic dimension except branches 2 & 3 within bank A and branch 1 & 2 within bank B in terms of Overall Comfort dimension. Also Fig. 5.30 shows that bank B has a higher mean value for this dimension than bank A. Branch 3 within bank A has a higher mean value than branches 1 and 2 for this dimension. Branch 2 within bank B has a higher mean value than branch 1 for this dimension.

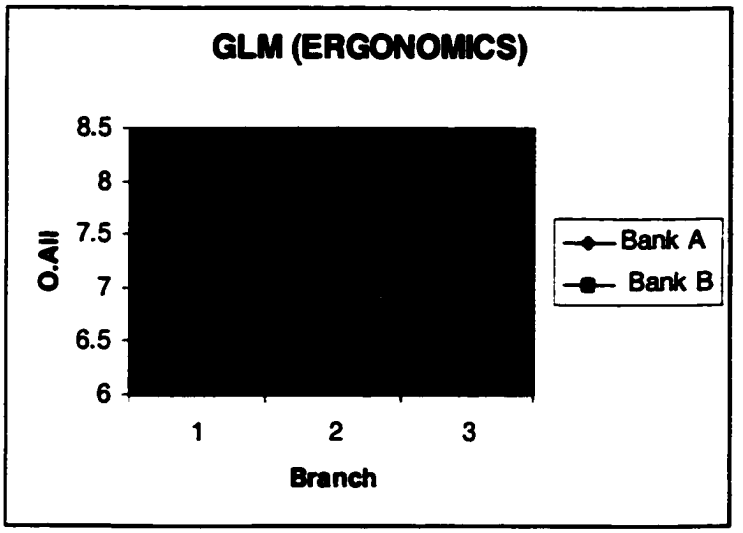

Fig.5.30: Effect of Overall Comfort on Ergonomics

5.3 Regression

5.3.1 Service Quality

Stepwise regression analysis was used for linking overall service quality as a dependent variable and five dimensions of service quality (Reliability Responsiveness, Assurance, Empathy, and Tangible) as independent variables. The following results were found as shown in Table 5.7.

Table 5.7: Regression (Overall Service Quality Vs. Five Dimensions of Service Quality)

	Stepwise Selections	R-sq
All banks	Overall=. 25+. 91 Reli. +. 05 Resp.	.87
Bank A	Overall=. 63+. 91 Reli.	.81
Bank B	Overall=. 768+. 89 Reli.	.81
Bank A1	Overall=. 14+. 86 Reli. +. 11 Resp.	.81
Bank A2	Overall=. 60+. 921 Reli.	.83
Bank A3	Overall=. 236+. 96 Reli.	.81
Bank B1	Overall=. 77+. 81 Reli. +. 082 Resp.	.8
Bank B2	Overall=. 009+. 992 Reli.	.81

For all Banks, reliability and responsiveness were both significant with $R^2 = 0.87$. For bank A, reliability was significant with $R^2 = 0.81$. For bank B, reliability was significant with $R^2 = 0.81$. For bank A's branch 1, reliability and responsiveness were both significant with $R^2 = 0.81$. For bank A's branch 2, reliability was significant with $R^2 = 0.83$. For bank A's branch 3, reliability was significant with $R^2 = 0.81$. For bank B's branch 1, reliability and responsiveness were both significant with $R^2 = 0.80$. For bank A's branch 2, reliability was significant with $R^2 = 0.81$.

5.3.2 Service Quality VS. Information Quality

Stepwise regression analysis was performed with overall service quality and five dimensions of service quality (reliability, responsiveness, assurance, empathy, and tangible) as dependent variables and sixteen dimensions of information quality (accessibility, accuracy, amount of information, believability, completeness, concise representation, consistent representation, ease of manipulation, ease of understanding,

interpretability, objectivity, reputation, security, timeliness, and value added) as independent variables. The following results were found as shown in Tables 5.8-5.13.

- Reliability vs. Information Quality:

Table 5.8: Regression (Reliability vs. Information Quality)

	Stepwise Selections	R-sq
All banks	Reli. = 5.95+. 26 Objectivity	.038
Bank A	Reli. = 5.95+. 26 Objectivity + .59 Cons.Repr	.1121
Bank B	None	
Bank A1	Reli. = .15 +. 89 Accur.	.515
Bank A2	Reli. = 13.53+. 58 Objectivity	.1560
Bank A3	Reli. = 10.89+. 44 Objectivity +. 725 Amount	.2348
Bank B1	None	
Bank B2	Reli. = 3.34+. 433 Amount	.092

For all banks, objectivity was significant with $R^2 = 0.038$. For bank A, objectivity and consistent representation were significant with $R^2 = 0.1121$. For bank B no variables were significant. For bank A's branch 1, accuracy was significant with $R^2 = 0.515$. For bank A's branch 2, objectivity was significant with $R^2 = 0.1560$. For bank A's branch 3, objectivity and amount of information were significant with $R^2 = 0.2348$. For bank B's branch 1, no variables were significant. For bank B's branch 2, amount of information was significant with $R^2 = 0.092$.

- Responsiveness vs. Information Quality:

Table 5.9: Regression (Responsiveness vs. Information Quality)

	Stepwise Selections	R-sq
All banks	Resp.= 9.064+ .22 Object. + .331Timeli.	.04
Bank A	Resp.= 5.9899 + .25 Accur.	.031
Bank B	None	
Bank A1	Resp.= 1.49 + .73 Belie.	.1595
Bank A2	Resp.=-1.05 9+ 1.092 Timeli.	.1992
Bank A3	None	
Bank B1	Resp.= 14.12 +. 73 Belie.	.079
Bank B2	None	

For all banks, objectivity and timeliness were significant with $R^2 = 0.04$. For bank A, accuracy was significant with $R^2 = 0.031$. For bank B, no variables were significant. For bank A's branch 1, believability was significant with $R^2 = 0.1595$. For bank A's branch 2, timeliness was significant with $R^2 = 0.1992$. For bank A's branch 3, no variables were significant. For bank B's branch 1, believability was significant with $R^2 = 0.079$. For bank B's branch 2, no variables were significant.

- Assurance vs. Information Quality:

Table 5.10: Regression (Assurance vs. Information Quality)

	Stepwise Selections	R-sq
All banks	None	
Bank A	Assu. = 6.087 + .223 Object.	.0329
Bank B	Assu. = 6.087 + .223 Access.	.0425
Bank A1	Assu. = 2.58 + .58 Belie.	.1436
Bank A2	None	
Bank A3	None	
Bank B1	Assu. = 11.273 + .52 Interpr.	.09
Bank B2	Assu. = 26.77+. 43 Object. +1.44 Timeli. +. 83 Value	.3441

For all banks, no variables were significant. For bank A, objectivity was significant with $R^2 = 0.0329$. For bank B, accessibility was significant with $R^2 = 0.0425$. For bank A's branch 1, believability was significant with $R^2 = 0.1436$. For bank A's branch 2, no variables were significant. For bank A's branch 3, no variables were significant. For bank B's branch 1, interpretability was significant with $R^2 = 0.09$. For bank A's branch 2, objectivity, timeliness, concise representation, and value- added were significant with $R^2 = 0.3442$.

- Empathy vs. Information Quality

Table 5.11: Regression (Empathy vs. Information Quality)

	Stepwise Selections	R-sq
All banks	Emp.= 28.4 + .65 Timeli. + .83 Value +. 38 Conc.Rep.	.36
Bank A	Emp. = 4.779 + .60 Belie. +. 36 Access	.1142
Bank B	None	
Bank A1	Emp. = - 1.42 + .88 Belie	.2574
Bank A2	Emp. = 4 + .67 Conc.Rep +. 23 Secur.	.214
Bank A3	None	
Bank B1	None	
Bank B2	Emp. = 11.037+ .42 Compl.	.1126

For all banks, timeliness, concise representation, interpretability, accessibility, and completeness were significant with $R^2 = 0.36$. For bank A, accessibility and believability were significant with $R^2 = 0.1142$. For bank B, no variables were significant. For bank A's branch 1, believability was significant with $R^2 = 0.2674$. For bank A's branch 2, concise representation and security were significant with $R^2 = 0.214$. For bank A's branch 3, no variables were significant. For bank B's branch 1, no variables were significant. For bank A's branch 2, completeness was significant with $R^2 = 0.1126$.

- Tangible vs. Information Quality:

Table 5.12: Regression (Tangible vs. Information Quality)

	Stepwise Selections	R-sq
All banks	Tang. = 10.38 + .35 Ease.Undr.	.031
Bank A	Tang. = 2.70 + .68 Relev. + .23 Access	.1232
Bank B	Tang. = 10.71+. 54 Interp.	.065
Bank A1	Tang. = 3.06 + .40 Belie	.0959
Bank A2	Tang. = 1.11 + .791 Compl.	.1064
Bank A3		
Bank B1	None	
Bank B2	Tang. = - .546 +. 57 Belie + .58 Ease.Undr.	.276

For all Banks, ease of understanding was significant with $R^2 = 0.031$. For bank A, accessibility and relevancy were significant with $R^2 = 0.1232$. For bank B, interpretability was significant with $R^2 = 0.065$. For bank A's branch 1, believability was significant with $R^2 = 0.0959$. For bank A's branch 2, completeness was significant with $R^2 = 0.1064$. For bank A's branch 3, no variables were significant. For bank B's branch 1, no variables were significant. For bank B's branch 2, believability, ease of understanding, and value - added were significant with $R^2 = 0.276$.

- Overall Service Quality vs. Information Quality:

Table 5.13: Regression (Overall Service Quality vs. Information Quality)

	Stepwise Selections	R-sq
All banks	Overall= 8.39 +. 26 Accur. + .27 Amount	.0539
Bank A	Overall= .44 + .4 Object. + .49 Cons.Rep.	.11
Bank B	None	
Bank A1	Overall= - 2.21 +. 56 Accur. + .59 Object	.564
Bank A2	Overall= 13.13 - .54 Object	.1561
Bank A3	Overall= 13.6+. 47 Accur. + 1.05 Amount	.2807
Bank B1	None	
Bank B2	None	

For all banks, accuracy and amount of Information were significant with $R^2 = 0.0539$. For bank A, objectivity and consistent representation were significant with $R^2 = 0.11$. For bank B, no variables were significant. For bank A1, accuracy and objectivity were significant with $R^2 = 0.564$. For bank A2, objectivity was significant with $R^2 = 0.1561$. For bank A3, accuracy and amount of information were significant with $R^2 = 0.2807$. For bank B1, no variables were significant. For bank B2, no variables were significant.

5.3.3 Ergonomics

Stepwise regression analysis was developed for model building with overall work comfort as a dependent variable and four dimensions of ergonomics (Chair, Environment, Other, and Workstation) as independent variables. The following results were found as shown in Table 5.14.

Table 5.14: Regression (Overall Work Comfort Vs. Ergonomics Dimensions)

	Stepwise Selections	R-sq
All banks	O.All=. 47+. 37Workst+. 39 Chair+. 29 Other	.32
Bank A	O.All= 4.65+. 39Workst	.24
Bank B	O.All= 4.16+. 44 Chair	.1127
Bank A1	None	
Bank A2	O.All= 4.39+. 41Workst	.3239
Bank A3	O.All= 4.45+. 22Workst	.14
Bank B1	O.All= 4.16+. 44 Chair	.094
Bank B2	O.All= 4.09+. 46 Chair	.1521

For all banks, chair, other, and workstation were significant with $R^2 = 0.32$. For bank A, workstation was significant with $R^2 = 0.24$. For bank B, chair was significant with $R^2 = 0.1127$. For bank A's branch 1, no variables were significant. . For bank A's branch 2, workstation was significant with $R^2 = 0.3239$. . For bank A's branch 3, workstation was significant with $R^2 = 0.14$. . For bank B's branch 1,chair was significant with $R^2 = 0.094$. For bank B's branch 2, chair was significant with $R^2 = 0.1521$.

5.3.4 Service Quality VS. Ergonomics

Stepwise regression analysis was performed with overall service quality and five dimensions of service quality (Reliability, Responsiveness, Assurance, Empathy, and Tangible) as dependent variables and five dimensions of ergonomics (Chair, Environment, Other, and Workstation, Overall comfort) as independent variables. The following results were found as shown in Table 5.15-5.19.

- Reliability VS. Ergonomics:

Table 5.15: Regression (Reliability VS. Ergonomics)

	Stepwise Selections	R-sq
All banks	None	
Bank A	None	
Bank B	None	
Bank A1	Relia. = 2.82 + .39 Worksta + .39 O.all	.1926
Bank A2	Relia. = 1.65 + .81 Chair	.16
Bank A3	None	
Bank B1	None	
Bank B2	None	

For bank A's branch 1,workstation and overall comfort were significant with R^2 = 0. 1926. For bank A's branch 2, chair was significant with R^2 = 0. 16. No variables were significant for the rest of banks.

- Responsiveness VS. Ergonomics:

Table 5.16: Regression (Responsiveness VS. Ergonomics)

Responsiveness	Stepwise Selections	R-sq
All banks	Respon. = 7.29 + .14 O.All	.044
Bank A	None	
Bank B	None	
Bank A1	None	
Bank A2	None	
Bank A3	None	
Bank B1	None	
Bank B2	Respon. = 12.96 + .36 Worksta. + .42 O.All	.2137

For all banks, overall comfort was significant with $R^2 = 0.044$. For bank B's branch 2, overall comfort and workstation were significant with $R^2 = 0.2137$. No variables were significant for the rest of banks.

- Assurance VS. Ergonomics:

No variables were significant for both banks and branches.

- Empathy VS. Ergonomics:

Table 5.17: Regression (Empathy VS. Ergonomics)

	Stepwise Selections	**R-sq**
All banks	Empa. = 3.13 + .32Other + .35 O.All	.1349
Bank A	Empa. = 11.15 + .27 Worksta. + .2 7Environ.	.091
Bank B	None	
Bank A1	None	
Bank A2		
Bank A3		
Bank B1	None	
Bank B2	Empa. = 9.56 +. 23 O.All	.0847

For all banks, overall comfort and other were significant with $R^2 = 0.1349$. For bank A, workstation and environment were significant with $R^2 = 0.091$. For bank B's branch 2, overall comfort was significant with $R^2 = 0.0847$. No variables were significant for the rest of the banks.

- Tangible VS. Ergonomics:

Table 5.18: Regression (Tangible VS. Ergonomics)

	Stepwise Selections	R-sq
All banks	Tang. = 6.96- .11 Worksta. + .179 Other	.036
Bank A	Tang. = 9.04- .29 Worksta	.11
Bank B	None	
Bank A1	None	
Bank A2	None	
Bank A3	Tang. = 4.59 + .4 79Other	.205
Bank B1	Tang. = .75 + .5 Chair + .4 2 Other	.2653
Bank B2	None	

For all banks. workstation and other were significant with $R^2 = 0.036$. For bank A, workstation was significant with $R^2 = 0.11$. For bank A3, other was significant with $R^2 = 0.205$. For bank B1, other and chair were significant with $R^2 = 0.2653$. No variables were significant for the rest of the banks.

- Overall Service Quality VS. Ergonomics:

Table 5.19: Regression (Overall Service Quality VS. Ergonomics)

	Stepwise Selections	R-sq
All banks	None	
Bank A	None	
Bank B	None	
Bank A1	Overall = 2.63 +. 47 Worksta. + .33 O.all	.1490
Bank A2	None	
Bank A3	None	
Bank B1	None	
Bank B2	Overall = 3.637+. 45 Environ.	.1186

For bank A1, workstation and overall comfort were significant with $R^2 = 0.1490$. For Bank B2, environment was significant with $R^2 = 0.11866$. No variables were significant for the rest of the banks.

5.3.5 Service Quality VS. Information Quality and Ergonomics

Stepwise regression analysis was performed (only for all banks) with overall service quality and five dimensions of service quality (reliability, responsiveness, assurance, empathy, and tangible) as dependent variables and twenty one dimensions of information quality and ergonomics (accessibility, accuracy, amount of information, believability, completeness, concise representation, consistent representation, ease of manipulation, ease of understanding, interpretability, objectivity, reputation, security, timeliness, value added, chair, environment, other, workstation, and overall comfort) as independent variables. The following results were found as shown in Table 5.20.

Table 5.20: Regression (Service Quality VS. Information Quality & Ergonomics)

Variables	Stepwise Selections	R-sq
Reli.	= 5.95+. 26 Objectivity	.038
Responsiv.	= 5.42+. 20 Objectivity + .15 O.all	.0451
Assuran.	None	
Empathy	= 29.53 +. 62 Time. +. 66 Com.+ .39 Interp. - .35 Conc. Rep-.25 Acce.	.3486
Tangible	= 9.39 +. 22 Accu. -.32 Obje. +. 34 Ease.Und -.17 WorkSt. +. 15 Other	.10
Overall	= 8.39 +. 26 Accu. +. 27 Amount	.053

As shown in Table 5.20, there is a relationship between reliability and objectivity, between responsiveness and objectivity and over all comfort, between empathy and timeliness, completeness, interpretability, concise representation, and accessibility, between tangibility and accuracy, objectivity, ease of understanding, workstation, and other, and between overall service quality and accuracy and amount of information.

5.4 Factor Analysis

Factor analysis was conducted to reduce the number of dimensions and variables associated with service quality, information quality, and ergonomics for all the banks using principal component analysis.

5.4.1 Service Quality

As shown in Table 5.21 one factor were retained for analysis since its Eigenvalue is more than unity. This factor explains 57% of variability of dimensions of service quality. Collectively factors1 and 2 both explain 72% of variability of dimensions of service quality.

Table 5.21: Principal Components for Service Quality

	Eigenvalue	Difference	Proportion	Cumulative
1	**2.86806742**	2.11808769	0.5736	**0.5736**
2	0.74997972	0.15770738	0.1500	0.7236
3	0.59227235	0.14863208	0.1185	0.8421
4	0.44364027	0.09760002	0.0887	0.9308
5	0.34604025		0.0692	1.0000

Based on the result of Varimax and Rotated Factor Pattern factor 1 is highly loaded on assurance dimensions of service quality as shown in Table 5.22.Thus factor 1 is assurance.

Table 5.22: Rotated Factor Pattern for Service Quality

Service Quality Dimensions	Factor1
Assu	**0.83118**
Resp	0.74307
Reli	0.63052
Tang	0.60088
Emp	0.59934

5.4.2 Information Quality

As shown in table 5.23 five factors were retained for analysis since their Eigenvalue are more than unity. Collectively the five factors explain 59% of variability of dimensions of information quality.

Table 5.23: Principal Components for Information Quality

	Eigenvalue	Difference	Proportio	Cumulative
1	**4.64904672**	3.09580471	0.2906	**0.2906**
2	**1.55324200**	0.39044157	0.0971	**0.3876**
3	**1.16280043**	0.15064957	0.0727	**0.4603**
4	**1.01215087**	0.00995835	0.0633	**0.5236**
5	**1.00219252**	0.07718740	0.0626	**0.5862**
6	0.92500511	0.08817126	0.0578	0.6440
7	0.83683386	0.10040069	0.0523	0.6963
8	0.73643317	0.04814485	0.0460	0.7424
9	0.68828831	0.04871051	0.0430	0.7854
10	0.63957780	0.03387730	0.0400	0.8253
11	0.60570051	0.02976295	0.0379	0.8632
12	0.57593756	0.10634647	0.0360	0.8992
13	0.46959108	0.03367689	0.0293	0.9285
14	0.43591420	0.05118644	0.0272	0.9558
15	0.38472775	0.06216964	0.0240	0.9798
16	0.32255812		0.0202	1.0000

Based on the result of Varimax and Rotated Factor Pattern factor 1 is moderately loaded on completeness, factor 2 is highly loaded on objectivity, factor 3 is moderately loaded on relevancy, factor 4 on concise representation. and factor 5 is moderately loaded on timeliness dimensions of information quality as shown in Table 5.24.Thus factors 1-5 will have the corresponding names.

Table 5.24: Rotated Factor Pattern for Information Quality

Dimensions of Information Quality	Factor1	Factor2	Factor3	Factor4	Factor5
Com.	**0.69975**	0.16785	0.07791	0.16497	-0.01879
Time	0.66244	0.15162	0.22334	0.17010	**0.58640**
Interp	0.48190	0.10255	0.20339	0.22719	0.14866
Value	0.42707	0.19643	0.40355	0.25233	0.21060
EasUn	0.37275	0.06970	0.17532	0.27558	-0.09526
Secu	0.17220	-0.05738	-0.02353	0.04642	0.10736
Obje	-0.05091	**0.96559**	0.08326	0.12270	0.07876
Accur	0.28053	0.58197	0.32497	0.15866	-0.02713
Belie	0.21117	0.46028	0.33892	0.12929	-0.18569
Relev	0.30366	0.26562	**0.60789**	0.05421	0.27266
Reput	0.02447	0.15663	0.50432	0.30301	-0.15206
ConcRep	0.27261	0.16777	0.04736	**0.50336**	0.26080
Amoun	0.20853	0.13156	0.14261	0.47796	0.00581
Concept	-0.17081	-0.04209	-0.14811	-0.43522	0.25794
EasMan	0.14661	0.16572	0.05692	0.11486	0.20777
Acce	-0.03284	0.03406	0.00864	-0.03964	-0.31828

5.4.3 Ergonomics

5.4.3.1 Factor Analysis (excluding the Overall Comfort)

Since in the next section the overall Comfort dimension will be regressed on the factors using the factor scores procedure, first factor analysis was performed without using the overall comfort. As shown in Table 5.25 two factors were retained for analysis since their Eigenvalue are more than unity. Collectively both explain 57% of variability of dimensions of service quality.

Table 5.25: Principal Components for Ergonomics (excluding the Overall Comfort)

	Eigenvalues	Difference	Proportion	Cumulative
1	**1.30100041**	0.28199250	0.3253	**0.3253**
2	**1.01900790**	0.12899933	0.2548	**0.5800**
3	0.89000857	0.10002546	0.2225	0.8025
4	0.78998312		0.1975	1.0000

Based on the result of Varimax and Rotated Factor Pattern factors 1 and 2 are moderately loaded on other and environment dimensions of ergonomics as shown in Table 5.26. Thus factors 1 and 2 will have the corresponding names.

Table 5.26: Rotated Factor Pattern for Ergonomics (excluding the Overall Comfort)

Ergonomic Dimensions	Factor1	Factor2
Other	**0.54050**	-0.06268
WorkSt	0.34969	0.21062
Chair	0.22307	0.19279
Envir	0.01709	**0.42586**

5.4.3.2 Factor Analysis (including the Overall Comfort)

As shown in Table 5.27 two factors were retained for analysis since their Eigenvalue are more than unity. Collectively both explain 57% of variability of dimensions of ergonomics.

Table 5.27: Principal Components for Ergonomics (including the Overall Comfort)

	Eigenvalue	Difference	Proportion	Cumulative
1	**1.80329809**	0.77983191	0.3607	**0.3607**
2	**1.02346618**	0.12369311	0.2047	**0.5654**
3	0.89977307	0.10233091	0.1800	0.7453
4	0.79744215	0.32142164	0.1595	0.9048
5	0.47602051		0.0952	1.0000

Based on the result of Varimax and Rotated Factor Pattern factors 1 and 2 are highly loaded on overall comfort and environment dimensions of ergonomics as shown in Table 5.28. Thus factors 1 and 2 will have the corresponding names

Table 5.28: Rotated Factor Pattern for Ergonomics (including the Overall Comfort)

Ergonomic	Factor1	Factor2
O.All	**0.94259**	0.06181
WorkSt	0.49842	0.06160
Other	0.35887	-0.04220
Chair	0.25374	0.06866
Envir	0.06865	**0.99764**

5.5 Regression Analysis Using Factor Scores

5.5.1 Service Quality

Using regression analysis with the overall service quality as a dependent variable and the factor from the result of Factor Score Analysis (assurance) as the independent variables, the flowing models was found with $R^2 = 0.4638$. This factors is significant with P.Value <0.0001.

Over all = 7.75 43 + 0.6238 Assu.

5.5.2 Ergonomics

Using regression analysis with the overall work comfort as a dependent variable and the factors from the result of Factor Score Analysis (other, environment) as the independent variables, the flowing models was found with $R^2 = 0.30$. Both factors are significant with P.Value <0.0001.

Over all Work = 7.364 + 0.6089 Other + 0.3235 Environment

5.5.3 Service Quality VS. Information Quality

Using regression analysis with the overall service quality and five dimensions of service quality (reliability, responsiveness, assurance, empathy, and tangible) as the dependent variable and the five factors from the result of factor score analysis (completeness, objectivity, relevancy, concise representation, and timeliness) as the independent variables, The following results were found as shown in Table 5.29.

Table 5.29: Regression (Service Quality VS. Information Quality)

Variables	Stepwise Selections	R-sq	P. Value for General Test	Significant Variables
Reli.	= 8.29 +. 0096 Completeness +. 148 Objectivity -.0006 Relevancy - .04 Concise Representation - .04 Timeliness	.046	.051	Completeness
Responsiv.	= 8.33 +. 11 Completeness +. 08 Objectivity -.036 Relevancy - .007 Concise Representation +. 085 Timeliness	.0425	.0738	None
Assuran.	= 8.12-. 03 Completeness +. 035 Objectivity +. 034 Relevancy - .017 Concise Representation -. 021 Timeliness	.0085	.85	None
Empathy	= 8.024-. 63 Completeness +. 07 Objectivity +. 08 Relevancy - .28 Concise Representation -. 06	.34	.0001	Completeness. Concise Representation
Tangible	= 7.41-. 12 Completeness +. 07 Objectivity +. 016 Relevancy - .16 Concise Representation +. 20 Timeliness	.087	.0008	Completeness. Concise Representation. and Timeliness
Overall	= 8.22 -. 0035 Completeness +. 130 Objectivity -.015 Relevancy - .54 Concise Representation - .025 Timeliness	.0363	.1285	None

As shown in Table 5.29 the relationship between reliability and completeness, between empathy and (completeness, concise representation), and between tangibility and (completeness, concise representation, timeliness), are significant.

5.5.4 Service Quality VS. Ergonomics

Using regression analysis with the overall service quality and five dimensions of service quality (reliability, responsiveness, assurance, empathy, and tangible) as the dependent variable and the two factors from the result of factor score analysis (overall

work comfort and environment) as the independent variables, The following results were found as shown in Table 5.30.

Table 5.30: Regression (Service Quality VS. Ergonomics)

Variables	Stepwise Selections	R-sq	P. Value for General Test	Significant Variables
Reli.	= 8.2966 +. 026 Overall Work +. 2222 Environment	.0014	.8509	None
Responsiv.	= 8.33 + .1019 Overall Work +. 094 Environment	.039	.0092	Overall Work, Environment
Assuran.	= 8.12 + .020 Overall Work +. 058 Environment	.011	.2707	None
Empathy	= 8.024 + .38 Overall Work -.08 Environment	.1179	.0001	Overall Work
Tangible	=7.41 -.0045 Overall Work -.058 Environment	.0064	.4726	None
Overall	=8.22 +. 045 Overall Work -.04 Environment	.0075	.4156	None

As shown in Table 5.30 the relationship between responsiveness and (overall work, environment), between empathy and the overall work other are significant.

5.6 Regression Analysis Using Overall Service Quality and Assurance (from the result of Factor Score Analysis) as the Dependent Variables

5.6.1 Service Quality vs. Information Quality

Using regression analysis with the overall service quality and assurance (from the result of factor score analysis) as the dependent variable and the five factors from the result of factor score analysis (completeness, objectivity, relevancy, concise representation, and timeliness) as the independent variables. The following results were found as shown in Table 5.31.

Table 5.31: Regression (Service Quality VS. Information Quality)

Variables	Stepwise Selections	R-sq	P. Value for General Test	Significant Variables
Overall	= 8.2288-. 0036 Completeness +. 131 Objectivity -.01595 Relevancy - .0547 Concise Representation - .0252 Timeliness	.0363	.1285	None
Assuran.	= .633 -. 0157 Completeness +. 0805 Objectivity +. 0001 Relevancy - .087 Concise Representation + .0326 Timeliness	.0697	.0051	Completeness

As shown in Table 5.31the relationship between assurance and completeness is significant.

5.6.2 Service Quality VS. Ergonomics

Using regression analysis with the overall service quality and assurance (from the result of factor score analysis) as the dependent variable and overall work comfort & environment (from the result of factor score analysis) as the independent variables. The following results were found as shown in Table 5.32.

Table 5.32: Regression (Service Quality VS. Ergonomics)

Variables	Stepwise Selections	R-sq	P. Value for General Test	Significant Variables
Overall	= 9.11 +. 144 Overall Work -.0306 Environment	.0076	.6190	None
Assuran.	= 2.187 +. 2749 Overall Work +. 0508 Environment	.026	.1095	None

As shown in Table 5.32 there is no significant relationship.

5.6.3 Service Quality VS. Information Quality and Ergonomics

Using regression analysis with the overall service quality and assurance (from the result of factor score analysis) as the dependent variable and the five factors from the result of factor score analysis (completeness, objectivity, relevancy, concise representation, and timeliness) and the two factors from the result of factor score analysis (overall work comfort, environment) as the independent variables. The following results were found as shown in Table 5.33.

Table 5.33: Regression (Service Quality VS. Information Quality and Ergonomics)

Variables	Stepwise Selections	R-sq	P. Value for General Test	Significant Variables
Overall	= 10.83 +. 0226 Completeness +. 136 Objectivity -.013 Relevancy - .043 Concise Representation - .016 Timeliness +. 338 Overall Work -.029 Environment	.0439	.2426	None
Assuran.	= .884 -. 01413 Completeness +. 081 Objectivity +. 020 Relevancy - .082 Concise Representation + .047 Timeliness+. 075 Overall Work +. 052 Environment	.078	.015	Completeness, Objectivity

As shown in Table 5.33 the relationship between Assurance and (Completeness & Objectivity) is significant.

Chapter 6

DISCUSSIONS AND CONCLUSIONS

This chapter provides a discussion of the results. The chapter is divided into eight main sections. The first section provides a discussion of descriptive statistics (tabular and graphical) for the dimensions of service quality, information quality and ergonomics. The second section provides a discussion of the results of ANOVA (General Linear Models) for the same dimensions to see the differences between banks and within the branches. The third section provides a discussion of the results of Multivariate Regression analysis to establish a relationship between the dimensions of service quality, information quality, and ergonomics variables. The fourth section provides the discussion of results of factor analysis to reduce the number of dimensions and variables associated with service quality, information quality and ergonomics. The fifth section provides the hypotheses for this research. The sixth section provides the overall discussion of the results. The seventh section provides the directions for future research. The eighth section provides the conclusions and recommendations.

6.1 Descriptive Statistics

As shown in the Table 6.1 responsiveness, reliability, and overall service quality respectively had a highest scores for all the banks together based on the mean values.

Table 6.1: Service Quality (All Banks)

Dimensions	Mean	Std Dev	Co.Varia.
Resp	7.8625	0.8576	0.1091
Reli	7.8219	0.8389	0.1073
Over	7.7543	0.8390	0.1082
Assu	7.6702	0.7472	0.0974
Emp	7.6474	1.1382	0.1488
Tang	6.9637	0.8537	0.1226

Note: The criteria was to choose the top two

The above statement is also true for Banks A and B separately as shown in the Appendix but bank A has higher mean values than bank B. For the branches (not the main banks) the above statement is almost the same except the ranking of these dimensions are different and empathy has the highest mean value. Reliability and responsiveness, although they would not lead to delighted customers, are areas where banks cannot afford to make mistakes as they are very important to customers and are potentially highly dissatisfying factors. All the branches, not the main banks, were found to be friendlier with the customers than the main banks since the branches' employees have more interaction with the customers.

Reputation, believability, value-added, and relevancy had the highest score for all the banks together. Completeness, access, and security have the lowest mean score as shown in the Table 6.2.

Table 6.2: Information Quality (All Banks)

Dimensions	Mean	Std Dev	Co.Varia.	Dimensios	Mean	Std Dev	Co.Varia.
Reput.	9.3463	0.4086	0.0437	Cons.Rp	8.5173	0.4243	0.0498
Belie.	9.2542	0.4151	0.0449	Eas.Man	8.3161	0.3489	0.0420
value	9.1915	0.3119	0.0339	Eas.Un.	8.2618	0.3573	0.0432
Relev.	9.1728	0.3304	0.0360	timel.	8.2237	0.3229	0.0393
Amoun.	9.0233	0.4080	0.0452	Interp.	8.1762	0.3840	0.4080
Conc.Rep	9.0180	0.4507	0.050	**Com.**	8.1413	0.4143	0.0470
Obje.	8.9073	0.5031	0.0565	**Acce.**	7.6699	0.5579	0.0727
Accur.	8.7762	0.5523	0.0629	**Secu.**	6.8538	0.5242	0.076

Note: The criteria was to choose the top three

The above statement is almost true for bank A, and bank B. In general bank A has the higher quality information than bank B. Completeness, access, and security have the lowest mean score for bank B. Interpretability, access, and security have the lowest mean score for bank A. The above statement is almost true for the branches.

It can be concluded that a good source of information, credibility of information, and how the information is beneficial to the employees and customers are emphasized in the banks. On the other hand availability of information, completeness of information, and security issues are not the emphasized in the banks.

Chair, environment, and overall work comfort, in sequence, are the most important ergonomic variables for all the banks based on the mean values as shown in the Table 6.3.

Table 6.3: Ergonomics (All Banks)

Dimensions	Mean	Std	Co.Varia.
Chair	8.1762	0.4457	0.0545
Envir.	7.6624	0.6021	0.0786
O.all	7.3644	0.7845	0.1065
Other	6.9728	0.6447	0.0925
WorkSt	6.2850	0.8529	0.1357

Note: The criteria was to choose the top three

For the branches (not the main banks) the above statement is true for banks A and B. The above statement is almost the same except the ranking of these dimensions are different. It can also be concluded that the workstation such as desktop has the lowest score for all the branches.

6.2 The General Linear Models Analysis

Reliability, responsiveness, assurance, empathy, tangible, and overall service quality dimensions differ for both bank A and bank B. Bank A has higher mean values than Bank B for all these dimensions. These dimensions are almost the same for the branches and as it was seen before, the empathy dimension is high for the branches compared to the main bank, which explains that the branches are friendlier to the customers than main banks.

Table 6.4: ANOVA Table for Service Quality

Variables	Main Effects	P.Value	Pair wise Comparison of Banks and Branches
Assurance	Branch (Banks)	0.2881	
	Banks	0.0001	A>B
Empathy	Branch (Banks)	0.0001	None of the branches are the same
	Banks	0.0001	A> B
Overall	Branch (Banks)	0.8087	
	Banks	0.0001	A>B
Reliability	Branch (Banks)	0.4271	
	Banks	0.0001	A>B
Responsiveness	Branch (Banks)	0.0087	A1=A2, A1=A3, B1=B2
	Banks	0.0001	A >B
Tangible	Branch (Banks)	0.0001	B1=B2
	Banks	0.0001	A> B

Note: A>B means bank A has a higher mean value than bank B for a given dimension.

The results show that (see Table 6.5) the two banks differ in all the dimensions of information quality except for accessibility dimension. All the branches within each bank are the same in all the dimensions except accessibility, relevancy, and value added. In general bank A has a higher mean values for these dimensions than bank B. It can be concluded that bank A addresses information quality better than bank B.

Table 6.5: ANOVA Table for Information Quality

Variables	Main Effects	P.Value	Pair wise Comparison of Banks and Branches
Accessibility	Branch (Banks) Banks	0.0001 0.1119	A2=A3, B1=B2
Accuracy	Branch (Banks) Banks	0.7074 0.0001	A>B
Amount of Information	Branch (Banks) Banks	0.7362 0.0001	A> B
Believability	Branch (Banks) Banks	0.3254 0.0001	A> B
Completeness	Branch (Banks) Banks	0.9561 0.0001	A>B
Concise Representation	Branch (Banks) Banks	0.8846 0.0001	A> B
Consistent Representation	Branch (Banks) Banks	0.9480 0.0001	B>A
Ease of Manipulation	Branch (Banks) Banks	0.9909 0.0001	A> B
Ease of Understanding	Branch (Banks) Banks	0.9465 0.0001	A> B
Interpretability	Branch (Banks) Banks	0.8179 0.0001	A> B
Objectivity	Branch (Banks) Banks	0.9666 0.0001	A>B
Relevancy	Branch (Banks) Banks	0.0163 0.0001	A2=A3, B1=B2 A> B
Reputation	Branch (Banks) Banks	0.9575 0.0001	A> B
Security	Branch (Banks) Banks	0.9887 0.0443	A>B
Timeliness	Branch (Banks) Banks	0.7437 0.0001	A> B
Value Added	Branch (Banks) Banks	0.0018 0.0001	A2=A3, B1=B2 A>B

Note: A>B means bank A has a higher mean value than bank B for a given dimension

The results show that banks differ in terms of chair, overall, other, and workstation dimensions (see Table 6.6), except for environment dimension. All the branches within each bank are the same in terms of all these dimensions. The result shows that bank B has a higher mean value for these dimensions than bank A. It can be concluded that bank B is more concerned than bank A regarding ergonomic issues and overall work comfort.

Table 6.6: ANOVA Table for Ergonomics

Variables	Main Effects	P.Value	Pair wise Comparison of Banks and Branches
Chair	Branch (Banks) Banks	0.93611 0.0018	 A>B
Environment	Branch (Banks) Banks	0.0016 0.3819	A1=B2, A2=A3, A2=B1, A3=B1, B1=B2
Overall	Branch (Banks) Banks	0.0001 0.0001	A2=A3, B1=B2 B>A
Other	Branch (Banks) Banks	0.9685 0.0001	 B>A
Workstation	Branch (Banks) Banks	0.0001 0.0001	A2=A3, B1=B2 B>A

Note: A>B means bank A has a higher mean value than bank B for a given dimension

6.3 Regression

- Overall Service Quality Vs. Five Dimensions of Service Quality

As shown in Table 6.7 for all the banks together, reliability and responsiveness were both significant with $R^2 = 0.87$. For bank A and bank B reliability was significant with $R^2 = 0.81$. For the branches, reliability and/or responsiveness were significant. It can be concluded that to perform the promised service dependently, accurately, and promptly

have a positive impact on the overall service quality. This result was consistent with the case study that was conducted by Najjar and Bishu (1998).

Table 6.7: Regression (Overall Service Quality Vs. Five Dimensions of Service Quality)

	Stepwise Selections	R-sq
All banks	Overall=. 25+. 91 Reli. +. 05 Resp.	.87
Bank A	Overall=. 63+. 91 Reli.	.81
Bank B	Overall=. 768+. 89 Reli.	.81
Bank A1	Overall=. 14+. 86 Reli. +. 11 Resp.	.81
Bank A2	Overall=. 60+. 921 Reli.	.83
Bank A3	Overall=. 236+. 96 Reli.	.81
Bank B1	Overall=. 77+. 81 Reli. +. 082 Resp.	.8
Bank B2	Overall=. 009+. 992 Reli.	.81

- Reliability vs. Information Quality:

For all the banks together, objectivity was significant and it can be concluded that the extent to which information is applicable and helpful for the task at hand is related to the reliability (to perform the promised service dependently and accurately). For bank A objectivity and consistent representation, bank A1 accuracy (accurate information leads to accurate statement), bank A2 objectivity, and bank A3 objectivity and amount of information were significant. For bank B2 amount of information was significant. None of the variables were significant for banks B and B1. The complete detail can be seen in Table 6.8.

Table 6.8: Regression (Reliability vs. Information Quality)

	Stepwise Selections	R-sq
All banks	Reli. = 5.95+. 26 Objectivity	.038
Bank A	Reli. = 5.95+. 26 Objectivity + .59 Cons.Repr	.1121
Bank B	None	
Bank A1	Reli. = .15 +. 89 Accur.	.515
Bank A2	Reli. = 13.53+. 58 Objectivity	.1560
Bank A3	Reli. = 10.89+. 44 Objectivity +. 725 Amount	.2348
Bank B1	None	
Bank B2	Reli. = 3.34+. 433 Amount	.092

- Responsiveness vs. Information Quality:

For all the banks together, objectivity and timeliness were significant and it can be concluded that the extent to which information is applicable and helpful for the task at hand and the extent to which the information is sufficiently up-to-date for the task at hand is related to the responsiveness (the willingness to help customers and provide the prompt service). For bank A accuracy, bank A1 believability (the extent to which information is regarded as true and credible), and bank A2 timeliness were significant. For bank B1 believability was significant. None of the variables were significant for banks B, B2, and A3. The complete detail can be seen in Table 6.9.

Table 6.9: Regression (Responsiveness vs. Information Quality)

	Stepwise Selections	R-sq
All banks	Resp.= 9.064+ .22 Object. + .331Timeli.	.04
Bank A	Resp.= 5.9899 + .25 Accur.	.031
Bank B	None	
Bank A1	Resp.= 1.49 + .73 Belie.	.1595
Bank A2	Resp.=-1.05 9+ 1.092 Timeli.	.1992
Bank A3	None	
Bank B1	Resp.= 14.12 +. 73 Belie.	.079
Bank B2	None	

- Assurance vs. Information Quality:

For all the banks together, bank A2, and bank A3 no variables were significant. For bank A objectivity, bank A1 believability, and bank B accessibility were significant. For bank B1 interpretability, and bank B2 objectivity, timeliness, and value- added were significant. It can be concluded that all these dimensions of information quality have a positive effect on assurance (the knowledge of employees and their ability to convey trust and confidence). The complete detail can be seen in Table 6.10.

Table 6.10: Regression (Assurance vs. Information Quality)

	Stepwise Selections	**R-sq**
All banks	None	
Bank A	Assu. = 6.087 + .223 Object.	.0329
Bank B	Assu. = 6.087 + .223 Access.	.0425
Bank A1	Assu. = 2.58 + .58 Belie.	.1436
Bank A2	None	
Bank A3	None	
Bank B1	Assu. = 11.273 + .52 Interpr.	.09
Bank B2	Assu. = 26.77+. 43 Object. +1.44 Timeli. +. 83 Value	.3441

- Empathy vs. Information Quality:

For all the banks together, timeliness, value added, and concise representation, were significant. For bank A objectivity, bank A1 believability, and bank A2 concise representation and security were significant. For bank B2 completeness was significant. No variables were significant for banks A3, B, and B1. It can be concluded that these variables directly related to empathy (the caring, individual attention provided to customers). The complete detail can be seen in Table 6.11.

Table 6.11: Regression (Empathy vs. Information Quality)

	Stepwise Selections	R-sq
All banks	Emp.= 28.4 + .65 Timeli. + .83 Value +. 38 Conc.Rep.	.36
Bank A	Emp. = 4.779 + .60 Belie. +. 36 Access	.1142
Bank B	None	
Bank A1	Emp. = - 1.42 + .88 Belie	.2574
Bank A2	Emp. = 4 + .67 Conc.Rep +. 23 Secur.	.214
Bank A3	None	
Bank B1	None	
Bank B2	Emp. = 11.037+ .42 Compl.	.1126

- Overall Service Quality vs. Information Quality:

For all the banks together and bank A3 accuracy and amount of information were significant. For bank A objectivity and consistent representation, bank A1 accuracy and objectivity, bank A2 objectivity, and bank A3 accuracy and amount of information were significant. No variables were significant for banks B, B1, and B2. It can be concluded that these variables directly related to the overall service quality. The accurate information, the right amount of information, and unbiased information leads to better customer satisfaction. The complete detail can be seen in Table 6.12

Table 6.12: Regression (Overall Service Quality vs. Information Quality)

	Stepwise Selections	R-sq
All banks	Overall= 8.39 +. 26 Accur. + .27 Amount	.0539
Bank A	Overall= .44 + .4 Object. + .49 Cons.Rep.	.11
Bank B	None	
Bank A1	Overall= - 2.21 +. 56 Accur. + .59 Object	.564
Bank A2	Overall= 13.13 - .54 Object	.1561
Bank A3	Overall= 13.6+. 47 Accur. + 1.05 Amount	.2807
Bank B1	None	
Bank B2	None	

- Overall Work Comfort Vs. Ergonomics Dimensions

For all the banks together, chair, other, and workstation were significant. For banks A and its two branches (A2, and A3) workstation was significant. For bank A1, no variables were significant. For bank B and all its branches chair was significant. It can be concluded that for all the banks, ergonomic chair, ergonomic computer, and other (stress, job demanding....) have a direct relation with overall work comfort. The result also shows that for bank A and its branches only ergonomic computer is related to the overall work comfort and for bank B and its branches only ergonomic chair is related to the overall work comfort. The complete detail can be seen in Table 6.13.

Table 6.13: Regression (Overall Work Comfort Vs. Ergonomics Dimensions)

	Stepwise Selections	**R-sq**
All banks	O.All=. 47+. 37Workst+. 39 Chair+. 29 Other	.32
Bank A	O.All= 4.65+. 39Workst	.24
Bank B	O.All= 4.16+. 44 Chair	.1127
Bank A1	None	
Bank A2	O.All= 4.39+. 41Workst	.3239
Bank A3	O.All= 4.45+. 22Workst	.14
Bank B1	O.All= 4.16+. 44 Chair	.094
Bank B2	O.All= 4.09+. 46 Chair	.1521

- Reliability VS. Ergonomics:

For bank A1, workstation and overall comfort were significant and for bank A2, chair was significant. No variables were significant for the rest of banks. It can be concluded that in general there is no significant relationship between reliability and ergonomics. The complete detail can be seen in Table 6.14.

Table 6.14: Regression (Reliability Vs. Ergonomics Dimensions)

	Stepwise Selections	R-sq
All banks	None	
Bank A	None	
Bank B	None	
Bank A1	Relia. = 2.82 + .39 Worksta + .39 O.all	.1926
Bank A2	Relia. = 1.65 + .81 Chair	.16
Bank A3	None	
Bank B1	None	
Bank B2	None	

- Responsiveness VS. Ergonomics:

For all the banks together, overall comfort was significant and for bank B2, overall comfort and workstation were significant. No variables were significant for the rest of banks. It can be concluded that overall comfort and workstation leads to a prompt service. The complete detail can be seen in Table 6.15.

Table 6.15: Regression (Responsiveness Vs. Ergonomics Dimensions)

Responsiveness	Stepwise Selections	R-sq
All banks	Respon. = 7.29 + .14 O.All	.044
Bank A	None	
Bank B	None	
Bank A1	None	
Bank A2	None	
Bank A3	None	
Bank B1	None	
Bank B2	Respon. = 12.96 - .36 Worksta. - .42 O.All	.2137

- Assurance VS. Ergonomics:

No variables were significant for both banks and branches.

- Empathy VS. Ergonomics:

For all the banks together, overall comfort and other were significant and for bank A, workstation and environment were significant. For bank B2, overall comfort was significant and no variables were significant for the rest of the banks. It can be concluded that these variables directly related to empathy (the caring, individual attention provided to customers). The complete detail can be seen in Table 6.16.

Table 6.16: Regression (Empathy Vs. Ergonomics Dimensions)

	Stepwise Selections	**R-sq**
All banks	Empa. = 3.13 + .32Other + .35 O.All	.1349
Bank A	Empa. = 11.15 + .27 Worksta. - .2 7	.091
Bank B	None	
Bank A1	None	
Bank A2		
Bank A3		
Bank B1	None	
Bank B2	Empa. = 9.56 - .23 O.All	.0847

- Tangible VS. Ergonomics:

For all the banks together, workstation and other were significant. For bank A, workstation, bank A3, other was significant. For bank A3, other was significant. For bank B1, chair and other were significant. No variables were significant for the rest of the banks. It can be concluded that workstation and chair are intangible and they are related to the intangibility of dimension of service quality. The complete detail can be seen in Table 6.17.

Table 6.17: Regression (Tangible VS. Ergonomics)

	Stepwise Selections	R-sq
All banks	Tang. = 6.96- .11 Worksta. + .179 Other	.036
Bank A	Tang. = 9.04- .29 Worksta	.11
Bank B	None	
Bank A1	None	
Bank A2	None	
Bank A3	Tang. = 4.59 + .4 79Other	.205
Bank B1	Tang. = .75 + .5 Chair + .4 2 Other	.2653
Bank B2	None	

- Overall Service Quality VS. Ergonomics:

For bank A1. workstation and overall comfort were significant and for bank B2. environment was significant. No variables were significant for the rest of the banks. It can be concluded that workstation, overall comfort, and environment have a positive impact on overall service quality only for some branches. The complete detail can be seen in Table 6.18.

Table 6.18: Regression (Overall Service Quality VS. Ergonomics)

	Stepwise Selections	R-sq
All banks	None	
Bank A	None	
Bank B	None	
Bank A1	Overall = 2.63 +.47 Worksta. + .33 O.all	.1490
Bank A2	None	
Bank A3		
Bank B1	None	
Bank B2	Overall = 3.637+.45 Environ.	.1186

- Service Quality VS. Information Quality and Ergonomics

This regression analysis was performed using service quality only for all the banks. The results show that there is a relationship between reliability and objectivity, between responsiveness and objectivity and over all comfort, between empathy and timeliness, completeness, interpretability, concise representation, and accessibility, between tangibility and accuracy, objectivity, ease of understanding, workstation, and other, and between overall service quality and accuracy and amount of information. The complete detail can be seen in Table 6.19. The result is almost the same as regression analysis when ergonomics were not included except the overall comfort and workstation were added to the model.

Table 6.19: Regression (Service Quality VS. Information Quality & Ergonomics)

Variables	Stepwise Selections	R-sq
Reli.	= 5.95+. 26 Objectivity	.038
Responsiv.	= 5.42+. 20 Objectivity + .15 O.all	.0451
Assuran.	None	
Empathy	= 29.53 +. 62 Timel. +. 66 Com.+ .39 Interp. - .35 Conc. Rep-.25 Acce.	.3486
Tangible	= 9.39 +. 22 Accu. -.32 Obje. +. 34 Ease.Und -.17 WorkSt. +. 15 Other	.10
Overall	= 8.39 +. 26 Accu. +. 27 Amount	.053

6.4 Factor Analysis

Regarding service quality dimensions one factor was retained for analysis since its Eigenvalue was more than unity. This factor explains 57% of variability of dimensions of service quality. It can be concluded that the number of dimensions of service quality reduced only to one variable and it could be used for further analysis in the next section. Based on the result of Varimax and Rotated Factor Pattern, factor 1 is highly loaded on assurance dimensions of service quality. Thus factor 1 is assurance.

Regarding information quality dimensions five factors were retained for analysis since their Eigenvalue are more than unity. Collectively the five factors explain 59% of variability of dimensions of information quality. It can be concluded that the number of dimensions of information quality reduced only to five variables and they could be used for further analysis in the next section. Based on the result of Varimax and Rotated Factor Pattern factor 1 is moderately loaded on completeness, factor 2 is highly loaded on objectivity, factor 3 is moderately loaded on relevancy, factor 4 on concise representation, and factor 5 is moderately loaded on timeliness dimensions of information quality. Thus factors 1-5 will have the corresponding names.

Regarding ergonomics dimensions first factor analysis was performed without using the overall comfort. Two factors were retained for analysis since their Eigenvalue are more than unity. Collectively both explain 57% of variability of dimensions of service quality. Based on the result of Varimax and Rotated Factor Pattern factors 1 and 2 are moderately loaded on Other and Environment dimensions of ergonomics. Thus factors 1 and 2 will have the corresponding names. Then factor analysis was performed including

the overall comfort. Two factors were retained for analysis since their Eigenvalue are more than unity. Collectively both explain 57% of variability of dimensions of service quality. It can be concluded that the number of dimensions of ergonomics reduced only to two variables and they could be used for further analysis. Based on the result of Varimax and Rotated Factor Pattern factors 1 and 2 are highly loaded on overall comfort and environment dimensions of ergonomics. Thus factors 1 and 2 will have the corresponding names.

Using regression analysis with the overall service quality as a dependent variable and the factor from the result of factor score analysis as the independent variables, the flowing models was found:

- Overall Service Quality VS. Assurance

Using regression analysis with the overall service quality as a dependent variable and the factor from the result of Factor Score Analysis (Assurance) as the independent variables, the flowing models was found with $R^2 = 0.4638$. This factors is significant with p.value <0.0001. This variable was not significant when regression (non -Factor Scores) was performed, thus feeling secure to do banking business has a positive effect on Overall service quality.

Over all = 7.75 43 + 0.6238Assu.

- Overall work comfort VS. Other and Environment

Using regression analysis with the overall work comfort as a dependent variable and the factors from the result of factor score analysis (other, environment) as the independent variables, the flowing models was found with $R^2 = 0.30$. Both factors are significant with P.Value <0.0001. The other was significant along with the chair and workstation when regression (non -factor scores) was performed, so the result is not the same as before. Both models are reliable and further analysis should be conducted to investigate the discrepancy.

Over all Work = 7.364 + 0.6089 Other + 0.3235 Environment

- Service Quality VS. Information Quality

Using regression analysis with the overall service quality and five dimensions of service quality (reliability, responsiveness, assurance, empathy, and tangible) as the dependent variable and the five factors from the result of factor score analysis (completeness, objectivity, relevancy, concise representation, and timeliness) as the independent variables, the following results were found as shown in Table 6.20.

Table 6.20: Regression (Service Quality VS. Information Quality)

Variables	Stepwise Selections	R-sq	P. Value for General Test	Significant Variables
Reli.	= 8.29 +. 0096 Completeness +. 148 Objectivity -.0006 Relevancy - .04 Concise Representation - .04 Timeliness	.046	.051	Completeness
Responsiv.	= 8.33 +. 11 Completeness +. 08 Objectivity -.036 Relevancy - .007 Concise Representation +. 085 Timeliness	.0425	.0738	None
Assuran.	= 8.12-. 03 Completeness +. 035 Objectivity +. 034 Relevancy - .017 Concise Representation -. 021 Timeliness	.0085	.85	None
Empathy	= 8.024-. 63 Completeness +. 07 Objectivity +. 08 Relevancy - .28 Concise Representation -. 06	.34	.0001	Completeness. Concise Representation
Tangible	= 7.41-. 12 Completeness +. 07 Objectivity +. 016 Relevancy - .16 Concise Representation +. 20 Timeliness	.087	.0008	Completeness. Concise Representation. and Timeliness
Overall	= 8.22 -. 0035 Completeness +. 130 Objectivity -.015 Relevancy - .54 Concise Representation - .025 Timeliness	.0363	.1285	None

As shown in Table 6.20 there is a relationship between reliability and completeness (as before), between empathy and (completeness, concise representation). Also these two variable (completeness, concise representation) were parts of the regression model using the non-factor scores. There is a relationship between tangibility and (completeness, concise representation, timeliness) and for the non-factor scores model ease of understanding was significant. It can be concluded that the non-factor scores model.is more reliable since the R-sq was higher than the new model.

- Service Quality VS. Ergonomics

Using regression analysis with the overall service quality and five dimensions of service quality (reliability, responsiveness, assurance, empathy, and tangible) as the dependent variable and the two factors from the result of factor score analysis (overall work comfort and environment) as the independent variables, the following results were found as shown in Table 6.21

Table 6.21: Regression (Service Quality VS. Ergonomics)

Variables	Stepwise Selections	R-sq	P. Value for General Test	Significant Variables
Reli.	= 8.2966 +. 026 Overall Work +. 2222 Environment	.0014	.8509	None
Responsiv.	= 8.33 + .1019 Overall Work +. 094 Environment	.039	.0092	Overall Work, Environment
Assuran.	= 8.12 + .020 Overall Work +. 058 Environment	.011	.2707	None
Empathy	= 8.024 + .38 Overall Work -.08 Environment	.1179	.0001	Overall Work
Tangible	=7.41 -.0045 Overall Work -.058 Environment	.0064	.4726	None
Overall	=8.22 +. 045 Overall Work -.04 Environment	.0075	.4156	None

As shown in Table 6.21 the relationship between responsiveness and (overall work, environment), between empathy and the overall work other are significant. It is interesting to see that the relationship that mentioned above was not true for all the banks together using a non-factor score regression. It can be concluded that these dimensions are significant.

- Service Quality VS. Information Quality

Using regression analysis with the overall service quality and Assurance (from the result of factor score analysis) as the dependent variable and the five factors from the result of fctor score analysis (completeness, objectivity, relevancy, concise representation, and timeliness) as the independent variables and the following results were found as shown in Table 6.22

Table 6.22: Regression (Service Quality VS. Information Quality)

Variables	Stepwise Selections	R-sq	P. Value for General Test	Significant Variables
Overall	= 8.2288-. 0036 Completeness +. 131 Objectivity -.01595 Relevancy - .0547 Concise Representation - .0252 Timeliness	.0363	.1285	None
Assuran.	= .633 -. 0157 Completeness +. 0805 Objectivity +. 0001 Relevancy - .087 Concise Representation + .0326 Timeliness	.0697	.0051	Completeness

As shown in Table 6.22, the relationship between assurance and completeness is significant and this was not the case when using a non-factor score regression (no variable was significant). Also there was a relationship between overall service quality and accuracy & amount of information, but none are significant in this model.

- Service Quality VS. Ergonomics

Using regression analysis with the overall service quality and assurance (from the result of factor score analysis) as the dependent variable and overall work comfort & environment (from the result of factor score analysis) as the independent variables. the following results were found as shown in Table 6.23.

Table 6.23: Regression (Service Quality VS. Ergonomics)

Variables	Stepwise Selections	R-sq	P. Value for General Test	Significant Variables
Overall	= 9.11 +. 144 Overall Work -.0306 Environment	.0076	.6190	None
Assuran.	= 2.187 +. 2749 Overall Work +. 0508 Environment	.026	.1095	None

As shown in Table 6.23 there is no significant relationship; the same result was found when using a non-factor score regression for overall service quality. assurance had a relationship with other along with overall work comfort.

- Service Quality VS. Information Quality and Ergonomics

Using regression analysis with the overall service quality and Assurance (from the result of factor score analysis) as the dependent variable and the five factors from the result of factor score analysis (completeness, objectivity, relevancy, concise representation, and timeliness) and the two factors from the result of factor score analysis (overall work comfort, environment) as the independent variables, the following results were found as shown in Table 6.24.

Table 6.24: Regression (Service Quality VS. Information Quality and Ergonomics)

Variables	Stepwise Selections	R-sq	P. Value for General Test	Significant Variables
Overall	= 10.83 +. 0226 Completeness +. 136 Objectivity -.013 Relevancy - .043 Concise Representation - .016 Timeliness +. 338 Overall Work -.029 Environment	.0439	.2426	None
Assuran.	= .884 -. 01413 Completeness +. 081 Objectivity +. 020 Relevancy - .082 Concise Representation + .047 Timeliness+. 075 Overall Work +. 052 Environment	.078	.015	Completeness. Objectivity

As shown in Table 6.24 the relationship between assurance and (completeness & objectivity) is significant and no variable was significant when using a non-factor score regression. In a non-factor score regression accuracy and amount had moderate relationship with overall service quality

6.5 Hypotheses

The followings are the conclusions regarding the hypotheses that proposed in chapter three:

- Information quality has a direct positive effect on quality of banking service.
- Ergonomics have a direct positive effect on quality of baking service.
- Service quality dimensions have direct positive effect on overall quality of banking service.

- Ergonomics dimensions have direct positive effect on overall work comfort in the banking industry
- The mean score for dimensions of service quality for banks and branches are the same.
- The mean score for dimensions of information quality for banks and branches are the same.
- The mean score for dimensions of ergonomics for banks and branches are the same.The hypothesis in this study will examine:

6.6 Overall Discussions

The objective of this study was to determine the impact of information quality and ergonomics on service quality in the banking industry. In this study, the banking industry was the domain of interest. Two different large regional banks were selected (bank A with 3 branches and bank B with 2 branches) for this study. Note that the branch 1 is the main bank for both banks A and B. First, a sample of 800 customers was randomly selected from the five branches and the service quality questionnaires were sent to them by mail. Second, the IQ (Information Quality) questionnaires and the ergonomics questionnaires were sent to 278 employees of the banks that use information to serve internal or external customers.

The results of *service quality* showed that reliability and responsiveness were the two most critical dimensions of service quality and they are directly related to overall service quality. Responsiveness and reliability have been shown to be important factors,

supporting previous work by, for example, Berry et al. (1985), and Avkiran (1994). Allred, A. and Addams, H.L. (2000) conducted a similar study in a banking industry in a midwestern city and found out that assurance, reliability, and responsiveness are the most critical dimensions of service quality. Johnston (1997) conducted a study in the UK banking industry to combine the classification of quality factors into satisfiers and dissatisfiers together with relative importance. The factors that may delight customers tend to be concerned more with the intangible nature of the service, commitment, attentiveness, friendliness, care and courtesy. The main sources of dissatisfaction appear to be cleanliness, aesthetics, integrity, responsiveness, reliability and security, which are associated with either the more tangible aspects of service or systemic issues. Thus reliability and responsiveness dimensions of service quality have been shown to be important factors, supporting previous works.

The results of *information quality* showed that Wang and Strong's 16 data quality dimensions are important within the banking industry. All of the data quality dimensions except accessibility were significantly different between banks, but they were the same for branches within each bank. In general bank A has higher quality information than bank B. Reputation, believability, value-added, and relevancy had the highest score for all the banks together as a whole, bank A, and bank B. Completeness, access, and security had the lowest mean score for all the banks as a whole and bank B. Interpretability, access, and security have the lowest mean score for bank A. Gendron et al. (2001) examined Wang and Strong's data quality dimensions for three sectors of the healthcare industry. Their statistical analyses indicated that fifteen of Wang and Strong's

data quality dimensions are sufficient to define data quality in all sectors of the healthcare industry. Accuracy, accessibility, and security had the highest score and amount of information, consistent representation, and reputation had the lowest mean score for all sectors of the healthcare industry. Huang, K. Lee, Y. Wang, R. (1999) conducted a study to asses the information quality in Appliance Company. Their statistical analyses indicated that believability, reputation, and relevancy had the highest score and ease of manipulation, security, and amount of data had the lowest mean score for Appliance Company. Thus, few dimensions of information quality are common across the different industries; in general different industries view information quality differently.

In addition the result showed that accuracy (accurate information leads to accurate statement), and amount of information were related to the overall service quality. Objectivity (the extent to which information is applicable and helpful for the task at hand), timeliness, and believability (the extent to which information is regarded as true and credible), were also related to the dimensions of service quality.

The results of *ergonomics* showed that the workstation such as the desktop has the lowest score for all the branches. The result also showed that for bank A and its branches only the workstation is related to the overall work comfort. For bank B and its branches only the chair is related to the overall work comfort. All of the dimensions of ergonomics (workstation, overall comfort, other, and environment) had a positive impact on overall service quality. Workstation and overall comfort were seen repeatedly in different regression models.

Service quality tools that were used in this research have been used extensively in the other service industries as well as the manufacturing industries. The five-dimensional structure could possibly serve as a meaningful framework for tracking a firm's service quality performance over time and comparing this performance against the performance of competitors (Parasuraman, 1993). The wording of some individual items may need to be customized to each service setting. Items on some dimensions should be expanded if necessary for reliability.

Wang and Strong's information quality dimensions have been used in all sectors of the healthcare industry, manufacturing industry, and many other service industries. It is suggested that the sixteen dimensions of information quality proposed by Wang and Strong need to be tested and customized to each service setting.

The ergonomics tools that were used in this study can be generalized to any service and manufacturing industry since all the dimensions of ergonomics are common among all the industries.

As it shown in chapter four, the response rate of customers from bank B is higher than bank A and this may cause differential biases in data collection. Since the sample sizes are large enough and data were normalized using square means, so the differential biases in data collection should not have an effect on the analysis. One explanation might be that bank B customers might have had a high morale and were satisfied with the service quality or very dissatisfied with the service quality.

Tracking customers and developing creative strategies to retain them is very profitable. For example, in 1982, Charles Cawley, the president of the credit card

company MBNA of America, became increasingly frustrated by numerous complaints from defecting customers and took action. Cawley announced to all MBNA employees that the mission of the company would be to keep every customer. To accomplish this goal, a strategy was implemented to call defecting customers personally and obtain information about the reason for their defection. Chronic problems were determined and prioritized; appropriate changes were implemented. Eight years later, MBNA's defection rate was reduced to just 5 percent, one of the lowest in the industry. Without making any acquisitions, MBNA's industry ranking went from 38 to 4, and profits increased 16-fold (Reichheld and Sasser, 1990). Many studies indicate that it costs eight to ten times less to keep a customer than to develop a new one Thus improving service quality leads to the customer satisfaction and ultimately to customer loyalty.

Poor data quality is pervasive and costly to industry. Redman reports that error rates of 1-5% are typical, with an estimated immediate cost of about 10% of revenue (Redman, 1996). Customers, suppliers, distributors, and employees are negatively impacted through poor service, billing errors, and inconvenience. Data quality problems may cause serious financial problems for organizations. Data quality problems recently cost a fiber-optics manufacturer $500,000 when a mislabeled shipment caused the wrong cable to be laid along the bottom of a lake, caused a brokerage firm to lose $500 million when a dealer entered an incorrect exchange rate, and caused the U.S. government to lose over $2 billion in federal loan monies (Firth, 1996).

A prerequisite for satisfying the external customers, through high external quality, is that the internal customers are also satisfied through high internal quality (Axelsson

and Bergman, 1999). Thus improving ergonomics design will lead to satisfied internal customers and external customer and ultimately increase profit.

6.7 Directions for Future Research

Measurement of service quality has been a challenge and will remain a challenge. Nobody has written the final chapter of quality improvement in the service organization. This is only a starting point and more research in this area needs to be done to understand the confusion and the complexity of service quality. Future research should compare performance for foreign banks because of the partnership in a global market. Cultural differences might be an obstacle for a successful partnership. As we have seen, merging or partnership among the banks might be an answer to improve service quality due to global market economy. The service quality tools might be applied the electronic banking customers in order to compare these two segments of population.

Improving the accuracy of data during data collection may provide an avenue for future research. Future studies could examine the TQM, falsifying, and concurrent engineering concept to improve data quality at the source through education and quality circles as we have seen in manufacturing and service industries. Future research should apply statistical process control (SPC) techniques to continuously improve data accuracy. Researchers and practitioners interested in data quality assurance must also focus on preventing defective data at the source to improve information quality.

Another issue that has been raised at MIT conferences and seminars regarding information quality is 'what is the cost associated with poor information quality'?

This concern also was addressed from Union Pacific and University of Nebraska at Omaha. The University of Nebraska at Omaha is in the process of assessing information quality from the user perspective, within the SAP Enterprise Resource Planning (ERP) system. There has not been any straight answer regarding this concern.

Thus improving ergonomics design will lead to satisfied internal customers and external customer and ultimately increase profit. Future research should focus on 'what is the cost associated with the ergonomics design that will lead to satisfied internal customers and external customer and ultimately increase profit '?

6.8 Conclusions

6.8.1 Conclusions on Research Hypothesis

- The results of *service quality* showed that reliability and responsiveness were the two most critical dimensions of service quality and they are directly related to overall service quality.
- The results of *information quality* showed that Wang and Strong's 16 data quality dimensions are important within the banking industry. All the data quality dimensions except accessibility were significantly different between banks, but they were the same for branches within each bank. In general bank A has higher quality information than bank B. Reputation, believability, value-added, and relevancy had the highest score for all the banks together as a whole, bank A, and bank B. Completeness, access, and security had the lowest mean score for all the

banks as a whole and bank B. In addition the result showed that accuracy (accurate information leads to accurate statement), and amount of information were related to the overall service quality. Objectivity (the extent to which information is applicable and helpful for the task at hand), timeliness, and believability (the extent to which information is regarded as true and credible), were also related to the dimensions of service quality.

- The results of *ergonomics* showed that the workstation such as the desktop has the lowest score for all the branches. The result also showed that for bank A and its branches only the workstation is related to the overall work comfort. For bank B and its branches only the chair is related to the overall work comfort. All of the dimensions of ergonomics (workstation, overall comfort, other, and environment) had a positive impact on overall service quality. Workstation and overall comfort were seen repeatedly in different regression models.

6.8.2 Recommendations

Measuring service quality to identify its underlying dimensions helps in pinpointing areas of inefficiency to improve service quality. To be competitive locally and globally in the marketplace, any service banking organization must have some kind of quality techniques to improve all the dimensions of service quality. The five-dimensional structure could possibly serve as a meaningful framework for tracking a firm's service quality performance over time and comparing it against the performance of competitors. The wording of some individual items may need to be customized to each

service setting. Items on some dimensions should be expanded if that is necessary for reliability. Thus the banking industries must continuously measure and improve these dimensions in order to gain customer's loyalty.

The result showed that Wang and Strong's 16 data quality dimensions are important within the banking industry and could possibly serve as a meaningful framework for tracking a firm's information quality performance over time and comparing it against the performance of competitors. It is recommended that banks A and B continuously measure and improve the dimensions of information quality especially the lower end dimensions since they are very critical to be competitive in the marketplace. The result showed that accuracy and amount of information were related to the overall service quality. Objectivity, timeliness, and believability were also related to the dimensions of service quality. These dimensions repeatedly were shown in the regression models and it is recommended that the banking industries must ensure continuously improving these critical dimensions of information quality.

The result showed that the workstation such as desktop has the lowest score for all the branches. The result also showed that for bank A and its branches only the workstation is related to the overall work comfort and for bank B and its branches only chair is related to the overall work comfort. Therefore, it is recommended that the management in banks A and B should provide better ergonomics environments to their internal customers for better serving the external customers. All of the dimensions of ergonomics: workstation, overall comfort, and environment had a positive impact on overall service quality. Workstation and overall comfort were seen repeatedly in different

regression models and it is recommended that an ergonomically designed computer is very important for overall comfort that leads to a better service quality.

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Appendix A

1. Figures

2. Tables

1. Figures

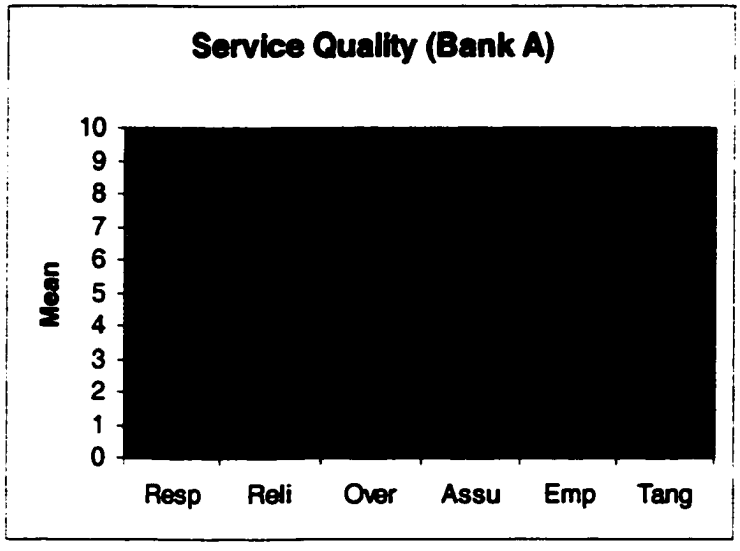

Fig.1: Service Quality (Bank A)

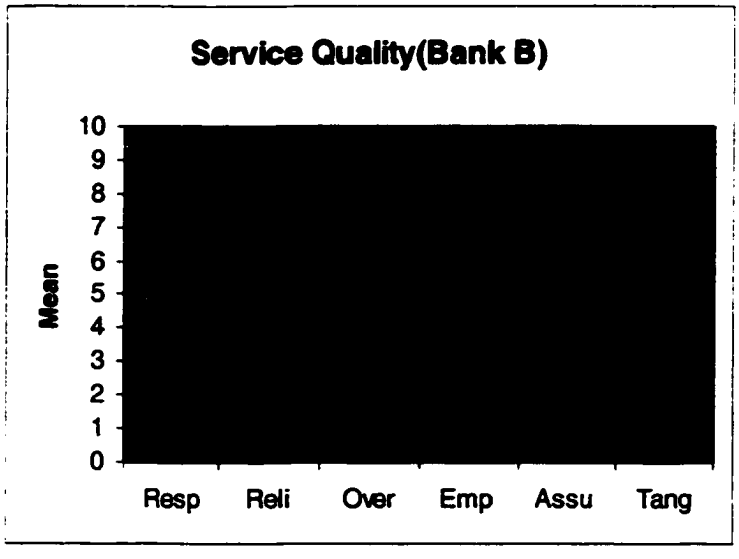

Fig.2: Service Quality (Bank B)

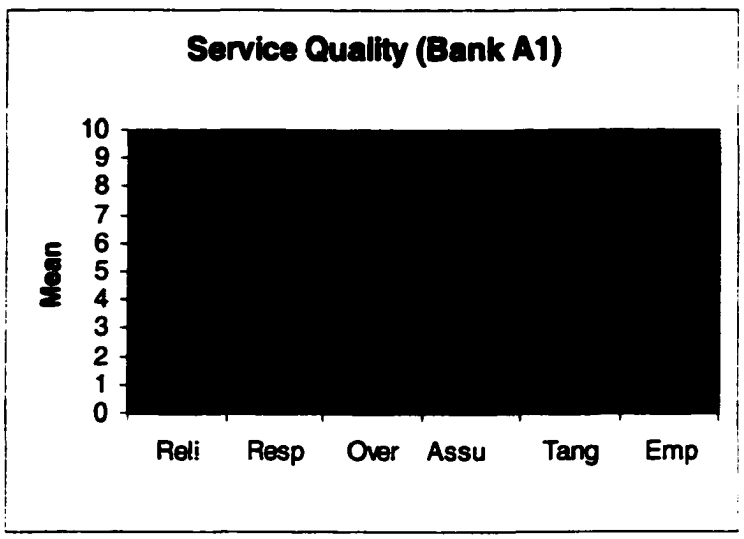

Fig.3: Service Quality (Bank A1)

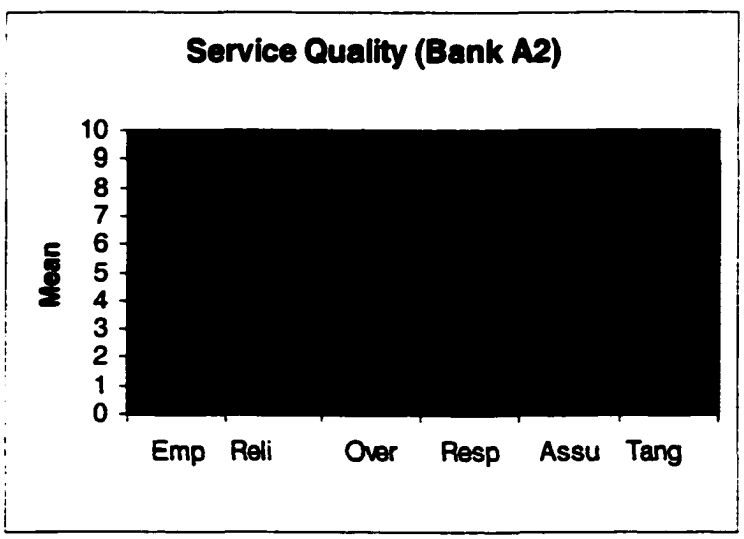

Fig.4: Service Quality (Bank A2)

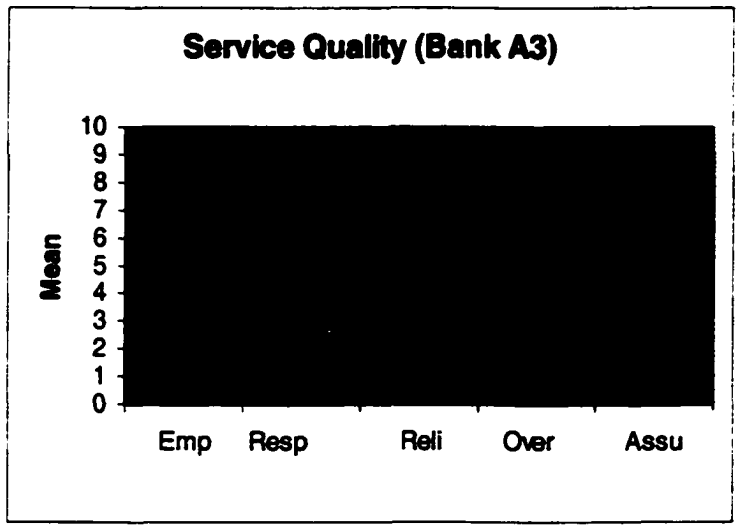

Fig.5: Service Quality (Bank A3)

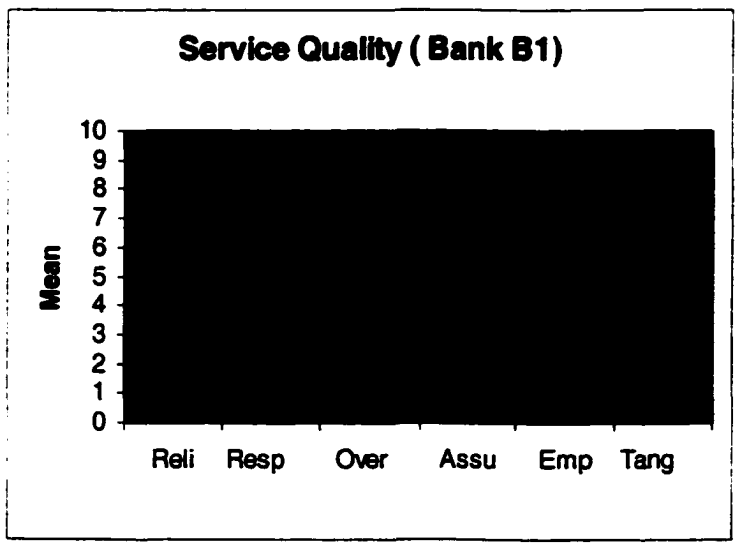

Fig.6: Service Quality (Bank B1)

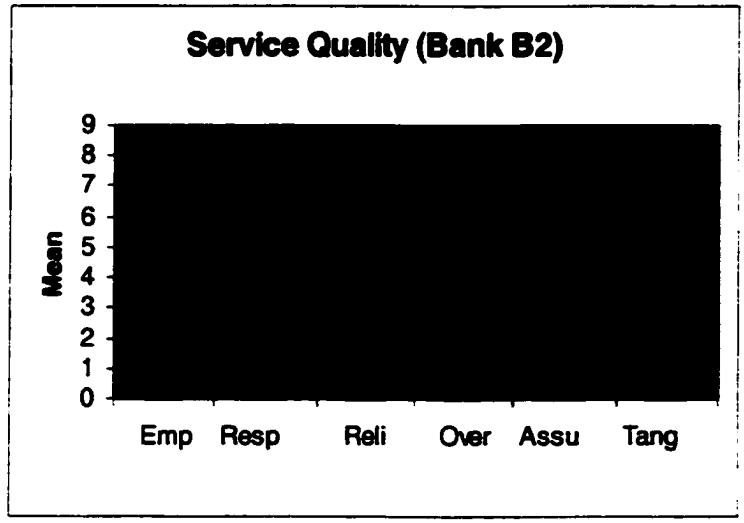

Fig.7: Service Quality (Bank B2)

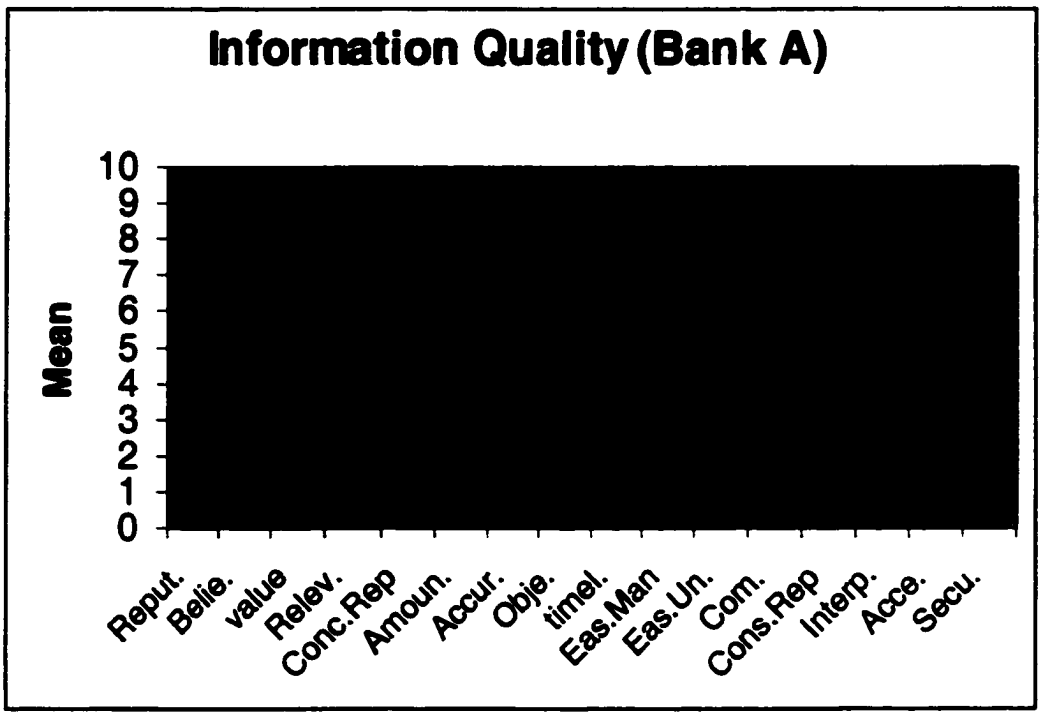

Fig.8: information Quality (Bank A)

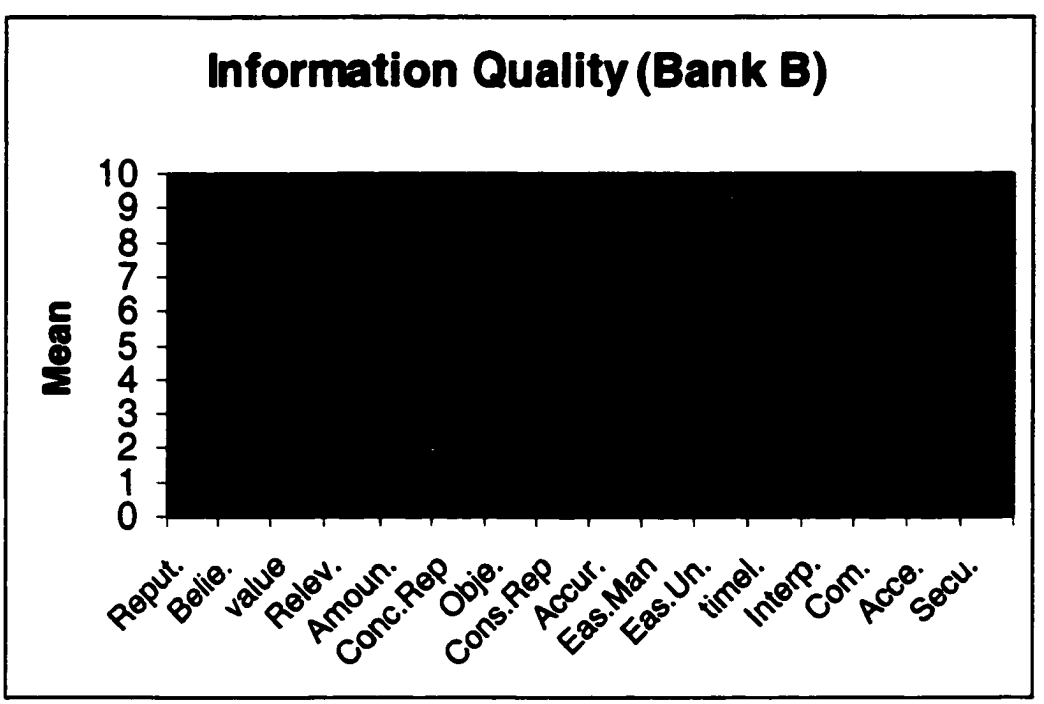

Fig. 9: information Quality (Bank B)

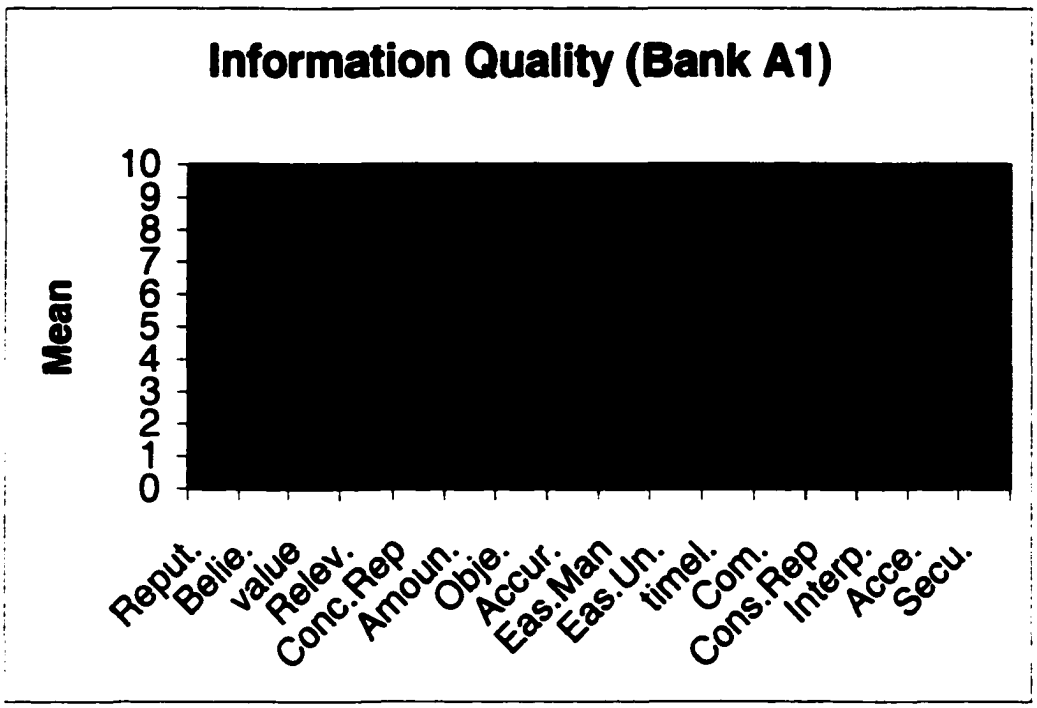

Fig. 10: information Quality (Bank A1)

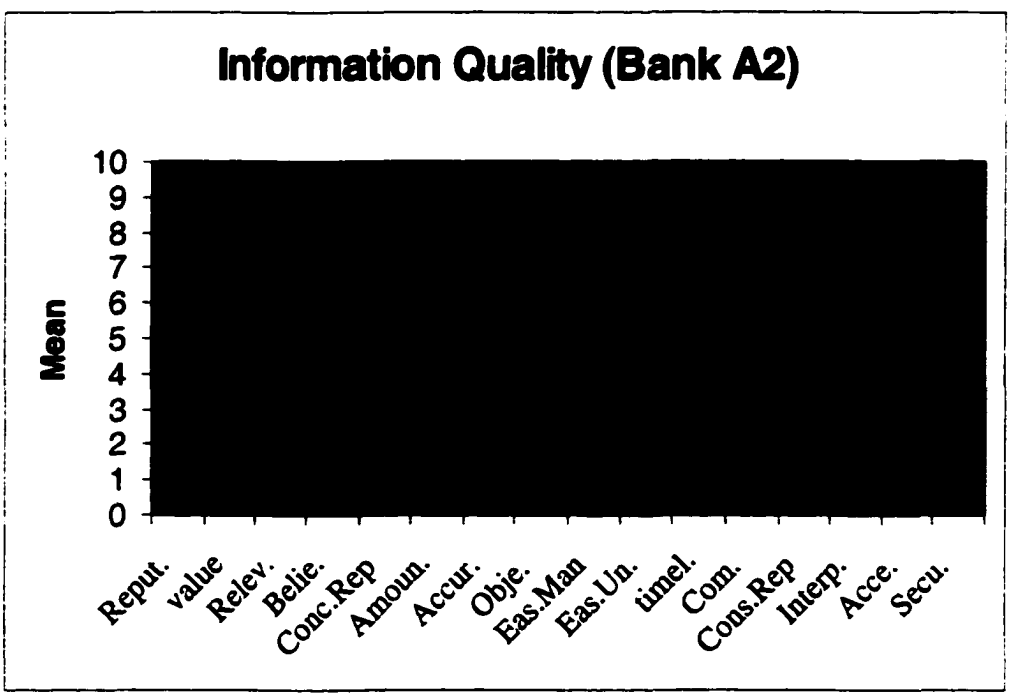

Fig .11: information Quality (Bank A2)

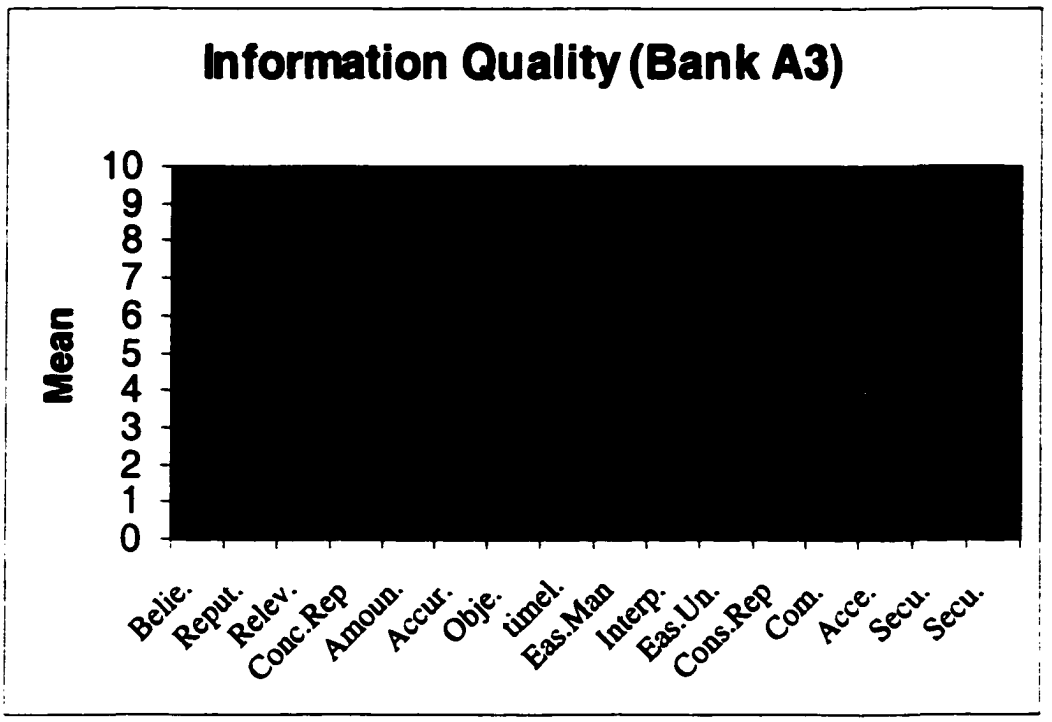

Fig .12: information Quality (Bank A3)

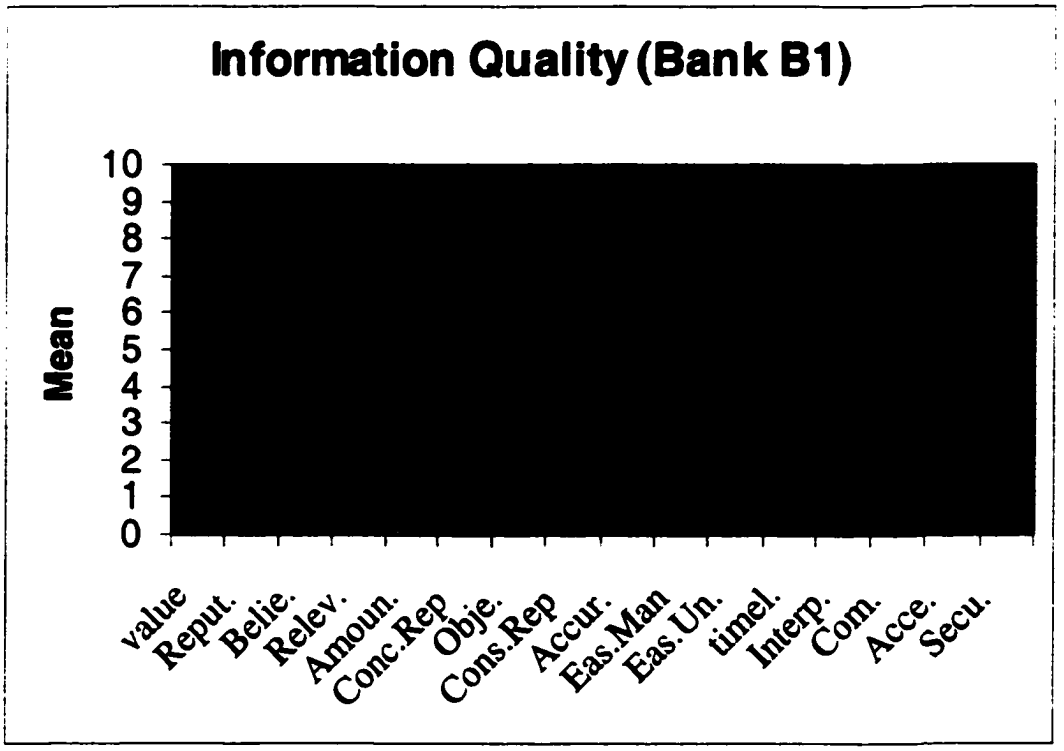

Fig .13: information Quality (Bank B1)

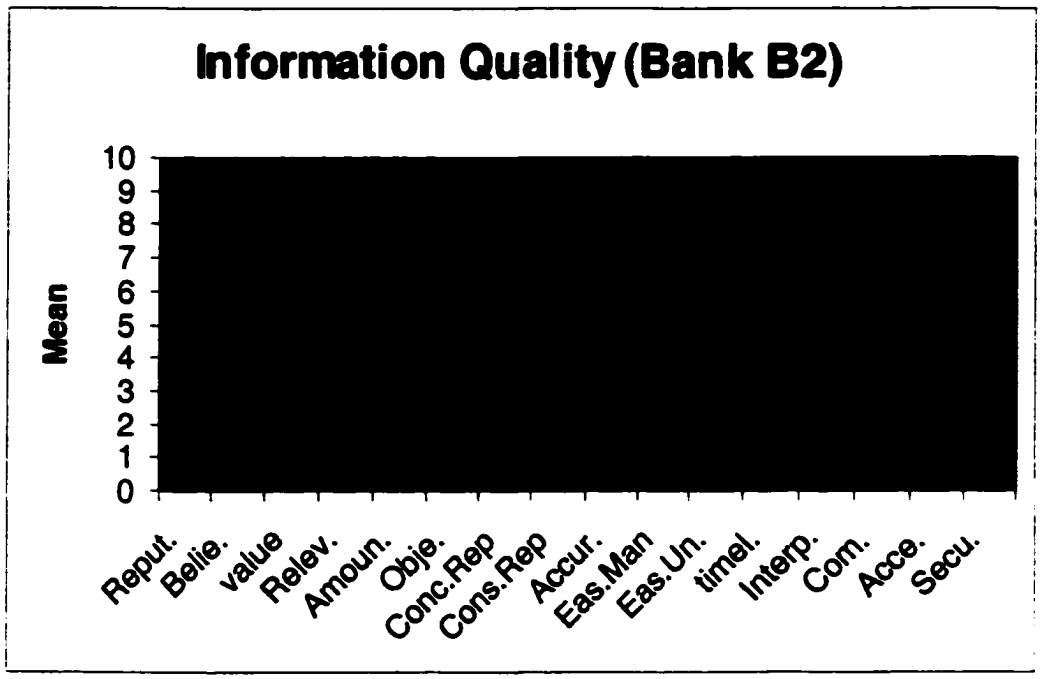

Fig .14: information Quality (Bank B2)

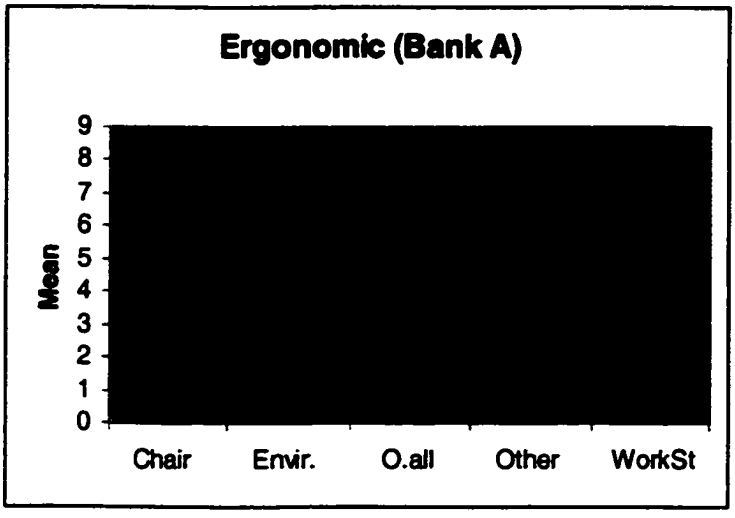

Fig .15: Ergonomics (Bank A)

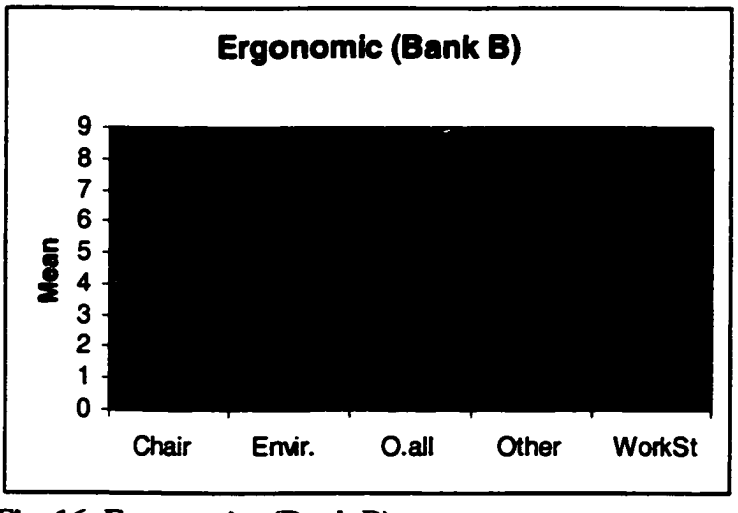

Fig .16: Ergonomics (Bank B)

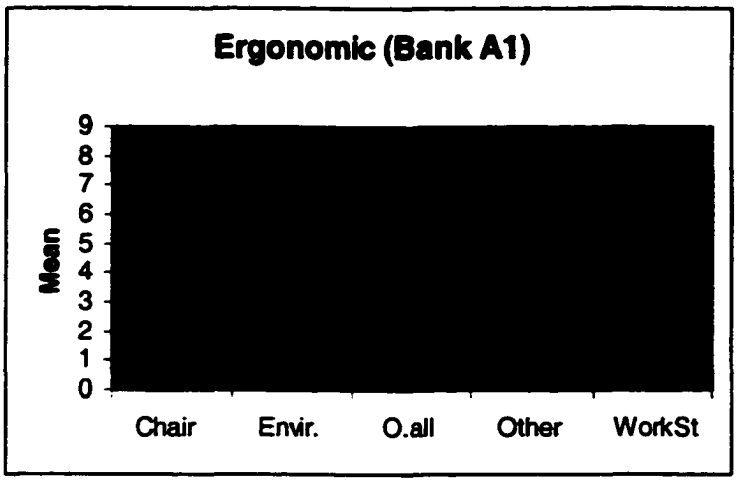

Fig. 17: Ergonomics (Bank A1)

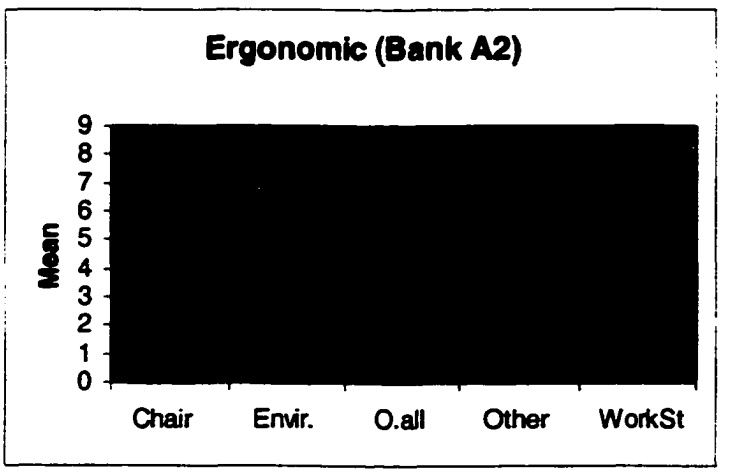

Fig. 18: Ergonomics (Bank A2)

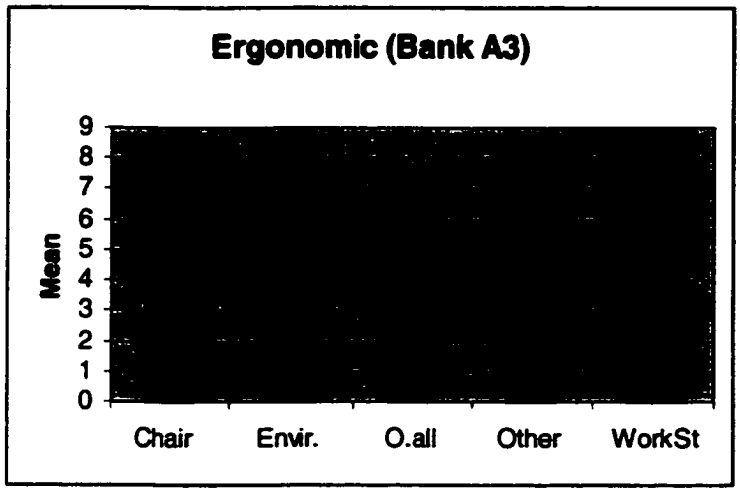

Fig. 19: Ergonomics (Bank A2)

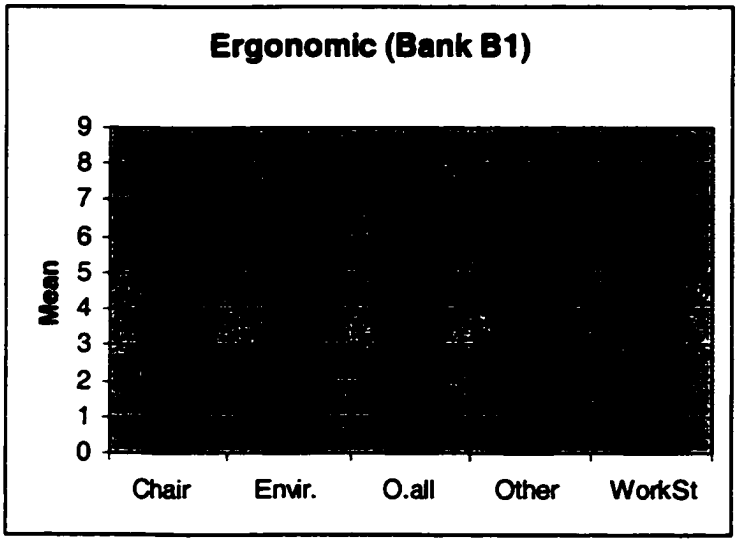

Fig. 20: Ergonomics (Bank B1)

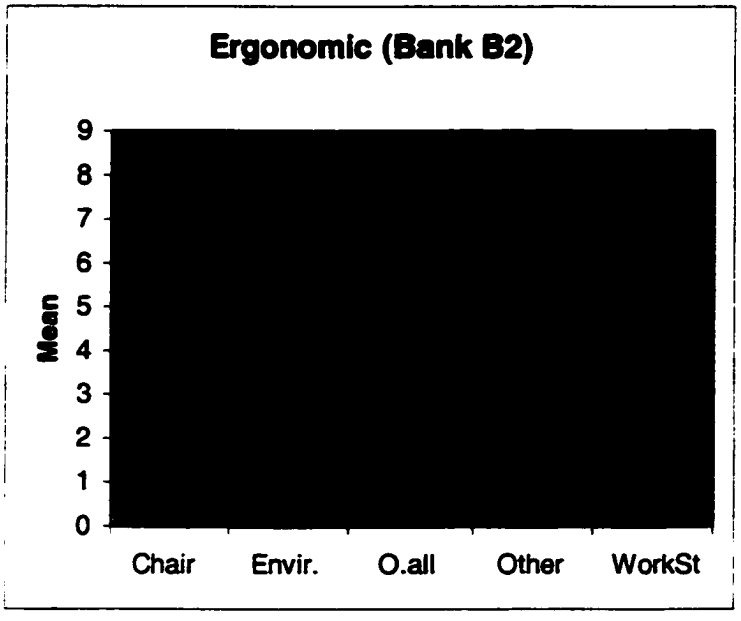

Fig. 21: Ergonomics (Bank B2)

2. Tables

SERVICE QUALITY

Table 1: Bank A

Variable	Mean	Std Dev
Resp	8.3306229	0.7004963
Reli	8.2831978	0.6852624
Over	8.2113821	0.6969559
Assu	8.1260167	0.5831490
Emp	8.0555554	1.0834074
Tang	7.4051491	0.7239285

Table 2: Bank B

Variable	Mean	Std Dev
Resp	7.3438432	0.7043562
Reli	7.3108110	0.68378
Over	7.2477477	00.677277
Emp	7.1951952	1.0225890
Assu	7.1651655	0.5616778
Tang	6.4744745	0.7084197

Table 3: Bank A1

Variable	Mean	Std Dev
Reli	8.3369562	0.7152521
Resp	8.3369558	0.7615516
Over	8.2173913	0.7082882
Assu	8.0507257	0.6441887
Tang	7.1086957	0.6705176
Emp	6.8731884	0.6897866

Table 4: Bank A2

Variable	Mean	Std Dev
Emp	8.5925926	0.4594683
Reli	8.2551440	0.7115546
Over	8.2098765	0.7196536
Resp	8.1522634	0.6325640
Assu	8.1234564	0.5175911
Tang	7.7242802	0.6683094

Table 5: Bank A3

Variable	Mean	Std Dev
Emp	8.9497712	0.4864568
Resp	8.5205475	0.6478510
Reli	8.2465758	0.6187084
Over	8.2054795	0.6658100
Assu	8.2237447	0.5639763
Tang	7.4246571	0.7011014

Table 6: Bank B1

Variable	Mean	Std Dev
Reli	7.3703701	0.7307917
Resp	7.2991447	0.7263302
Over	7.2905983	0.6703040
Assu	7.1737895	0.5477190
Emp	6.6068376	1.0167330
Tang	6.4558407	0.7065617

Table 7: Bank B2

Variable	Mean	Std Dev
Emp	7.8507937	0.4956672
Resp	7.3936502	0.6790217
Reli	7.2444451	0.6240657
Over	7.2000000	0.6850042
Assu	7.1555559	0.5793197
Tang	6.4952378	0.7132956

Information Quality

Table 8: Bank A

Dimensions	Mean	Std Dev	Dimensions	Mean	Std Dev
Reput.	9.4567669	0.3849824	Timel.	8.4180451	0.2645278
Belie.	9.3778195	0.4412625	Eas.Man	8.4075188	0.3059075
Value	9.362406	0.2571998	Eas.Un.	8.4	0.2994945
Relev.	9.3398496	0.3104102	Com.	8.3898496	0.2660570
Conc.Rep	9.2180451	0.2654569	Cons.Rep	8.3842105	0.5707483
Amoun.	9.1710526	0.2892788	Interp.	8.3842105	0.2698462
Accur.	9.0421053	0.5087433	Acce.	7.6368421	0.5707483
Obje.	9.0285702	0.4870233	Secu.	6.9154135	0.5622998

Table 9: Bank B

Dimensions	Mean	Std Dev	Dimensions	Mean	Std Dev
Reput.	9.2038835	0.3956683	Accur.	8.4330097	0.3961551
Belie.	9.0946602	0.3152895	Eas.Man	8.1980583	0.3667506
Value	8.9708738	0.2264955	Eas.Un.	8.0834951	0.3481315
Relev.	8.9572816	0.2089197	Timel.	7.9728155	0.1920959
Amoun.	8.8325243	0.4582955	Interp.	7.907767	0.3411886
Conc.Rep	8.7597087	0.5072058	Com.	7.8203883	0.3455201
Obje.	8.7508084	0.4821880	Acce.	7.7126214	0.5407293
Cons.Rep	8.6893204	0.5162388	Secu.	6.7742718	0.4611295

Table 10: Bank A1

Dimensions	Mean	Std Dev	Dimensions	Mean	Std Dev
Reput.	9.4528302	0.3849824	Eas.Man	8.4	0.2935198
Belie.	9.3584906	0.4288553	Eas.Un.	8.4	0.2935198
Value	9.2641509	0.2711048	Timel.	8.4	0.2935198
Relev.	9.2490566	0.2742982	Com.	8.395283	0.2710847
Conc.Rep	9.240566	0.2814893	Cons.Rep	8.395283	0.2710847
Amoun.	9.1933962	0.3201619	Interp.	8.395283	0.2710847
Obje.	9.0251509	0.4568951	Acce.	7.9566038	0.5382520
Accur.	9.0075472	0.5068185	Secu.	6.9198113	0.5498548

Table 11: Bank A2

Dimensions	Mean	Std Dev	Dimensions	Mean	Std Dev
Reput.	9.4702381	0.3951010	Eas.Man	8.4190476	0.311750
Value	9.4238095	0.2387054	Eas.Un.	8.4190476	0.308607
Relev.	9.4095238	0.3026787	Timel.	8.4095238	0.253562
Belie.	9.3154762	0.4687149	Com.	8.4035714	0.265359
Conc.Rep	9.1785714	0.2158768	Cons.Rep	8.3797619	0.278075
Amoun.	9.1190476	0.2483979	Interp.	8.3678571	0.272481
Accur.	9.0285714	0.5366044	Acce.	7.4583333	0.493605
Obje.	9.0079397	0.5333790	Secu.	6.9047619	0.589419

Table 12: Bank A3

Dimensions	Mean	Std Dev	Dimensions	Mean	Std Dev
Belie.	9.4736842	0.4223065	Timel.	8.4526316	0.2356553
Reput.	9.4473684	0.3818425	Eas.Man	8.4052632	0.3237845
Value	9.4315789	0.2157392	Interp.	8.3868421	0.2715531
Relev.	9.3894737	0.3415303	Eas.Un.	8.3789474	0.3041674
Conc.Rep	9.2302632	0.2928286	Cons.Rep	8.3736842	0.2718149
Amoun.	9.1973684	0.2856825	Com.	8.3671053	0.2654105
Accur.	9.1052632	0.4871025	Acce.	7.3881579	0.4887151
Obje.	9.0561412	0.4860915	Secu.	6.9210526	0.5638468

Table 13: Bank B1

Dimensions	Mean	Std Dev	Dimensions	Mean	Std Dev
Reput.	9.1863636	0.3944587	Accur.	8.4072727	0.4162685
Belie.	9.0954545	0.3099093	Eas.Man	8.1927273	0.3589360
Value	8.9854545	0.2368139	Eas.Un.	8.0909091	0.3460212
Relev.	8.9672727	0.2099864	Timel.	7.9672727	0.1953672
Amoun.	8.8227273	0.4681344	Interp.	7.9318182	0.3451199
Conc.Rep	8.7636364	0.4986514	Com.	7.8227273	0.3524804
Obje.	8.7393933	0.4872516	Acce.	7.7263636	0.5483016
Cons.Rep	8.7090909	0.5198906	Secu.	6.7590909	0.4713152

Table 14: Bank B2

Dimensions	Mean	Std Dev	Dimensions	Mean	Std Dev
Reput.	9.2239583	0.4002645	Accur.	8.4625	0.3739524
Belie.	9.09375	0.3246315	Eas.Man	8.2041667	0.3792256
Value	8.9541667	0.2153259	Eas.Un.	8.075	0.3540044
Relev.	8.9458333	0.2093133	Timel.	7.9791667	0.1901381
Amoun.	8.84375	0.4514309	Interp.	7.8802083	0.3381331
Obje.	8.7638882	0.4811288	Com.	7.8177083	0.3410699
Conc.Rep	8.7552083	0.5220907	Acce.	7.696875	0.5372711
Cons.Rep	8.6666667	0.5165694	Secu.	6.7916667	0.4535127

Ergonomics

Table 15: Bank A

Variable	Mean	Std Dev
Chair	8.0962406	0.4167708
Envir.	7.6466088	0.6123797
O.all	6.9548872	0.6497629
Other	6.7466165	0.6141697
WorkSt	5.9331248	0.8203994

Table 16: Bank B

Variable	Mean	Std Dev
Chair	8.2796117	0.4544678
O.all	7.8932039	0.6089628
Envir.	7.6828414	0.5911087
Other	7.2650485	0.5626807
WorkSt	6.7394029	0.6596094

Table 17: Bank A1

Variable	Mean	Std Dev
Chair	8.0792453	0.4460763
Envir.	7.8742031	0.5781816
O.all	7.3207547	0.5809007
Other	6.7471698	0.6049805
WorkSt	6.4180774	0.4117678

Table 18: Bank A2

Variable	Mean	Std Dev
Chair	8.1285714	0.3871634
Envir.	7.5238000	0.5941939
O.all	6.7380952	0.6270148
Other	6.7238095	0.6163660
WorkSt	5.6228095	0.8568156

Table 19: Bank A3

Variable	Mean	Std Dev
Chair	8.0842105	0.4149414
Envir.	7.4649105	0.5929503
Other	6.7710526	0.6396401
O.all	6.6842105	0.5253191
WorkSt	5.5997237	0.8882759

Table 20: Bank B1

Variable	Mean	Std Dev
Chair	8.2909091	0.4583678
O.all	7.8363636	0.6600684
Envir.	7.5999897	0.5997196
Other	7.2454545	0.5616834
WorkSt	6.7435473	0.6624253

Table 20: Bank B2

Variable	Mean	Std Dev
Chair	8.2666667	0.4544500
O.all	7.9583333	0.5441501
Envir.	7.7777757	0.5725602
Other	7.2875	0.5689202
WorkSt	6.7346542	0.6633410

Appendix B

1. **Service quality questionnaire**
2. **Information quality questionnaire**
3. **Ergonomics questionnaire**
4. **Informed consent**

1. Service quality questionnaire

Customer Questionnaire

Please show the extent to which you think your bank offering the following services. On a scale of 0 to 10, please circle the appropriate rating.

	Poor										Excellent
1. Serving you quickly and efficiently	0	1	2	3	4	5	6	7	8	9	10
2. Handling your transaction accurately	0	1	2	3	4	5	6	7	8	9	10
3. Being dependable	0	1	2	3	4	5	6	7	8	9	10
4. Providing clear explanations of services	0	1	2	3	4	5	6	7	8	9	10
5. Solving problems/ troubleshooting	0	1	2	3	4	5	6	7	8	9	10
6. Understanding your banking needs	0	1	2	3	4	5	6	7	8	9	10
7. Thanking you for your business	0	1	2	3	4	5	6	7	8	9	10
8. Feeling secure doing business here.	0	1	2	3	4	5	6	7	8	9	10
9. Making it easy for to do business here	0	1	2	3	4	5	6	7	8	9	10
10. Greeting & acknowledging you promptly	0	1	2	3	4	5	6	7	8	9	10
11. Addressing you by name	0	1	2	3	4	5	6	7	8	9	10
12. Providing friendly and caring service	0	1	2	3	4	5	6	7	8	9	10
13. The location of our bank to you is	0	1	2	3	4	5	6	7	8	9	10
14. Having up to date equipment	0	1	2	3	4	5	6	7	8	9	10
15. Accessibility to ATM	0	1	2	3	4	5	6	7	8	9	10
16. Overall service quality	0	1	2	3	4	5	6	7	8	9	10

Thank You

2. Information quality questionnaire

Information Quality Assessment (Section 1)

For each statement, indicate the extent to which this information is true: "This information" refers to the information or database selected by your company for reporting on this information quality questionnaire.	Not at all Completely
1. This information is easy to manipulate to meet our Needs.	0 1 2 3 4 5 6 7 8 9 10
2. It is easy to interpret what this information means.	0 1 2 3 4 5 6 7 8 9 10
3. This information is consistently presented in the same format.	0 1 2 3 4 5 6 7 8 9 10
4. This information includes all the necessary values.	0 1 2 3 4 5 6 7 8 9 10
5. This information is easily retrievable.	0 1 2 3 4 5 6 7 8 9 10
6. This information is formatted compactly.	0 1 2 3 4 5 6 7 8 9 10
7. This information is protected against unauthorized access.	0 1 2 3 4 5 6 7 8 9 10
8. This information is incomplete.	0 1 2 3 4 5 6 7 8 9 10
9. This information is not presented consistently.	0 1 2 3 4 5 6 7 8 9 10
10. This information has a poor reputation for quality.	0 1 2 3 4 5 6 7 8 9 10
11. This information is complete.	0 1 2 3 4 5 6 7 8 9 10
12. This information is presented concisely.	0 1 2 3 4 5 6 7 8 9 10
13. This information is easy to understand.	0 1 2 3 4 5 6 7 8 9 10
14. This information is believable.	0 1 2 3 4 5 6 7 8 9 10
15. This information is easy to aggregate.	0 1 2 3 4 5 6 7 8 9 10
16. This information is sufficient volume for your needs.	0 1 2 3 4 5 6 7 8 9 10
17. This information is correct.	0 1 2 3 4 5 6 7 8 9 10
18. This information is useful to our work.	0 1 2 3 4 5 6 7 8 9 10
19. This information provides a major benefit to our work.	0 1 2 3 4 5 6 7 8 9 10
20. This information is easily accessible.	0 1 2 3 4 5 6 7 8 9 10
21. This information has a good reputation.	0 1 2 3 4 5 6 7 8 9 10
22. This information is sufficiently current for our work.	0 1 2 3 4 5 6 7 8 9 10
23. This information is difficult to interpret.	0 1 2 3 4 5 6 7 8 9 10

Information Quality Assessment (Section 1) cont.

24. This information is not protected with adequate security.	0 1 2 3 4 5 6 7 8 9 10
25. This information is doubtful credibility.	0 1 2 3 4 5 6 7 8 9 10
26. The amount of information does match our needs.	0 1 2 3 4 5 6 7 8 9 10
27. This information is difficult to manipulate to meet our needs.	0 1 2 3 4 5 6 7 8 9 10
28. This information is not sufficiently timely.	0 1 2 3 4 5 6 7 8 9 10
29. This information is difficult to aggregate.	0 1 2 3 4 5 6 7 8 9 10
30. The amount of information is not sufficient for our needs.	0 1 2 3 4 5 6 7 8 9 10
31. This information is incorrect.	0 1 2 3 4 5 6 7 8 9 10
32. This information does not add value to our work.	0 1 2 3 4 5 6 7 8 9 10
33. This information was objectively collected.	0 1 2 3 4 5 6 7 8 9 10
34. It is difficult to interpret the coded information.	0 1 2 3 4 5 6 7 8 9 10
35. The meaning of this information is difficult to understand.	0 1 2 3 4 5 6 7 8 9 10
36. This information is not sufficiently current for our work.	0 1 2 3 4 5 6 7 8 9 10
37. This information is easily interpretable.	0 1 2 3 4 5 6 7 8 9 10
38. This information is neither too much or too little.	0 1 2 3 4 5 6 7 8 9 10
39. This information is accurate.	0 1 2 3 4 5 6 7 8 9 10
40. Access to this information is sufficiently restricted.	0 1 2 3 4 5 6 7 8 9 10
41. This information is presented consistently.	0 1 2 3 4 5 6 7 8 9 10
42. This information has a reputation for quality.	0 1 2 3 4 5 6 7 8 9 10
43. This information is easy to comprehend.	0 1 2 3 4 5 6 7 8 9 10
44. This information is based on facts.	0 1 2 3 4 5 6 7 8 9 10
45. This information is sufficiently complete for our needs.	0 1 2 3 4 5 6 7 8 9 10
46. This information is trustworthy.	0 1 2 3 4 5 6 7 8 9 10

Information Quality Assessment (Section 1) cont.

47. This information is relevant to our work.	0 1 2 3 4 5 6 7 8 9 10
48. Using this information increases the value of our work.	0 1 2 3 4 5 6 7 8 9 10
49. This information is presented in compact form.	0 1 2 3 4 5 6 7 8 9 10
50. This information is appropriate for our work.	0 1 2 3 4 5 6 7 8 9 10
51. The meaning of this information is easy to understand.	0 1 2 3 4 5 6 7 8 9 10
52. This information is credible.	0 1 2 3 4 5 6 7 8 9 10
53. This information covers the needs of our tasks.	0 1 2 3 4 5 6 7 8 9 10
54. Representation of this information is compact and concise.	0 1 2 3 4 5 6 7 8 9 10
55. This information adds value to our tasks.	0 1 2 3 4 5 6 7 8 9 10
56. The measurement units for this information are clear.	0 1 2 3 4 5 6 7 8 9 10
57. This information is objective.	0 1 2 3 4 5 6 7 8 9 10
58. Information can only be accessed by people who should see it.	0 1 2 3 4 5 6 7 8 9 10
59. This information is sufficiently timely.	0 1 2 3 4 5 6 7 8 9 10
60. This information is easy to combine with other information.	0 1 2 3 4 5 6 7 8 9 10
61. This information is represented in a consistent format.	0 1 2 3 4 5 6 7 8 9 10
62. This information is easily obtainable.	0 1 2 3 4 5 6 7 8 9 10
63. This information comes from good sources.	0 1 2 3 4 5 6 7 8 9 10
64. This information is quickly accessible when needed.	0 1 2 3 4 5 6 7 8 9 10
65. This information has sufficient breadth and depth for tasks.	0 1 2 3 4 5 6 7 8 9 10
66. This information presents an impartial view.	0 1 2 3 4 5 6 7 8 9 10
67. This information is applicable to our work.	0 1 2 3 4 5 6 7 8 9 10
68. This information is sufficiently up to date for our work.	0 1 2 3 4 5 6 7 8 9 10
69. This information is reliable.	0 1 2 3 4 5 6 7 8 9 10

3. Ergonomics questionnaire

Please show the extent to which you are ergonomically comfortable at your work place. On a scale of 0 to 10, please circle the appropriate rating. Please use 1 for YES and 0 for NO when is appropriate (can only be answered with yes or no).

Computer Workstation:

	Poor **Excellent**
2. Are the height and tilt of the work surface on which the keyboard is located adjustable?	0 1 2 3 4 5 6 7 8 9 10
1. Does the workstation ensure proper worker posture, such as	
a. Horizontal thighs?	0 1 2 3 4 5 6 7 8 9 10
b. Vertical lower legs?	0 1 2 3 4 5 6 7 8 9 10
c. Feet flat on floor or footrest?	0 1 2 3 4 5 6 7 8 9 10
d. Neutral wrists?	0 1 2 3 4 5 6 7 8 9 10
3. Is the keyboard detachable?	0 1 2 3 4 5 6 7 8 9 10
4. Do keying actions require minimal force?	0 1 2 3 4 5 6 7 8 9 10
5. Is there adjustable document holder?	0 1 2 3 4 5 6 7 8 9 10
6. Are arm rests provided where needed?	0 1 2 3 4 5 6 7 8 9 10
7. Are glare and reflections avoided?	0 1 2 3 4 5 6 7 8 9 10
8. Does the monitor have brightness and contrast controls?	0 1 2 3 4 5 6 7 8 9 10
9. Do the operators judge the distance between eyes and work to be satisfactory for their viewing needs?	0 1 2 3 4 5 6 7 8 9 10
10. Is there sufficient space for knee and feet?	0 1 2 3 4 5 6 7 8 9 10
11. Can the workstation be used for either right-or left hand activity?	0 1 2 3 4 5 6 7 8 9 10
12. Are high stroke rates avoided by	
a. Job rotation?	0 1 2 3 4 5 6 7 8 9 10
b. Self-pacing?	0 1 2 3 4 5 6 7 8 9 10
c. Adjusting the job to the skill of the worker?	0 1 2 3 4 5 6 7 8 9 10
13. Do workers use electronic input devices (e.g., keyboards, mice, joysticks, track balls) for continuous periods of more than 30 min?	0 1 2 3 4 5 6 7 8 9 10
14. Is there glare?	0 1 2 3 4 5 6 7 8 9 10

Chair:

15. Does the chair	
a. Adjust easily?	0 1 2 3 4 5 6 7 8 9 10
b. Have a padded seat with a rounded front?	0 1 2 3 4 5 6 7 8 9 10
c. Have an adjustable backrest?	0 1 2 3 4 5 6 7 8 9 10
d. Provided lumbar support?	0 1 2 3 4 5 6 7 8 9 10
e. Have casters?	0 1 2 3 4 5 6 7 8 9 10

Others:

16. Are adequate rest breaks provided for task demands?	0 1 2 3 4 5 6 7 8 9 10
17. Are employees trained in	
a. Proper postures?	0 1 2 3 4 5 6 7 8 9 10
b. Proper work methods?	0 1 2 3 4 5 6 7 8 9 10
c. When and how to adjust their workstations?	0 1 2 3 4 5 6 7 8 9 10
d. How to seek assistance for their concerns	0 1 2 3 4 5 6 7 8 9 10
18. Do workers perform tasks that are externally paced?	0 1 2 3 4 5 6 7 8 9 10
19. Do workers sit for periods of more than 30 minutes without the opportunity to stand or move around freely?	0 1 2 3 4 5 6 7 8 9 10
20. Are workers often under time stress?	0 1 2 3 4 5 6 7 8 9 10
21. Is your job demanding	
a. Knowledge?	0 1 2 3 4 5 6 7 8 9 10
b. Volume of work?	0 1 2 3 4 5 6 7 8 9 10

Environment:

22. Is the temperature too hot or too cold?	0 1 2 3 4 5 6 7 8 9 10
23. Is the workplace poorly lit?	0 1 2 3 4 5 6 7 8 9 10
24. Is there excessive noise that is annoying, distracting, or producing hearing loss?	0 1 2 3 4 5 6 7 8 9 10

Overall Comfort:

	Not at all	Completely
25. Are you overall comfortable	0 1 2 3 4 5 6 7 8 9 10	

Thank You

5. Informed consent

INFORMED CONSENT FORM:

IRB#

Identification of Project:

***Title of* Project:** Quality Information and Service Quality in the Banking Industry

Purposes of the Research:

- Determine the impact of information quality on the quality of service in the banking industry.
- Determine the impacts of employee comfort on the quality of service delivery.

Procedure:

You are eligible to participate because you are over 19 years old and are employed by a bank. You will be asked to complete two questionnaires. The questionnaires are related to information quality, service quality, and work comfort. Answering the questionnaires will take approximately twenty to thirty minutes all together. The questionnaires will be answered in the workplace (in the banks). The investigator will administer the survey.

Risks and/or Discomforts:

There are no known risks or discomforts associated with this research.

Benefits:

Information derived from this research can be immediately and directly applied in the banking industry to improve service quality and increase profitability. This study also contains an ergonomic study involving computer-related performance issues – keyboarding, monitor position, and so forth – that impact employee comfort and thus quality of service delivery.

Confidentiality:

Any information obtained during this study which could identify the subjects will be kept strictly confidential. The data will be stored in a locked cabinet in the investigator's office (PKI 174-F, UNO) and may only be seen by the investigator during the study. The information obtained in this study may be published in scientific journals or presented at scientific meetings but the data will be reported as aggregated data. The data will be kept on file for a period of three years.

Compensation:

There is no compensation for this research.

Opportunity to ask Questions:

You may ask questions concerning this research and have those questions answered before agreeing to participate or during the study. Or you may call the

investigator at any time, office phone (402) 554-2233, after hours (402) 721-4652, or e-mail najjar@unomaha.edu. If you have questions concerning your rights as a research subject that have not been answered by the investigator, you may contact the University of Nebraska-Lincoln Institutional Review Board, telephone (402) 472-6965.

Freedom to Withdraw:

You are free to decide not to participate in this study or to withdraw at any time without adversely affecting your organization's relationship with the investigator, the University of Nebraska or other participating organization. Your decision will not result in any loss of benefits to which you or your institution is otherwise entitled.

Consent, Right to Receive a Copy:

You are voluntarily making a decision whether or not to participate in this research study. Your signature certifies that you have decided to participate having read and understood the information presented. You will be given a copy of this consent form to keep.

Signature of Subject:

_____ _____ Signature of Research

Participant Date

Name, Phone Number, and e-mail of Investigators

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