2. LITERATURE SURVEY

A. Expert Systems for Bank Lending

There are not many significant Expert Systems so far designed focused to the area of bank lending. References to this area are somewhat rare; a good reference that can readily be found is that of Baldwin-Morgan (1996). His paper quotes other references like that of Lee (1988), Radding (1991), Keys (1991), Bridge and Lin (1992), Kador (1992), Klein (1992), Goodall (1993), Sangster (1995), Shao et al (1995). Most of these papers deal with the evaluation of business and continuous loan applications developed by the different authors for different banks.

Banks develop expert systems because they expect the Expert Systems to create a comparative advantage as discussed in Chorafas and Steinmann (1991). This ultimately desirable result may be achieved through such intermediate impacts as reduced cost (Shao et al 1995, Schwartz and Treece, 1992), an improvement in task process (Sviokla, 1986), an increase in decision quality (Leonard Bartor and Sviokla, 1986) and improved human productivity (Brown and Phillips, 1995). With many banking activities the reduction of risk is also an
important goal (Friedman, 1989, The Economist, 1993). These impacts and the motivation to use them to alter competitive - forces are an important part of an organization's strategy and development (Bakos and Treacy, 1986).

The organizational strategy process can be presented as a six-phase model. These interrelated and interdependent phases are described as distinct steps for the purpose of discussion (Boldwin-Morgan and Stone, 1995):

1. The state of the organization is assessed according to the organization's overall strategy. For example, a bank will assess its levels of risk, return and exposure, and determine whether their current levels fit in with the bank's strategy.

2. If the organization is not flawless, then the strategy indicates a desire to change the state of the organization. For example, a bank's management may determine that the levels of risk are too high and must be decreased.

3. The organization strategy drives the development of expert systems that will be used to change the organization as desired.

4. The implemented expert systems are used as a part of the organization's strategy for changing itself. For example, a bank may develop an expert
system to assist in analyzing loan applications to reduce the risks associated with granting loans.

5. The state of the organization impacts the expert system development. For example, a bank that has a history of technology innovation may be more likely to successfully develop and use an expert system than a bank that has traditionally been a "late-adopter" of useful banking technologies.

6. The development and use of the expert system impact the state of the organization. For example, a bank that successfully develops a credit card authorization system could see reduced costs, leading to higher profit.

B. Impacts of expert systems for Bank lending

Consideration of potential expert systems impact may be worthwhile because the strategy process uses expert systems to create impacts that change the organization. Baldwin-Morgan and Stone's matrix-model (1995) is a visualization tool for organizing and describing impacts of a particular expert system or of a set of expert systems. It comprises of a 4x5 matrix of potential types of impacts that may result from the use of expert systems. The horizontal axis comprises levels of impacts: industry, organizational, individual and task. The vertical axis represents
categories of impacts: efficiency, effectiveness, expertise, education and environment.

There is some discussion on impact of expert systems already available in the literature: Swokla (1986), Murphy (1990), Eoning and Dorr (1991), Federowicz (1992), Murphy and Dorr (1992), Baldwin-Morgan (1993), D'keefe et al (1993), Baldwin-Morgan (1994), Bouman and Knoxquwill (1994), Swonney (1994), Treweon (1994). From a thorough reading of these papers and the ensuing discussions therein, it would be realized that the impact of the expert systems in banking is largely overlooked. Through the Baldwin-Morgan and Stone Matrix model, a contextual view of a number of impacts that have been reported by various banks using expert systems may be presented as shown in Table 2.1.
# Reported Impact of Bank Expert Systems

<table>
<thead>
<tr>
<th>Categories of Impact</th>
<th>Levels of Analysis</th>
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<tbody>
<tr>
<td></td>
<td>Industry</td>
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<tr>
<td>Efficiency</td>
<td>Reduced costs</td>
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<td>Effectiveness</td>
<td>Improved Customer Service</td>
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<tr>
<td>Expertise</td>
<td>Distribution of Expertise</td>
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<tr>
<td>Education</td>
<td>Expert system used for Staff training</td>
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<tr>
<td>Environment</td>
<td>Balance of Competition is changed</td>
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Table 2.1
EFFICIENCY IMPACTS:

1. **Organizational Efficiency Impacts:**

   These have been indicated by a number of banks. For example, the security
   Pacific National Bank’s expert system was used for controlling debit card fraud.
   Again Citicorp’s Citi Expert system was helpful in the banks international funds
   transfer. Brown and Phillips (1995) reported reduced losses from credit card
   frauds when the FALCO\textsuperscript{N} expert system was used by the Colonial National Bank.

2. **Individual Efficiency:**

   Manufacturers Hanover Trust made use of the TARA foreign currency
   exchange expert system. The bank reported improved productivity by the
   employees as a result of using the TARA expert system. The Canadian Imperial
   Bank of Commerce has reported using an expert system called Lending Advisor as
   a result of which less time was consumed in administrative tasks. Again, Belgium's
   leading bank, the Kredit Bank reported using a personal loan application expert
   system which removed the need for the head office involvement in individual

3. **Effectiveness Impact:**

Barclays Bank made use of a credit card fraud expert system as a consequence of which there was a healthy reduction in the card fraud experienced subsequently. Similarly, the Bank of America used the customer service automation expert system and Citi Expert was used by the Citi Corporation Bank. Both the banks reported a significant improvement in the customer service, using the expert systems cited above.

There is also significant improvement reported in individual effectiveness involving the decision makers. Sanwa Bank reported using a Personal Portfolio Management system which resulted in improved productivity and customer service ability of the individual manager. The details can be found in the paper by Bridge and Lin (1992). Again Lee (1988) quotes an expert system that helped in enhancing the authority of the officials in local bank-branches in processing personal loan applications.
Expert systems also helped in vastly reducing and in some cases totally eliminating various types of errors and mistakes inadvertently committed in banking practice. For example, using the International Funds Transfer Expert System helped the Citicorp in the reduction of data entry errors. The security Pacific Bank reduced wire-transfer errors. Barclays Bank implemented an expert system called Fraud Watch which resulted in the easy identification of the fraudulent accounts. Brown and Phillips (1995) reported in their paper that the Swiss Bank Corporation and Ohio Star Bank Corporation experienced an improved consistency in their operational procedure with the help of expert systems.

4. Expertise Impacts:

Individual expertise is enhanced through the use of an expert system as reported by the Swiss Bank using its MOCCA system.

Organizational expertise is impacted as the knowledge of experienced fraud investigators is made available to all employees. The Security Pacific National Bank used one such debit card fraud system as reported in the paper by Brown and Phillips (1995).
5. Education Impacts:

Swiss Bank made use of an expert system called CUBUS in staff-training as also enhancing an individual's knowledge of the banking operations. The Security Pacific Bank using its debit card fraud system, actually educates employees in fraud prevention and detection.

6. Environmental Impacts:

Many banks find the Bank Industry Environment is impacted by affecting the balance of competition. It is reported in the paper by Shao et al (1995) that the expert systems used by two U.K. Banks could really enhance their competition advantages. So is the case with the TARA expert system implemented by Manufacturers Hanover Trust Bank as described in the paper by Brown and Phillips (1995).

The use of appropriately designed expert systems by the banks results in a significant reduction of their business risk as well. Again it is reported in the same paper by Brown and Phillips (1995) as to how Swiss Bank reduced its business risk by using the expert system MOCCA and as to how the use of the system CUBUS considerably reduced the loan defaults.
The job-potential may be impacted with the use of expert systems in banking. This aspect is of considerable social significance. However, no uniform pattern is discernable to-date in this respect. Some expert systems result in the need for less employees than saving considerable sums in employee cost, which enhances directly the bottom line of the bank. However, Shao et al (1995) claim that one U.K. bank actually created jobs using expert systems. However, the enhanced manpower again contributes to the bottom line and extra profit by increasing the productivity of the bank. Also, the Canadian Imperial Bank of Commerce reported that it could boost the employee confidence by resorting to the expert system -- Lending Advisor.

The Task Environment may be impacted by changes in the task process. Swiss Banks MOCCA system resulted in decentralizing the lending process. Also, expert systems may be used to reduce task specific risk. For example, the Lending Advisor of the Canadian Imperial Bank of Commerce controls the risk of the commercial loan evaluation through its expert system -- Lending Advisor. The Bank of Boston reported better management of credit risk by its automated credit application processing system.
Table 2.1 presents an overall view of how expert system technology has been found to impact a range of aspects. As such it is a guide to the possibilities offered through adopting the technology in the banking environment. However it has been constructed from the published research material on each of the Expert Systems cited specifically and, as such, can only include those impacts considered most significant in each case.