A Credit Assessment Model For Small Businesses In Egypt

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1. INTRODUCTION

Small businesses are an important part of the economy of virtually every nation; they are widely viewed as the fountainhead of job creation and the engine of economic growth. In the U.S., for example, small businesses account for about half of all private-sector employment and non-farm Gross Domestic Product (GDP) (Appl.sba.gov). Another example similar to the US is Australia where small businesses in 1997-1998 accounted for about 50 % of total private sector non-agricultural employment and produced about one-third of GDP; Nonetheless, small firms have historically faced significant difficulties in accessing funding for credit worthiness due to a lack of credible information about them by potential providers of funds (Allen and Frame, 2005).

In Egypt, the situation is indifferent. Till early 1990s, Egyptian private sector was dominated by a plethora of small businesses in different areas, but all businesses shared a common characteristic: they rarely employed more than 10 people (93% of the non-agricultural private sector employs one to four people) (IDRC, 2006). Egypt's small businesses generate approximately 75,000 jobs every year and account for almost two million workers which represent an approximate 60 per cent of the private, non- agricultural informal sector's workforce (Nasr, 2006). While they constitute a substantial sector of the Egyptian economy, the paucity of credit available to micro-entrepreneurs has significantly constricted their potential for growth (IDRC,2006; UNESCO, 2007). In fact, a study initiated and financed by USAID in 1988 on small businesses in Alexandria (the second largest governorate in Egypt) revealed that the primary hindrance to the productivity of this sector was a lack of access to formal credit (UNESCO, 2007). In the late 1990s, the government of Egypt started turning its attentions to small businesses as mean for export increase. Yet, Egypt's small and medium-sized enterprises (SMEs) faced numerous obstacles; among which the inability to have access to credit services so they build personal networks to obtain loans based on trust (IDRC, 2006). Aligned with the governmental efforts to resolve the problem, the Central Bank of Egypt (CBE) has launched, in 2006, a five-year national plan aimed at providing financial services for Egypt's sizeable yet still fragile micro- enterprise sector. The plan announced at the beginning of the year is entitled "A National Strategy for Micro- Finance (Nasr, 2006)"

Small businesses are typically much more informational opaque than large corporations because they often do not have certified audited financial statements to yield credible financial information on a regular basis. As well, these firms usually do not have publicly traded equity or debt, yielding no market prices or public ratings that might suggest their quality. In addition to the fact that small businesses are more volatile and have higher turnover, many new firms are entering the market and others are exiting when compared with larger businesses. Usually, small businesses in Egypt do not have access to funds from commercial banks due to the unreliable nature of their financial statements. Only those with approved new projects may have limited access to funds from the government. The weakness of available collateral from small business is another major constraint when pledging a small business asset can only be done by fund providers if the small business has non-movable assets to pledge. In the case of other credit providers who wish to extend credit to small businesses, the only reliable collateral in this case is a bank letter of guarantee covering the extended credit value.However; this option cannot work for small businesses that would have to tie this amount in the bank for the supplier as they lack access to bank facilities. Other forms of collateral such as post dated guarantee check, promissory note, or note payable are only accepted by very high risk taking credit providers due to the lengthy unreliable law procedures in Egypt, which would be necessary in case of collection default. On the other side, one major challenge facing credit providers in Egypt is the lack of Credit Insurance for local sales, as there are entities that insure credit on export sales. The unavailability of Credit Insurance service in Egypt makes it rather more difficult for credit providing firms to mitigate their credit risk. Unavailability of Credit Bureaus in Egypt to assist companies in assessing small business credibility is another obstacle credit providers face in Egypt. Also, there is no record of small business credit history unless there was a bankruptcy filing in the name of the business owner.

This paper will develop an assessment model that helps credit managers in evaluating the creditability of small businesses to enable them in deciding whether to approve / disapprove a trade credit application. The assessment model will use financial and non-financial indicators that are relevant to the structure of the Egyptian economy and, hence, to other developing countries.

Following the introduction section, the rest of this paper is organized as follows: section 2 reviews related concepts

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and research. Section three presents the approach used in this research, followed by the theoretical framework in section four. Data findings and analysis are provided in section five, and the proposed framework in presented in section six and, at the end, discussions and conclusions in section seven.

2. RELATED WORK

2.1 Credit Scoring

Credit Scoring is a method which "applies statistically derived weights for key financial and credit characteristics to predict whether a credit applicant will pay the requested credit in a timely fashion" (Gitman, 2003). Credit scoring is a scientific method of assessing the credit risk associated with new credit applications. Statistical models derive predictive relationships between application information and the likelihood of satisfactory repayment. Clearly, credit scoring is a risk management tool as it can help a company ensure more consistent underwriting and can provide management with a more insightful measure of credit risk.

Credit scoring cannot predict individual loan loss; rather it predicts the likelihood or odds of a "bad" outcome.Usually this will be some level of average or total days in arrears at which associated costs make the loans unprofitable. Nor should a credit scoring system alone approve or reject a loan application; rather the underwriter must decide how he or she will incorporate the credit score into the loan review. Finally, credit scoring is not meant to increase approval rates; rather, it promotes consistency and efficiency while maintaining or reducing historic delinquency rates. It also allows the users to focus their attention and time on applications that are not obvious approvals or obvious declines.

2.2 Hurdles of Credit Scoring

Despite the advantages of credit scoring of small business, there are certain obstacles. One reason cited for the slow growth of small business credit is the limited information available on their credit performance. In addition, the cost of collecting, analyzing, and disseminating information on the credit risk of a pool of small business credit is high. In evaluating small business credit, credit providers rely on credit reports, financial statements, application information, personal histories, and business judgment to make lending decisions. Over time, some of these credit providers might acquire private or confidential information about the borrower that could be helpful in future credit arrangements (Berger et al., 1995). In any event, these credit providing practices tend to be expensive, time-consuming for both- the credit provider and credit applicant, and frequently arbitrary. However, little of this information about the credit histories of different types of small business has been systematically compiled or made available to credit rating firms and investors. Therefore, without adequate information or loss-probability, distribution of different types of small business credit, business credit losses cannot be estimated and, thus, small business credit cannot be securitized. Many developing countries also limit access to particular kinds of credit data to prevent banks from sharing information on their customers' accounts. Irregular business practices such as tax avoidance make the reliability of financial statements questionable. Agency managers in Kenya and China referred specifically to these problems: "No company in Kenya will give you their monthly accounts receivable, plus most companies keep five sets of books, one for the tax man, one for the owners, etc. Which one do you rely on?" (Olegario, 2000).

2.3 Scoring Methods

The most commonly used traditional credit risk measurement methodology is the multiple discriminant credit scoring analysis pioneered by Altman (1968) called the Z-Score model which is a multivariate approach built on the values of both ratio-level and categorical measures. These values are combined and weighted to produce a credit risk score that best distinguishes or 'discriminates' between healthy and default firms. The Z-Score model was constructed using financial ratios based on historical data from default and non-default firms where the multiple discriminant analysis explains the difference both cases. Merton (1974) models evaluate a firm's equity as a call option on its assets. If at the option expiry, the firm's asset is greater than the value of its debt, then the shareholders will exercise the option by repaying the debt and repurchasing the company's assets. However, if the market value of the firm's assets was less than the value of its debt, the option will not be exercised and the shareholders will default. The higher the distance-to-default is, the lower is the probability to default. To convert the distance-to-default into a probability for estimating default, Merton (1974) assumes that asset values are lognormally distributed which in practice is an assumption often violated.

Moody's RiskCalc for private Companies (Falkenstein et al., 2000) is a non-structural model. It does not employ a precise function based on theory, but it is highly conversant by the communal experience of Moody. Moody determines the financial ratios that are most important in determining default of private companies through previous default data analysis. The outcome of the financial ratios of a firm is multiplied by the weights assigned for each ratio to determine one and five year expected default frequencies. The expected default frequency can then be mapped into Moody's rating categories.

According to Dwyer, et al. (2004) Moody's KMV EDF (Expected Default Frequency) RiskCalc v3.1 is a powerful technology for default prediction of middle market credit risk as outperformed all other models in terms of accuracy of the probabilities that are produced and its predictive power.
By far, the most commonly used methods in credit scoring are traditional discriminant analysis and logistic regression. Both models were fit to distinguish good loans from bad ones among the approved applications. The estimated parameters are therefore subject to bias in sample selection when these models are applied to all applicants. Other studies have employed neural networks (Arminger et al., 1997), count data (Dionne et al., 1996) models and classif ication trees. But, these methods tend to suffer from problems with either the estimation, the calibration, or their parameters' interpretation. In addition to that sample selection bias mentioned earlier, they also fail to take account for the multi-period character of an optimal debt contract and its implication on the credit-granting decision.
Financial ratios are widely used by academic researchers, lenders, financial analysts, and small business managers in developing scoring systems that best predict loan repayment (Barnes, 1987). Empirical studies of failure have concentrated almost exclusively on financial ratio data, though studies of failure usually cite managerial variables as being critical, yet financial ratios is most commonly used as business failure predictor variables (Scherr, 1989). Storey et al. (1987) indicated that qualitative data could at least provide as good a prediction as traditional financial ratios. To overcome the unavailability and unreliability of financial statements for small businesses, several studies on non-financial variables to be added in the construction of failure-forecasting models were addressed as in (Ketz 1978; Norton and Smith 1979) assessment of different accounting methods, macroeconomic factors (Mensah 1984) and industry factors as other factors that can be used to forecast a firm's failure. Few studies tried to forecast the failure of small businesses from non-financial data. Lussier (1985) used non-financial variables to construct a failure-forecasting model, while Keasey and Watson (1987) used variables such as management structure, auditing delays, accounting information system, and financial statements to construct a failure-forecasting model. To test the usefulness of financial ratio-based business failure prediction models and to construct a suitable evaluation model for assessing credit worthiness of small and medium business in Taiwan, the study conducted by (Hsien-Chang Kuo, et al., 2003) proposed a credit evaluation model that combines both financial non-financial variables to measure the quality of financial reports.

3. RESEARCH APPROACH

The main objective of this research is to develop an assessment model that helps credit managers in evaluating the creditability of small business to enable them in deciding whether to approve / disapprove a trade credit application. The assessment model will rely not only on financial indicators used in most common credit assessment models, but also on non-financial factors that are relevant to the structure of the Egyptian economy and, hence, to other developing countries. To achieve this objective, the approach presented in Figure 1 was followed. This research is exploratory as it seeks finding the necessary small business credit evaluation factors that can meet Egypt's business environment and to add those factors to common credit evaluation practices used worldwide. The research is also of analytical type as to the measurement of the prevailing credit assessment methodologies used by trade credit providing firms in Egypt when extending credit to small business. Paradigm-wise, this research is quantitative as proposed model is to reach a credit score for small business where this score is converted to accept / reject decision making tool for credit mangers use upon assessing small business credibility.

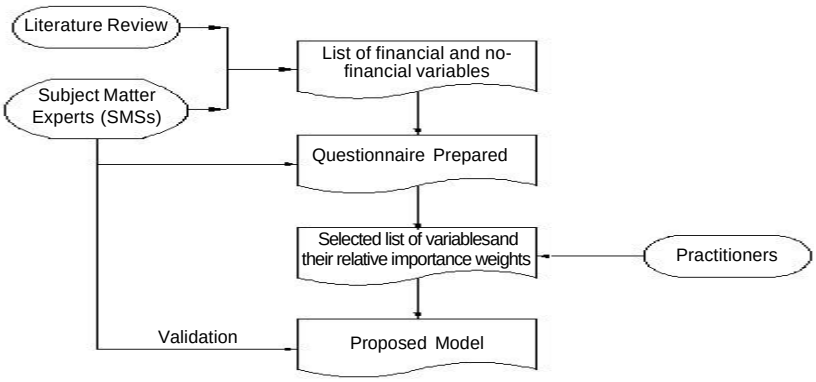

Figure 1: Research Approach

3.1 Sampling

Two samples were made in conducting this research, both of which was of non- probability judgmental type, these were: subject matter experts (SMEs), and credit managers. The first sample consisted of five non-banking experts in credit evaluation of business. As for the second sample, its population represents all firms that perform credit sales

to small business which was identified as either having an average annual sale of one million Egyptian Pounds, or employing 15 employees or less, or has an invested capital of twenty thousand Egyptian Pounds or lower. The exact population size could not be determined from secondary available reliable sources, and obtaining a special research was very expensive to conduct for time and cost constraints, so the maximum sample size of 384 was targeted, while physically addressed 495 large or manufacturing companies in different sectors. Sampling was used targeting large business or manufacturers based on the assumption that large business or manufacturers are the ones capable of providing credit to small business.

3.2 Definition of Small Business

A wide range of definitions have been accepted for small business (Ang, 1991; Tate et al., 1978; Hertz, 1982; Nappi and Vora, 1980; Gibson, 2001). For the purpose of this research, the following definition for small business in the Egyptian economy will be used:

- A small business can be defined as any business with invested capital of EGP 20,000 or less. Or;
- Operating with average number of employees of 15 or less. Or,
- Average annual turnover of 1 Million Egyptian pounds; and (Bell Report, 1996):
  - Independently owned and operated. o Most, if not all, capital contributed by owners and managers.
  - Closely controlled by owner/managers who make principal decisions.

3.3 Data Collection Instrument and Source

Primary data collection for the research problem validation was done through direct structured interviews. A second round of interviews with experts was conducted to validate the opinions summary. Based on the outcome collected, a questionnaire was prepared covering the validated factors agreed upon with the experts and was reviewed by the experts and by five other credit managers as a pilot questionnaire before sending the final questionnaire to credit and finance managers in the market. The questionnaire is provided in Appendix A.

The questionnaire was sent to the attention of finance or credit managers as a word document attachment by e-mail to 138 large companies. For the difficulty in reaching a larger platform of large companies and manufactures, a credible credit assessment agency was utilized, where copies of the questionnaire was sent by fax to another 357 large or manufacturing companies in the agency's data base where the questionnaire was faxed three times to each company once to the attention of the financial manger, another to the credit manager and the third one to the accounting manager. The questionnaire was structured to: (1) validate the variables used in the model, and (2) gather information about the market practices in credit assessment of small business. Accordingly, the structure of the questionnaire was made as follows:

- Question 1 was to classify the questionnaire response according to industry sector.
- Question 2 was to filter the questionnaire response to focus and study only respondents granting credit to small business, and compare their volume to the rest of the respondents not extending credit to small business.
- Questions 3, 4 and 5 are intended to measure the patterns used for small business credit terms regarding the average credit period, and the credit assessment methods used.
- Question 6 and 7 are meant to test all the variables used in the model and each variables' weight contribution, also variables mentioned in questions 6 are validated in the answer to question 7.
- Question 8 is to cover the financial variables used in the model and to validate the answers regarding the use of financial analysis mentioned in questions 6 and 7.
- Question 9 is testing the use of collateral and the collateral forms accepted by companies.

4. THEORETICAL FRAMEWORK

Reviewing several credit scoring models, different approaches for evaluation were used but, most commonly, models were using financial evaluation factors. In this research, we will use relevant non-financial factors provided by credit experts in the Egyptian economy. Also only applicable financial factors to the small business conditions in Egypt will be used in the model. The theoretical framework is shown in Figure 2.

4.1 Dependent Variable

Credit Score: Defined as the score derived from key financial and credit characteristics to predict whether a credit applicant will pay the requested credit in a timely fashion.

4.2 Independent Variables

Financial Variables: Defined by the various number of ratios indicating the financial situation of the firm from liquidity, profitability and solvency perspective and the outcome of those ratios are compared to the minimum expected average aiding at making a decision whether or not to extend credit to the credit seeking firm. Ratios used for evaluation are discussed in Appendix B.

Non-Financial Variables: This research considers six non-financial variables: age of the firm, labor force, legal structure, potential sales, collateral provided, use of bank facilities, and credit history. Details are provided in Appendix C.

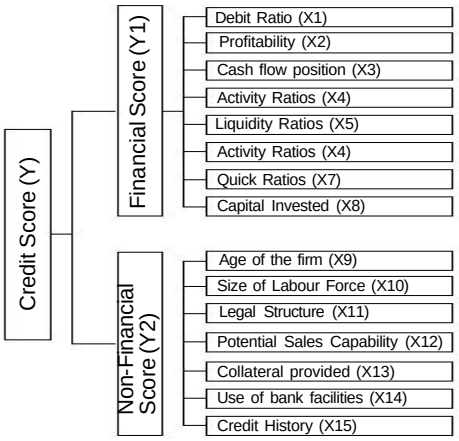

Figure 2 : Theoretical Framework

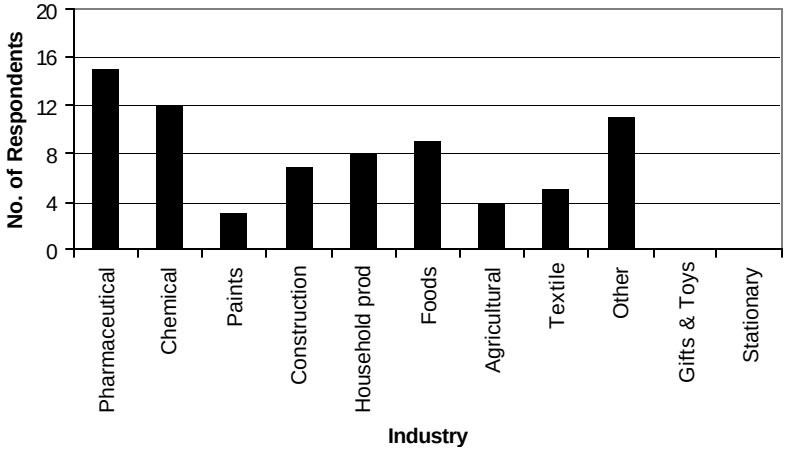

Figure 3 : Sample Characteristics

5. DATA FINDINGS AND ANALYSIS

5.1 Sample Characteristics

The questionnaire was filled by 169 respondents in different sectors, 74 (44%) of which were extending credit to small business, while the other 95 (56%) do not extend credit to small business. The average credit period offered is illustrated in Figure 2. From the sample it was found that most companies who responded to the questionnaire (92%) were making the credit assessment activities in house, without referring to expert credit evaluating firms. The use of credit assessment agencies is more in developed countries where credit bureaus exist, while in Egypt there are very few agencies that conduct credit assessment. Those firms normally are collection agencies and perform credit assessment as a side activity.

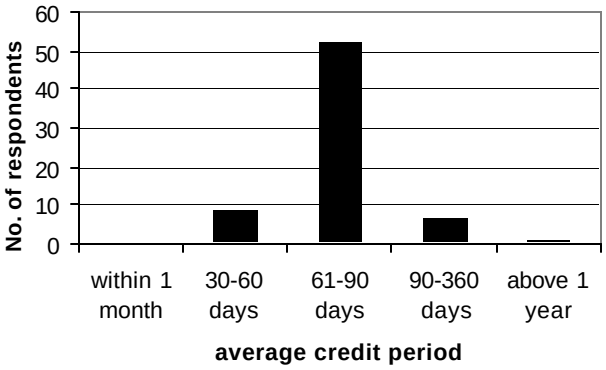

Figure 4 : Average Credit Period

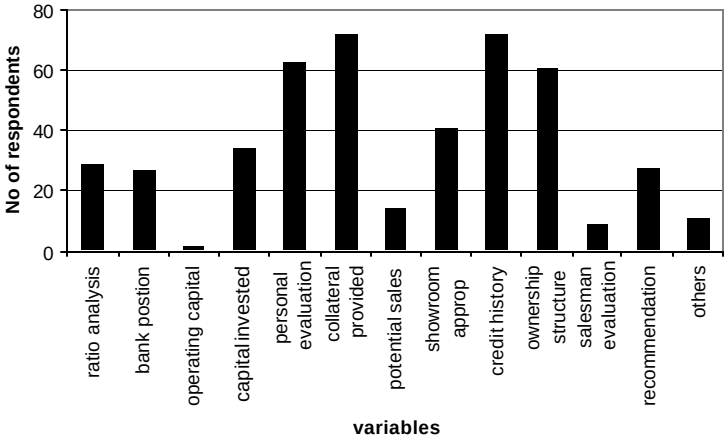

Figure 5 : Variables used by questionnaire respondents in assessing small business credibility

From the 74 responses received on small business credit assessment practices, as shown in Figure 5, it was found that collateral and credit history were the most important credit risk determinants, where all 74 respondents fully agreed to these two variables. 64 respondents use personal evaluation - which is rather subjective - in assessing small business credibility. Ownership and legal structure of the small business came in fourth position with 63 respondents agreement on the use of this variable in their credit assessment of small business.

Showroom appropriateness and potential sales were selected by 43 and 15 respondents respectively with 7 respondents choosing both variables, this indicator of small business credibility is arising from default risk in case the small business does not establish acceptable sales levels to cover its payment obligations, in this case these factors are indicators of how much credit would be extended to the studied small business. Financial variables such as Capital invested, Ratio analysis, and Bank position were selected by 35, 30 and 25 respondents respectively, and only 2 respondents considered Operating capital in their credit assessment of small business. The use of common financial analysis/ratios as concluded from the respondents answers are illustrated in Figure 6.

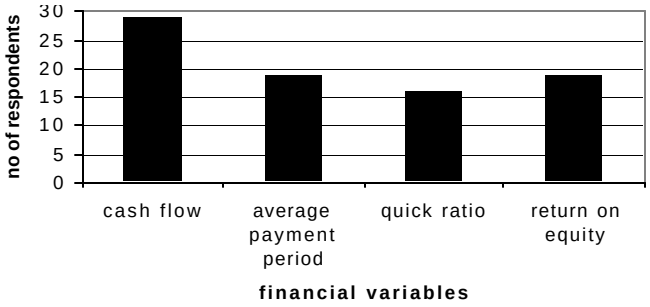

Figure 6: Use of financial analysis / ratios

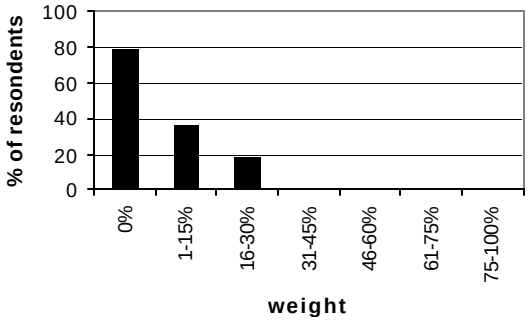

Figure 7: weight of ratio analysis in small business credit assessment

The weights assigned by the questionnaire respondents to the financial variables are illustrated in figures 7, 8, and 9. The figures depicts that the majority of respondents did not assign significant weight to financial analysis, however, it might not be a major indicator of small business credibility, but the assigned weight of 10% to all financial variables' weight in the proposed model rationalizes with the sample results. Figure 8 illustrates the weights assigned by the 64 respondents who chose personal evaluation as a tool used in their credit assessment of small business. As shown in figure, 62% of those 64 respondents assign 16-30% of their evaluation of the small business to their personal subjective impression. . For the sake of building a non-subjective easy to use standard model, personal evaluation weight is not considered in the model, however other factors such as the age of the firm (assigned 5% of the assessment weight in proposed model) and the average annual size of labor force (assigned 3% of the assessment weight in proposed model)are indicators of the small business stability, also the use of bank facilities (assigned 3% of the assessment weight in proposed model) is another indicator of a business' trustworthiness to fund providers.

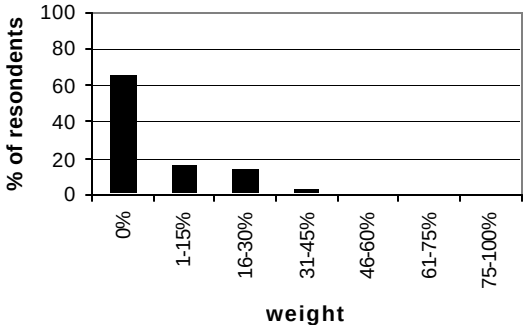

Figure 8: weight of bank position analysis in small business credit assessment

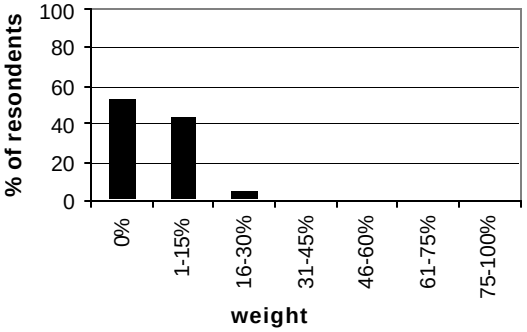

Figure 9: weight of capital invested by small business in credit assessment

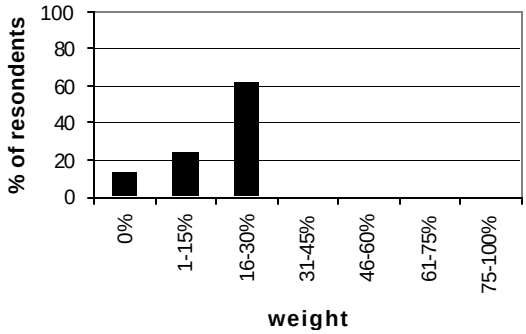

Figure 10 : weight of personal evaluation in small business' credit assessment

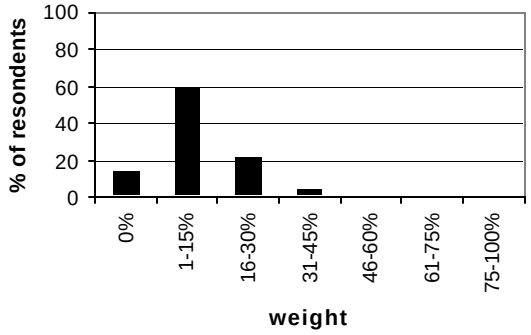

Figure 11: weight of ownership & legal structure in small business' credit assessment

As for the ownership and legal structure variable, the result - illustrated in Figure 11 - shows that the majority of respondents (59%) assigned this variable 1-15% of their evaluation weight, while 22% assigned this variable 16-30% of their evaluation weight, and only 15% did not assign any weight to this variable in their evaluation of small business credibility. In the proposed model the assigned weight for this variable is 3%, that is to account for the variable, however, giving other indicators more weights that from the researcher and expert's point of view are more crucial in the credit evaluation process.

Figure 12 illustrates the response to the potential sales variable from the questionnaire. Results indicated that 80% of the respondents did not assign any weight to this factor. As for the response on appropriateness of the small business

showroom, 42% did not assign any weight to this variable, Figure 13. The importance of the potential sales as an indicator of the small business default and as an outline of the value of credit to be extended to small business was indicated by the credit assessment experts to be a major factor in the credit assessment process. The model proposed a 10% weight to this factor which is perceived as a fair weight from the experts and researcher's perspectives due to its non-subjectivity and relevance to the credit line volume and the base for setting the collateral value. Figure 14 shows the current practice of small business credit assessment, where another subjective variable is used, 87% or 64 respondents did not count this variable in their credit assessment. This variable is not considered in the model due to several reasons one of which is its subjectivity, potential bias involved in the credit assessment process, unreliability and potential for fraud if credit default is not set as a criterion for the salesman evaluation as much as sales targets normally are. Recommendation of small business by a third party was accountable for 28 respondents, of which 19 (26%) assigned 1-15 % weight to this variable in small business' credit assessment, while 46 respondents (62%) do not consider this factor in their assessment of small business credibility. Figure 15 illustrates the results.

Credit history of the small business was weighted between 31-75% by 80% of the questionnaire respondents. As illustrated in Figure 16, only 1 respondent assigned 1-15% weight to credit history as a determinant of small business credibility, 6 respondents (8%)assigned 16-30% weight to credit history as a determinant of small business credibility, 21 respondents (29%) assigned 31-45% weight to credit history as a determinant of small business credibility, 24 respondents (34%) assigned 46-60% weight to credit history as a determinant of small business credibility, 12 respondents (17%) assigned 61-75% weight to credit history as a determinant of small business credibility, 8 respondents (11%) assigned 75-100% weight to credit history as a determinant of small business credibility. In the proposed credit assessment model credit history is weighted to account for 25% of the small business credit assessment which is reasonably weighted amongst other model variables form experts and researcher's perspectives.

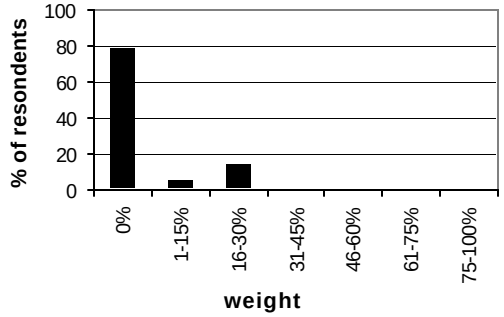

Figure 12 : weight of the small business' potential sales in its credit assessment

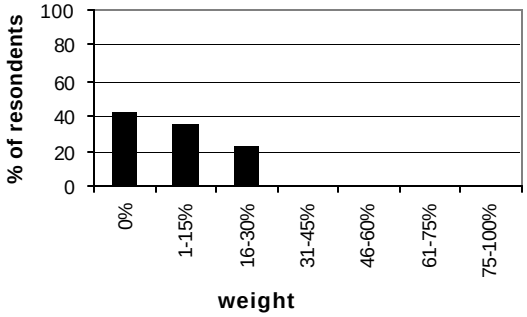

Figure 13 : weight of the small business' showroom appropriateness in its credit assessment

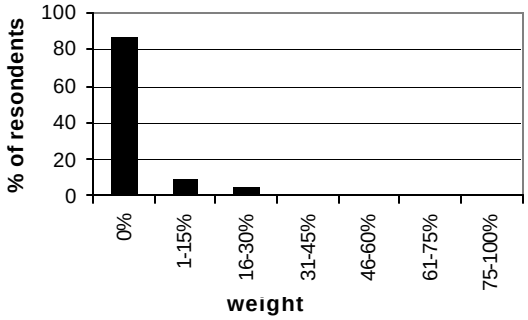

Figure 14 : weight of salesman evaluation of small business for its credit assessment

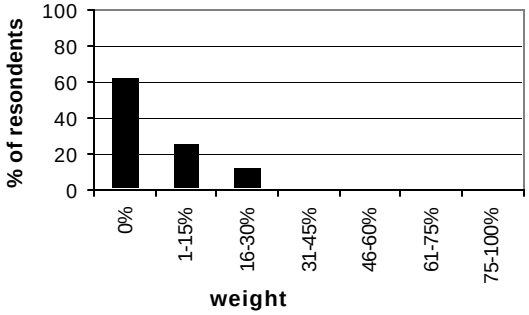

Figure 15 : weight of recommendation of small business in its credit assessment

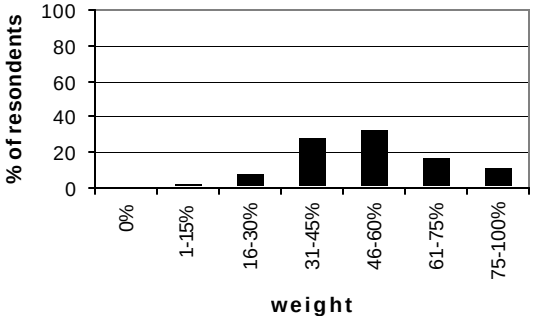

Figure 16 : weight of small business' credit history in establishing its credit assessment

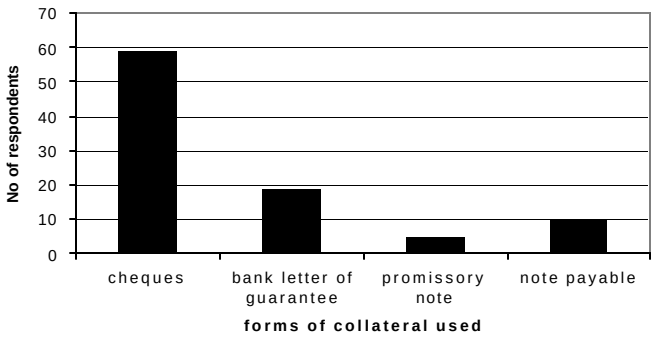

Figure 17 : Forms of collateral used

Only 7 respondents selected other factors for small business credit assessment which included committee setting for credit assessment and a visiting committee to the business to provide an impression about the business and its actual operation. No analysis was made to these factors due to their volume insignificance and their subjectivity.
The last question in the questionnaire was concerned with the acceptable form of collaterals used for small business. Figure 17 shows the results collected form the respondents. The form of collateral most commonly required from small business is usually cheques due to their lack of access to credit facilities. As a conclusion to the questionnaire findings, most of the variables in the proposed small business credit assessment model were confirmed by the questionnaire results; however the model also included additional non-financial variables replacing the subjective variables used in practice by Credit and Finance Managers in assessing small business. Based on the feedbacks from questionnaire, the proposed model in its final form is shown in Figure 18.

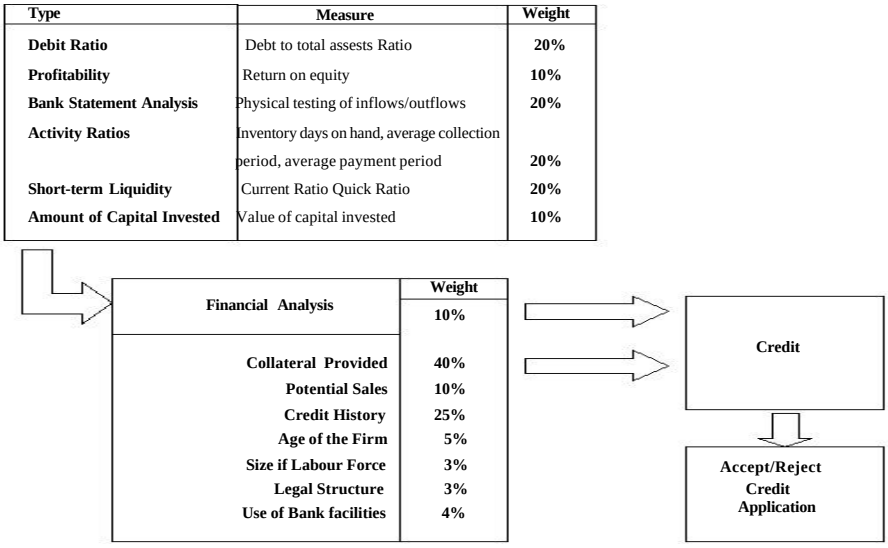

Figure 18 : Proposed Model

6. IMPLEMENTATION FRAMEWORK

The scoring for each variable is with a maximum of 100, the score established for each criteria is multiplied by the criteria's weight in the model, then the score for all the model variables is added to give the final score for the credit applicant. In the proposed model applications with a score of 50 or above are approved otherwise rejected. The proposed scoring for each variable in the model is detailed as follows.

A- Non-Financial variables:

1- Collateral Provided

The stronger the collateral provided by the credit applicant to the credit provider, the more guaranteed are the credit sales to the credit provider and the lower will be the applicant's default risk and the higher will be the credit score. As shown in Table 1, if the credit applicant provides a bank letter or guarantee or makes a cash deposit, these two forms are the most secured collateral forms and would score the credit applicant with 100 in this criteria, if the applicant provides a cheque his score will be 70, a promissory note or note payable would score the applicant with 20 points only; while the absence of collateral would score the applicant with zero in this criterion.

Table 1: Scoring of Collateral Provided

Collateral	Letter of guarantee	Cash deposit	Cheque	Promissory Note	Note Payable	No collateral
Score	100	100	70	20	20	0

2- Potential sales

The higher the credit applicant's potential sale, the higher is the expectation that the credit applicant will meet the payment obligations; the lower is the credit default risk and the higher is the assigned credit score.

a) In showroom business

The potential sales are measured based on the showroom appropriateness, warehouse capacity, showroom location, and management skills (sales and marketing skills). Table 2 illustrates scores for each case. The maximum score that can be obtained in each aspect of potential sales measurement is stated in the above average row. Measuring the showroom appropriateness can be based on the showroom preparation and competition available near the showroom. For example, the credit provider needs to evaluate whether the applicant's showroom looks too small compared to a competitor's showroom next door, see if the showroom is properly sized and well-prepared. Showroom appropriateness is classified as above, below, average or poor based on its condition.

Table 2 : Scoring of Potential sales (showroom business)

Rating	Showroom Appropriateness	Warehouse capacity	Location in respect to		Management skills			Maximum Score for criteria
			Traffic	Competition	Hired labor skills	Products display	Sales orientation	
Above average	20	20	20	20	10	5	5	100
Average	10	10	10	10	4	3	3	50
Below average	5	5	5	5	2	1	2	25
Poor	0	0	0	0	0	0	0	0

Warehouse capacity is measured based on its appropriateness, cleanliness, size, and storage conditions. The acceptable level for each credit provider depends on the product provided. For example, if product provided is classified under foods, the warehouse might need to be equipped with required storage temperature; pests free and has acceptable humidity level. For other commodities, same requirements may apply or be substituted with other requirements. Location of the showroom is referring to the condition of traffic in the area and the existence of competition. Very high traffic areas are scored above average as they are expected to generate high sales, and receive a score of 20. However, if the area is full of competition outlets, then the score will be below average in respect to competition and would receive a score of 5 in this criteria, making the total location score of 25 (20+5).

The management sales and marketing skills scoring depends on the management characteristics, the displays in the showroom and the quality of sales staff in the showroom. This is rather subjective of a measure however; it contributes to the expected sales from the showroom. If the management tends to hire cheap untrained labor, does not make proper product display, is not sales oriented with clients, the score for the criteria would be poor.

b) In Non-Showroom Business

In the non-showroom business such as contracting offices, the potential sales are measured based on the strength of the available contracts with the client and the firm's management sales and marketing skills. The availability of signed contracts between the credit applicant with large credible known end clients where the credit provider will supply the contractor with the materials (for the contract for example, then the credit applicant will be scored with 60), if the contracts in hand by applicant are of small values, for small or medium clients, the contract criteria will be scored 30 as average. Where if the contract with the credit applicant is with weak clients, it will be classified as weak and receive a score of 10. If the contract terms are of poor values, specifications, or delivery time limitations, the contract will be classified as poor receiving a zero score in this criterion. Management skills for non-showroom can be measured in terms of the credit applicant's client network and history of major jobs / deals the credit applying firm has successfully established. If the firm has large client network and has evidence of history in of various reputable business deals, then the firm will be classified as above average and would be scored with 40 in this criteria. Table 3 presents score for different cases.

Table 3 : Scoring of Potential sales (non-showroom business)

Strength of contracts	Contracts in hand	Management skills criteria	Management skills	Maximum Score for criteria
Strong contracts	60	Above average	40	100
Average	30	Average	20	50
Weak contracts	10	Below average	10	20
Poor	0	Poor	0	0

3- Credit History

The matrix for scoring the length of credit history and the payment behavior is illustrated in Table 4 (a) where for example a firm with between one to two years credit history and delays of one to two weeks in meeting payment obligations would be scored with 30 points in this criterion. The 30 points will be multiplied by the credit history weight of 25% to produce a score of 7.5 to the credit applicant. The longer the credit history with timely payment behavior, the less risky the firm is perceived, the higher credit score it will achieve.

Table 4 (a) : Scoring of Credit History

Length of credit history	Timely payments	Less than 1 week delay in payments	1-2 weeks delayed payments	2-4 weeks delayed payments	Above 4 weeks delay / Default / Bounced cheque
Above 2 years	100	80	50	10	0
1-2 years	90	70	30	0	0
6 months-1year	70	30	10	0	0
Below 6 months	40	0	0	0	0
Maximum Score	100	80	50	10	0

4- Age of the Firm

The age of the firm is determined by the number of consecutive years the firm has been operating in the same line of business, the longer the age of the firm, the higher it scored as that is an indication for its strength and success, given the fact that profitability indicators from financial variables may not reflect the real firm position as discussed earlier in the research. The older is the firm, the less risky it is perceived, and the higher is its credit score. From Table 4 (b), a firm aging between two and three years will get 40 points in this criteria which is then multiplied by the weight of 5%,

for the age variable to give the credit applicant a score of 2 ,which will be added to the scores collected from other variables to determine the firm's acceptability or rejection to its credit application submitted to the credit provider.

Table 4 (b) : Scoring of Firm's Age

Age of the firm	Above 5 Years	4-5 years	3-4 years	2-3 years	1-2 years	New business
Score	100	80	60	40	20	0

5- Size of Labor Force

The higher the annual average labor count of the credit applying firm, the higher the stability indication for the firm, the less default risk it entails and hence the higher is its credit score. Table 6 shows the scoring criteria based on the average annual labor count.

Table 5 : Scoring of Labour Force Size

Average Annual Labor Count	Above 20	15-20	10-15	5-10	Less than 5 employees
Score	100	80	60	40	20

6- Legal Structure of the Firm

The legal structure of the firm refers to its legal company documentation appropriateness by means of its license, registration, ownership contracts, and payments authorization. Different criteria and scores are shown in Table 6. Under legal structure we have five criteria to evaluate, these are:

- Whether office premises (or showroom), it is owned or rented.
- A work equipment or warehouse measurement criterion is measured in the same way as for office / showroom.
- Commercial registration presented by the credit applicant should first be stating the applying company's premises/ branches, otherwise it is considered incorrect. Then the commercial registration submitted by the applicant is com pared to the copy extracted by the credit provider from the registration authority in terms of: capital invested, owners, date of business registration, nature of business, location of business premises, obligations to banks for facilities extended or any other amendments in the commercial registration. If the copy submitted by the credit applicant matched that extracted from the authorities, then the applicant submitted correct data and is scored with 30 for this criterion, otherwise, the applicant is scored with zero.
- Licensed to operate the main business activity, means that if the applicant is buying a commodity for trading purposes, the applicant's trading license should state trading in the same commodity's line of business, otherwise the applicant will be making unlicensed trade activity and the showroom may be closed and applicant will be subject to violation fines where the credit provider may be exposed to credit default risk when the applicant fails to fulfill the contractual payment obligations. For example, a store that has a license to operate as carpentry cannot be contracting with an ice cream company to sell ice cream from the same carpentry store without the applicant adding trading in foods to the store's license for operation.

  A credit applicant that submits a trading license that is appropriate for the credit provider's traded commodity, is scored with 10 as a correct license, otherwise applicant will be scored zero.
- In the last criteria for the legal structure factor, the payment for the contractual obligation should be done by the same person stated in the contractual agreement and the legal documentation. Meaning that a company cannot be supplying products to a business and receiving payments in return of the sold products by cheques from a third party, unless there is a written agreement that the third party will be responsible to fulfill the payment obligation on behalf of the credit applicant. Otherwise, the credit supplier will not be able to claim defaulting cheques received from a third party. A credit applicant performing its own payment activity is scored with 20, otherwise zero, unless there is a third party agreement, where in this case the third party will need to be assessed for its credibility, if credibility is acceptable then, the original applicant will be scored 20 in this criteria, otherwise score will be zero.

  The better the legal position of the credit applicant, the less risk of legal violation the firm may be exposed to, the less will be the default risk of the firm and the higher is its credit score.

7- Applicant's Use of Bank Facilities

A firm that has bank facilities is perceived credible by banks and hence entails less risk and is scored higher in these criteria. Credible firms to banks are periodically followed on their financial performance through the facility providing bank(s). Facility received from the governments Social Fund for Development is not accounted for as a bank facility. The risk coupled with the bank financing is measured in the financial variables performance. From Table 7, a company with loan or bank overdraft facility for two to three years prior to credit application to supplier (trade credit provider) is scored with 80 points that will be multiplied by the facilities criteria weight of 4% to produce a score of 3.2.

Table 6 : Scoring of Legal Structure

Criteria	Cases	Score	Maximum Score
Office / showroom	Owned	20	20
	Rent	10	
	Contracting through delegate	5	

Work Equipment /Warehouse	Owned	20	20
	Rent	5	
	Contracting through delegate	0	
Commercial Registration	Correct	30	30
	Incorrect	0	
Licensed to Operate the main business activity	Correct	10	10
	Incorrect	0	
Payment through	Owner	20	20
	Third party	0	

Table 7: Scoring of use of bank facilities

Bank Services	Above 3 Years	2-3 years	1-2 years	Below 1 year	None
Overdraft facility / Bank loan	100	80	60	20	0

B- Financial Variables

Based on the calculations for the financial ratios, the outcome for each analysis is measured and scored separately, the score for each of the six financial variables used in the model are added together, then the outcome is multiplied by the weight of the financial variables which is 10% in the model, then the financial score of the credit applicant is obtained to be added to the score outcome of the other seven non-financial variables to complete the final credit applicant's score.

1- Debt to Total Assets

Obtained by dividing the firm's total liabilities by its total assets, the higher the outcome, the higher the debt the applicant bears, the higher is his default risk and the lower is the credit score as demonstrated in Table 8 below.

Table 8: Scoring of Debt to total assets ratio

Debt / Total Assets outcome	Less than 30%	30-40%	41-50%	51-60%	Above 60%
Score	100	80	60	20	0

2- Return on Equity

Return on equity is obtained by dividing the firm's net income by its total equity. The more profitable the firm is, the less is its default risk and the higher is its credit score. This ratio takes into consideration the result of two financial years. If a firm's return on equity is increasing from a year to another, the score will be higher, however the return on equity is compared to the bank deposits interest rates, where if the bank interest rates are higher than the return on equity for both years, then the firm might consider shutting down the business and move its equity to bank deposits or to another business activity. Accordingly, the lower the return on equity in comparison with bank interest rate on deposits, the higher the business closing down risk and the lower is the credit applying firm's score. Table 9 demonstrates the scoring measurement.

Table 9: Scoring of Return on equity

Return on Equity	Profits performance			Returns in Comparison With Interest Rate on Bank Deposits		Maximum Score for criteria
	Improving	Deteriorating	Loss generating	Higher	Lower	
Score	50	10	0	50	0	100

3- Actual Cash Position Analysis

In examining the credit applying firm's bank statement for at least six months, if the inflows exceed the outflows, the firm has a positive cash position reflecting a low default risk, then a higher credit score is assigned to the credit applicant and vice versa. From Table 10, a firm with inflows equivalent to its outflows receives a score of 50 in this criteria.

Table 10 : Scoring of cash position

Cash Position	Inflows Exceed Outflows	Inflows Equal Outflows	Outflows Exceed Inflows
Score	100	50	0

4- Activity Ratios Outcome

For activity ratios measurement, the main concern is to see whether the average payment period exceeds the credit applicant's collection period, if the collection period from the applicant's customers is longer than the average payment period, the credit applicant will default in meeting his payment obligations and hence will be scored with zero in this criteria. If the payment period exceeds the collection period with 10-25 %, the credit applicant will be considered risky and will have a low score in this criteria. The highest score is granted when the payment period is at least 50% above the collection period (as illustrated in Table 11.)

Table 11: Scoring of Activity ratios

Activity Ratios	Average Payment Period Less Than or Equal Average Collection Period	Payment Period Exceeds Collection Period		
		1.1 - 1.25 times	1.25 - 1.5 times	Above 1.5 times
Score	0	20	40	100

5- Short term liquidity

The short term liquidity ratios as indicators of the credit applicant's ease in meeting his payment obligations are

measured through current and quick ratios calculated as follows:
Current ratio: derived by dividing the firm's current assets over its current liabilities. Quick ratio: derived by dividing the firm's current assets (excluding inventory) over its current liabilities. Each ratio comprises a weight of 50% for this measurement criterion. The higher the ratio outcome, the higher the likeliness that the firm will meet its payment obligations, the lower is its default risk and the higher is its credit score as illustrated in Table 12.

Table 12: Scoring of Short term liquidity

Liquidity Ratios	Above 1.5	1 - 1.5	1	0.75 - 1	Below 0.75
Current Ratio	50	40	30	0	0
Quick Ratio	50	50	40	30	0

6- Amount of capital invested

The amount of owner's invested capital indicates the owner's capability and seriousness in supporting the business. The higher the invested capital, the higher is the owner's likeliness to support the business, the less expected is the firm's default risk and the higher is its credit score. Table 13 shows the proposed scoring for the capital invested criteria in the model.

Table 13: Scoring of capital invested

Capital Invested in EGP	Above 20,000	10,000-20,000	5,000-10,000	Below 5,000
Score	100	50	25	0

After the scoring for each variable is obtained and multiplied by the variable weight in the model, and after adding the variables scores together; the credit applicant will have a score between 1 and 100. The minimum acceptable credit score proposed in this model is 50; however, it is customizable based on each credit provider's risk tolerance.

7. Enhancing the Credit Decision Making Process with Monte Carlo Simulation

The use of Monte Carlo simulation compliments the scoring model by enabling the credit decision maker to visualize the credit score obtained against the distribution of delinquent historical credit applications built in the simulation model, where the decision maker can decide whether to accept or decline the application based on the firm's choice of risk tolerance (certainty level).
In the recent years, faster computers have made it possible to create models that simulate reality and aid in making predictions. Monte Carlo simulation provides the ability to take into account randomness by investigating hundreds of thousands of different scenarios. The results are then compiled and used to make decisions. Monte Carlo simulation is often used in business for risk and decision analysis, to help make decisions given uncertainties in market trends, fluctuations, and other uncertain factors.
The proposed credit assessment model can be complimented with a simulation tool where the credit applicant's likeliness for default may be easily visualized based on the calculated outcome of the model evaluation variables. The simulation model will require historical data from previous clients to be identified in the system, the applicant's score in each criteria is then entered, when the model runs, the scores of the new applicant will be matched with previous historical data to determine its likeliness for default and construct a frequency distribution to illustrate the findings. The following hypothetical example can demonstrate the Monte Carlo application using Crystal Ball Software Professional 2000 as follows: If we apply the model's measurement criteria on a credit applicant, where the applicant scores zero in the financial variables, and assuming that the applicant scores 20, 80, 40, 60, 40, 80, and 90 points respectively in the Collateral, Potential sales, Credit History, Age of firm, size of labor force, legal structure and use of bank facilities. The credit score of the applicant will be 36.2 as illustrated in Figure 19.
Instead of specifying a score for each variable, a probability distribution will be defined. For illustration purposes, the Triangular distribution will be used for all variables with the following parameters: minimum = 0, maximum = 100 and the most likely differs from one applicant to the other based on credentials provided. In practice, these distributions can be drawn from history data or a further research can try to define them. One-point estimate approach would lead a decision of rejecting this applicant as the total score is 36.2. Using Monte Carlo, simulation would give the decision maker (Credit Manager) more flexibility. Keeping in mind that the higher the score, the lower the risk of not repaying the credit given, so let's considers the following observations:

1) The 'forecast chart' shown reveals that the applicant score would be in the range from 15 to 69 with 100% certainty level as illustrated in Figure 20.
2) The mean - expected score - is 42.1 while the score of 36.2 represents certainty of 68.6. (Figure 21)
3) The applicant score can be equal to or more than 50 with certainty of 23%. (As illustrated in Figure 22. Sensitivity chart displays different variables ranked according to their contribution to variance as demonstrated in Figure 23. From the previous example, the flexibility of using MC is apparent as the decision maker can change the certainty level - according to company's risk tolerance - and gets a better picture for the risk associated with a certain applicant.

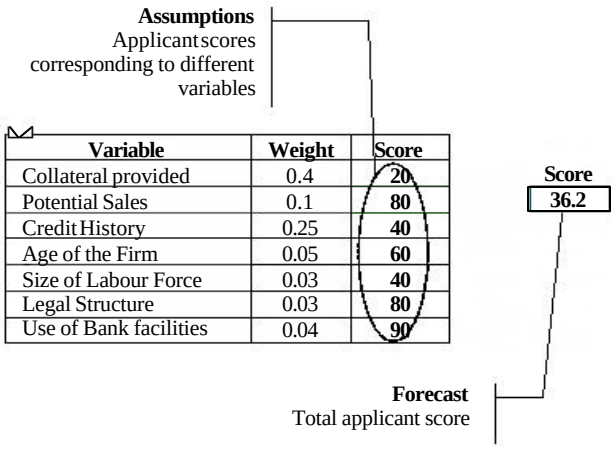

Figure 19: Model score for a hypothetical example

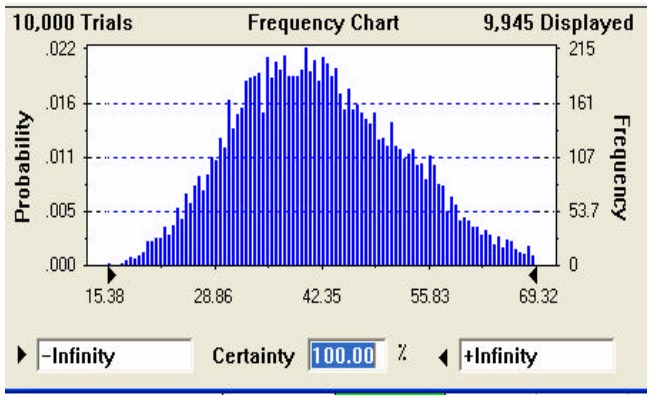

Figure 20: Monte Carlo Simulation

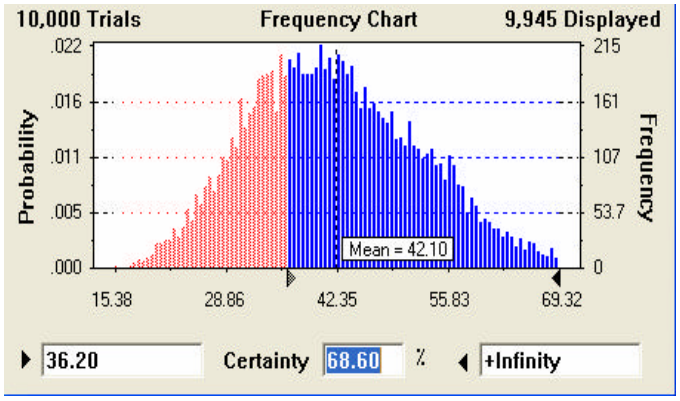

Figure 21: Monte Carlo Simulation example at 68.6 % certainty

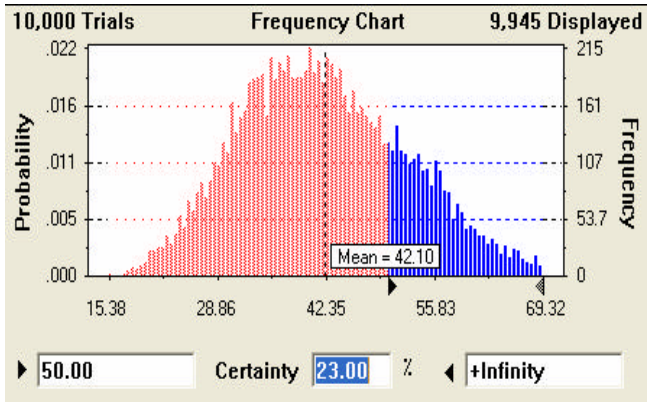

Figure 22: Monte Carlo Simulation example at 23 % certainty

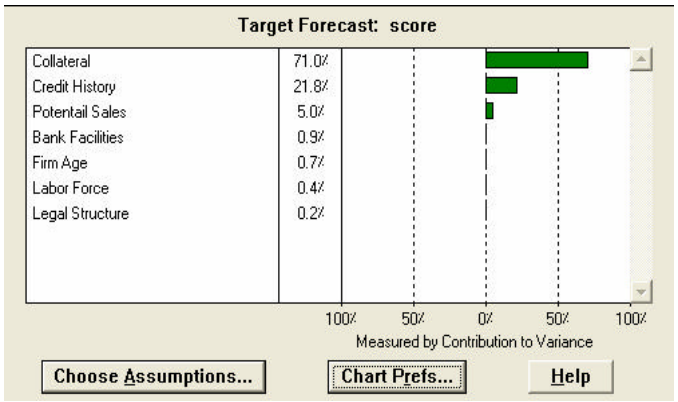

Figure 23: The simulation process

8. DISCUSSIONS AND CONCLUSIONS

This research addressed the credit assessment problem of small businesses in Egypt where in addition to the challenges faced in small business credit assessment worldwide, there is also absence of credit bureaus to provide the trade credit providers with data about the small business credit history, in addition to the risk that the credit providers will not be able to mitigate through credit insurance which does not cover local sales in Egypt.

In order to solve the deficiency presented, the research formulated a model suitable for small business conditions in Egypt where credit providers can rely on in making their decision each time they receive a credit application, where they can easily accept or reject the application. Based on the experts' feedback, a model was constructed using the variables and their weights contribution in the credit decision. In the second phase, a questionnaire addressed to Finance and Credit Managers was administered. The purpose of the questionnaire was to check whether the credit decision makers in firms were using the major common credit assessment model variables, explore other common

practices of credit assessment used in the field and add any valid additional variables to the proposed research model. The questionnaire results were analyzed and used to finalize the model which was finally validated by experts.

After identifying the model variables that are mainly (90%) non-financial reliant, and after weighting each factor's contribution to the assessment process; given that the model's total score is 100 and knowing that the minimum acceptable credit score to extend credit is a score of 50 or higher, credit providers in the Egyptian market can use the proposed non-financial variables reliant research model to assess the credibility of small business. However, adding the application of Monte Carlo simulation to the presented research assessment model, the results obtained from the assessment can be visualized and when historical data of credit applications are added to the model, a predictive default pattern is identified from the historical data and a frequency distribution is obtained showing the default probability against the credit score, based on which credit decisions can be easier to determine depending on each firm's risk tolerance. The research provided a credit assessment model that relies with 90% of its scoring weight on non-financial variables.

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