

II

آية قرآنية

قال تعالى:-

♥ قَالَ أَجْعَلْنِي عَلَى خَزَايِنِ الْأَرْضِ إِنِّي حَفِيظٌ عَلِيمٌ ♦ ََ

صدق الله العظيم

سورة يوسف - آية رقم 55

DEDICATION

*I dedicate this work to the soul of **my father** ...*

***My mother** the most precious person in my life...for her prayers and encouragement and continual support ...*

*To the ever-lasting support and extended concurrence ... **my husband***

*To my future expectations **my children, Abed-Alhaleim, Mohammed Maymanah***

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ABSTRACT

The problem of this study is that the phenomena of over due debts are a major problem to the banks in the field of bank credit. The banks crises studies in different countries, whether advanced or developed, point out that most of the countries which are exposed to financial crises are due to the main

reason of the over due credits (financial defaults). It is worth mentioning that 131 countries suffered from bank crises, which differ in its magnitude during the period (1975 - 2000). The losses that resulted from credit risk are not only restricted to direct accounting losses, but also extend to include opportunity cost, operations costs, and bank debts related expenses. Most major banking problems have been either explicitly or indirectly caused by weakness in credit risk management. The reasons for this problem can be summarized in the following points: concentration of bank credit to a minority of clients, the credit processing, market and liquidity- sensitive exposures, and inadequate monitoring. Basel Committee on Banking Supervision emphasized this as an important aspect of credit risk.

The banks face very challenging and important financial problems. These problems appear in the last few years. The reasons for these problems are mainly due to the lack in using good credit ratings and assessment, which might indicate a high risk of defaulting on a loan, and thus leads to high interest rates. In turn, the high interest rates may cause companies or individuals to default in the repayment of the loans in the agreed period, determined by bank. In other words, there will be a financial failure, because of the weakness in credit-risk assessment by the bank granting the credit. In the Banking System, there has always been a lack of, and insufficient analysis of the financials of the credit applicants. In addition, banks face credit risks because of weak feasibility studies presented to them, plus the fact that the collaterals accepted were mainly insufficient, as well as the absence of an efficient controlling system by the banks.

The objectives of this thesis are:

- a) To investigate the possibility of developing an expert system tool that includes the knowledge of the bankers' experts in the domain of bank credit, plus the literature on banks credit risks. This tool is intended to aid the decision maker to issue the right decision with familiar and

easy-to-use interfaces, which allows for encoding the knowledge in a simple way.

- b) The expert system must assess the financial position of an applicant. This requires analysis of both quantitative and qualitative information on the financials of the company. Moreover, the economic aspects, which consist of the global economic conditions, the national economic and political conditions, and the social impact of the project, should also be considered. In addition, the marketing and technical feasibility studies aspects must be considered. Moreover, collaterals must be taken into consideration as risk mitigation.
- c) The expert system must evaluate the credit application with the view of avoiding the possibility of over due debts (financial defaults).
- d) The expert system should help in reducing the time devoted to the analysis of the credit application, and improves quality of the evaluation which would produce substantive benefits to the banks using the system.

In general, the main objective of the expert system is to use both quantitative and qualitative information in order to capture as closely as possible the experience of the recognized experts in the field of banking credit.

The banks traditional systems were failed to give the correct credit decisions, which was obvious in the table 1-1 in the section of the statement of the problem. Therefore, the importance of this study stems from the following points:

- a) There are no an expert systems in supporting credit decisions that are applied in the Sudan.
- b) There is a big need for those systems in the banks sector, exactly in management of risks in the banks.
- c) Relying on an expert system in supporting credit decisions reduces the phenomenon of the over due debts (financial default) and helps in the socio-economic development.

- d) The expert system in supporting credit decisions will help in allocating efficiently the scarce financial resources that are pooled in the Banking Sector.

The methodology that is used is the CommonKADS (Knowledge Acquisition Development Systems).

The major contribution of this study is to propose an expert system for evaluating and supporting credit decisions on the banking sector (ESESCD). This type of system has never been introduced into the Sudan before. And the evaluation process has taken into consideration all the variables that need to be considered in the decisions of the banking credit, which was not dealt with in all such expert systems even internationally.

The most important results that has emerged from this study is that:

- (1) The proposed expert system has achieved the objectives of the study.
- (2) The expert systems can help efficiently and objectively why a particular decision in granting credit is made.
- (3) It can eliminate any weaknesses in the traditional procedures of credit assessment and granting of a loan.
- (4) It can evaluate objectively the credit-worthiness of the applicants of bank loans.
- (5) It can objectively help in assessing and determining the risks associated to all loans.
- (6) The Expert System is designed to give logical justifications for the decisions made regarding the granting or rejection of the credit applications.
- (7) The designed expert system is very flexible, and it can accommodate any new variables that may arise in credit decisions including weight for the different parts that affect the credit decision.

- (8) This system is very easy to apply and hence help decision makers to take the right decisions in a very short period, in other words using such a system is economical to all banks.
- (9) By testing the system on tow real credit application cases it gave decisions and justifications that can help banks to avoid credit risks.
- (10) The expert systems have unlimited potentials to assist financial institutions in their future work.
- (11) They can be used to train new employees to improve their efficiency to conduct their duties.

The main recommendations of this thesis are:

- 1. Such a system is recommended to be used by all types of banks in assessing credit applications, because it is economical and easy to apply.
- 2. The system can easily be adjusted to accommodate all the requirements needed by all financial institutions.
- 3. The banks must not grant credit without preparing accurate studies to avoid the over due debts phenomenon.
- 4. The banks when granting credit should flow logical system which will reduce the risk of over due debts.

The most important future works that has emerged from this study can be summarized in the following:

- 1- As an extension of this thesis the decision support system can be used in other financial and non financial fields after adjusting it to suit the purposes of such fields.
- 2- The expert system can be used by scholars to strengthen their analytical ability and communicational skills, plus improving the research skills of university students who attempt to design such systems.

ملخص الدراسة

إن مشكلة الدراسة تتمثل في أن ظاهرة الديون المتعثرة من أهم المشاكل الرئيسية التي تواجه القطاع المصرفي. وتشير الدراسات المتعلقة بالأزمات المصرفية في دول العالم المختلفة عموماً ومن بينها السودان خاصة إلى أن أهم أسباب هذه الأزمات المصرفية كانت تتمثل في تعثر الائتمان. والجدير بالذكر، أن هنالك 131 دولة عانت من أزمات مصرفية تختلف حدتها من دولة إلى أخرى خلال الفترة (1975-2000). ولا تقتصر الخسائر الناتجة عن مخاطر الائتمان على الخسائر المحاسبية المباشرة، ولكن تمتد هذه الخسائر لتشمل تكاليف الفرصة البديلة وتكاليف المعاملات، والمصاريف المتعلقة بالائتمان المتعثر. وتنشأ مخاطر الائتمان من احتمال عدم قدرة المقترض (أو الطرف الثالث) من القيام بالوفاء بالتزاماته في الأوقات المحددة مما يؤدي إلى إلحاق خسائر اقتصادية للبنك.

إن كثيراً من المشاكل المصرفية الرئيسية سواء الصريحة أو الضمنية تحدث نتيجة للضعف في إدارة مخاطر الائتمان. أهم أسباب هذه المشكلة تتلخص في النقاط التالية: تركيز الائتمان المصرفي لمقترضين محددين، وعملية الائتمان نفسها، وتعرض الائتمان لحساسية السوق والسيولة وعدم كفاية الرقابة المصرفية. لجنة بازل للأشراف والمتابعة المصرفية أكدت على هذه الأسباب.

إن المصارف تواجه مشاكل ومصاعب مالية كبيرة بسبب عدم استخدامها لمعايير الائتمان الجيدة مما يؤدي للتعثرات وبعبارة أخرى بسبب الضعف في تقييم مخاطر الائتمان ولا شك أن هنالك عدة عوامل تؤدي إلى مخاطر الائتمان وحدث التعثر، في النظام المصرفي مثلاً عدم التحليل المالي الكافي لطلبات الائتمان والضعف في دراسات الجدوى والضمانات المقدمة عادة غير كافية وغياب نظام الرقابة الفعال بالبنك.

أن أهم أهداف هذه الدراسة تغطية كل أوجه تحليل اتخاذ القرار الائتماني وتشمل النقاط

التالية:

1. تهدف هذه الدراسة إلى اقتراح نظام خبير من خلال معارف وتجارب الخبراء المصرفيين في مجال المصارف لدعم اتخاذ القرار الائتماني و يساعد صانعي القرار في قطاع البنوك في تقييم قرار الائتمان من خلال مجموعة من الأسئلة ومعادلات مالية بأوزان محددة تغطي أجزاء النظام المختلفة وهي تمثل المعايير التي تدعم القرار الائتماني بالبنك من خلال استخدام واجهات بسيطة. و من أجل تطوير مثل هذا النظام يجب أن نحدد أولاً المعرفة اللازمة لكل أنواع المستخدمين.

2. النظام الخبير يجب أن يقيم الوضع المالي للشركة أو المشروع مقدم الطلب وهذا التقييم يشمل تقييم كمي ونوعي، والجوانب الاقتصادية التي تشمل الظروف العلمية والمحلية والجانب الاجتماعي، كذلك النواحي الفنية والتسويقية وجانب الضمانات. لأنها تمثل إجراءات لدرء المخاطر.

3. يجب أن. يقيم النظام. المخبير طلب الائتمان. آخذاً. في الاعتبار. وجهة النظر الخاصة بمنع وتجنب التعثرات.

4. النظام. المخبير يجب أن. يساعد على تقليل وقت التحليل وتحسين جودة التقييم مما ينعكس بفوائد ملحوظة للبنك خصوصاً والنظام المصرفي عموماً.

بصورة عامة أن هدف النظام المخبير أن يستخدم كلتا المعلومات الكمية والنوعية كي يتمكن بقدر الإمكان من محاكاة أسلوب الخبراء المعترف بهم في حقل الائتمان المصرفي من حيث التفكير واتخاذ القرار الصحيح المناسب .

أنظمة البنوك التقليدية فشلت في اتخاذ قرارات الائتمان الصحيحة وضح هذا من خلال جدول 1-1 في الجزئية الخاصة بمشكلة الدراسة لذا تتبع أهمية هذه الدراسة من الآتي:

1. عدم وجود أنظمة خبيرة لدعم القرار الائتماني مطبقة في السودان.

2. ولهذا الغرض سوف تتم الاستعانة بأنظمة خبيرة تخفف من حدة الديون المتعثرة مما ينعكس ذلك بدوره على التنمية الاقتصادية والاجتماعية.

3. و مثل هذه الأنظمة الخبيرة التي تدعم القرار الائتماني تساعد على توزيع الموارد المالية لدى البنوك وعلى تخصيص الموارد المالية لدى البنوك بصورة كفوءة .

ولقد استخدمت منهجية أنظمة تطوير استخلاص المعرفة (Common Kads) وهي منهجية بناء النظم الخبيرة وهي متبعة في أوروبا وبعض الدول الأخرى التي يتم فيها بناء النظم الخبيرة و تعتمد على ثلاث مراحل لبناء النظام المرحلة الأولى بناء المهام (Tasks) ، والثانية الواجهة (Interface) ، والثالثة القطاع (Domain) . ولقد تم تصميم نظام خبير مقترح بعنوان (نظام خبير لدعم وتقويم القرار الائتماني في قطاع البنوك). ولتصميم مثل هذا النظام تمت الاستعانة بآراء مجموعة من الخبراء المصرفيين داخل وخارج السودان ، لهم خبرات واسعة في هذا المجال . ومحاور هذا النظام تتمثل في :

1- دراسة الجدوى الاقتصادية التي اشتملت على أسئلة حول الظروف العالمية والمحلية والأثر الاجتماعي للمشروع .

2- دراسة الجدوى المالية التي اشتملت على معايير كمية ونوعية لقياس سلامة الأداء المالي للمشروع مستخدمة أساليب وأدوات التحليل المالي المختلفة مثل (معدل العائد الداخلي وفترة الاسترداد ونسب السيولة والرفع المالي.....الخ) و تحليل الحساسية وتحليل اتجاهات معدل الأرباح باستخدام السلاسل الزمنية وتحليل نقطة التعادل للمشروع.

3- دراسة الجدوى الفنية التي اشتملت على تقييم النواحي الإنتاجية والفنية البحتة واثر المشروع على البيئة مثل (تحليل التكلفة والأسعار وخدمات ما بعد البيع والمواصفات الفنية للمعدات والآلات.....الخ) .

- 4- دراسة الجدوى التسويقية والتي اشتملت على (تحليل العرض والطلب، البيئة الداخلية والخارجية للمشروع، تحليل المنافسين.....الخ)
- 5- الضمانات كإجراءات لدرء المخاطر المصاحبة لعملية منح الائتمان.

وأعطى النظام الخبير ككل مائة نقطة تم توزيعها - بناءا على آراء الخبراء - . كالآتي:

- محور دراسة الجدوى الاقتصادية أعطي 15 نقطة .
- محور دراسة الجدوى المالية أعطي 30 نقطة .
- محور دراسة الجدوى الفنية أعطي 20 نقطة .
- محور دراسة الجدوى التسويقية أعطي 20 نقطة.
- محور الضمانات أعطي 15 نقطة .

وتم تطبيق النظام على حالتين لطلب ائتمان في القطاع المصرفي السوداني . كانت الحالة الأولى لائتمان قصير الأجل والأخرى لائتمان متوسط الأجل. وأعطى النظام نتائج يعتمد عليها في اتخاذ القرار الائتماني كما سيتضح في الدراسة.

المساهمة الرئيسية لهذه الدراسة هي تصميم وبناء نظام خبير لتقييم ودعم القرار الائتماني في القطاع المصرفي هذا. النوع من الأنظمة لم يقدم من قبل المي السودان.. وعملية التقييم أخذت. في الاعتبار كل المتغيرات التي تؤثر على اتخاذ القرار الائتماني التي لم تؤخذ من قبل في أي دراسة سواء محليا أو عالميا.

ولقد أعطى النظام الخبير النتائج التالية :

1. النظام الخبير حقق جميع أهداف الدراسة بموضوعية.
2. النظام الخبير يساعد بطريقة موضوعية وفعالة في اتخاذ القرار وتبريره.
3. يحد من الضعف في الإجراءات التقليدية في عملية تقييم ومنح الائتمان.
4. يستطيع أن يقيم بموضوعية الجدارة الائتمانية لطلبات القروض المصرفية.
5. يستطيع أن يحدد ويقيم بموضوعية المخاطر المتعلقة بالقروض.
6. صمم النظام الخبير لإعطاء تبريرات منطقية للقرار سواء كان بالرفض أو القبول أو التخفيض أو المراجعة.
7. تصميم النظام يتميز بالمرونة للتعامل مع متغيرات مختلفة تظهر في قرارات الائتمان وتتضمن أوزان كل المحاور الموجودة بالنظام والتي تؤثر على اتخاذ القرار .
8. النظام سهل الاستخدام ويساعد متخذي القرار لاتخاذ القرار الصحيح في وقت قصير. بعبارة أخرى استخدامه اقتصاديا للبنوك.
9. باختبار النظام على حالتين حقيقيتين من بنوك محلية أعطي النظام قرارات وتبريرات تساعد في تجنب مخاطر التعثر.

10. الأنظمة الخبيرة لها إمكانيات غير محدودة لمساعدة المؤسسات المالية في عملهم المستقبلي.
11. يمكن أن- تستخدم. الأنظمة الخبيرة لتدريب المستخدمين الجدد. لتحسين كفاءتهم لإنجاز واجباتهم.

ولقد توصلت الدراسة إلى توصيات من أهمها:

1. استخدام البنوك لمثل هذه الأنظمة الخبيرة لدعم القرار الائتماني حتى تتجنب البنوك مشاكل التعثرات. المصرفية وتستطيع اتخاذ القرار الصحيح بناء على توصيات النظام المدعمة بآراء وتوجيهات الخبراء المختلفة.
 2. كما يمكن تعديل النظام بسهولة لتلبية المتطلبات التي تحتاجها المؤسسات المالية.
 3. على البنوك. عند منح الائتمان. استخدام. نظام. منطقي يساعد في تخفيض آثار. مخاطر الديون المتعثرة.
- الأعمال المستقبلية لهذا النظام الأكثر أهمية التي ظهرت من هذه الدراسة:
1. كامتداد. لهذا. النظام. يمكن تعديله ليدعم القرار. في المؤسسات. المالية وغير المالية بعد تعديله لمناسبة أغراض مثل هذه الحقول.
 2. النظام الخبير يمكن أن يستعمل من قبل العلماء والباحثين وطلاب الجامعات لتقوية قدراتهم التحليلية ومهارة الاتصال لديهم واستخدامه في تصميم أنظمة شبيهة في بحوثهم الجامعية.
 3. يجب على البنوك عدم منح الائتمان بدون عمل وتهيئة دراسات دقيقة ووافية لتجنب مشاكل الائتمان المتعثر.

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List of Abbreviations

AI	Artificial Intelligent
ADB	Asian Development Bank
BEP	Break even point
BG	Bank Guarantee
BIS	Bank for International Settlements
CAMELS	C – Capital adequacy A – Asset quality M –Management E – Earnings L – Liquidity S – Sensitivity to market risk
CG	Company Guarantee
CBR	Case Base Reasoning
CPA	Collection period average (activity ratio)
CML	Conceptual Modeling Language
CLIPS	C Language Integrated Production System
CTO	Cash turn over ratio (liquidity management)
DA	Deposit Account
EDBMS	Data Base Management System
DSS	Decision support system
EBRD	European bank for reconstruction and development
EIRR	Economic internal rate of return
EP	Earnings power
ES	Expert system
FAS	Financial accounts standards
FIBA	Financial Investment Bank
FICO	Fair Isaac Corporation
FIRR	Financial internal rate of return
FRAs	Floating rate positions
FS	The financial structure ratio
FX	Foreign exchange
IAIGC	Inter-Arab Investment Guarantee Corporation
iCiEC	Islamic corporation for the insurance of investment and export credit
ICT	Information and communication technology
IDB	Islamic development bank
IWC	Stock to net working capital ratio (liquidity ratio)
KA	Knowledge acquisition
KADS	Knowledge Acquisition Development Systems
KBS	Knowledge Base System
L/C	A letter of credit
MIGA	Multilateral Investment Guarantee Agency
NPV	Net present value
NWC	Net working capital / gross assets
PCI	Perfect corporate investment Bank

PDs	Probabilities of Default
PN	Promissory Note
PORT-MAN	PORTFOLIO MANAGEMENT
ROA	Return on Assets
ROE	Return on Equity
RV	Repayment Period
SA	Sensitivity analysis
SC	Sources of working capital

