UNIVERSITI PUTRA MALAYSIA

FINANCIAL PERFORMANCE EVALUATION AND FAILURE PREDICTION OF IRANIAN FOOD AND AGRICULTURAL CORPORATION

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FINANCIAL PERFORMANCE EVALUATION AND FAILURE PREDICTION OF IRANIAN FOOD AND AGRICULTURAL CORPORATION

By

MOHAMMAD REZA HAJ SEYED JAVADI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

June 2015

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DEDICATIONS

This thesis is dedicated to my dear family.

To my parents,

For instilling in me the values of dedication throughout in this study

To my wife, and my loving daughter,

For their continued support and understanding over the year that this journey has taken.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

FINANCIAL PERFORMANCE EVALUATION AND FAILURE PREDICTION OF IRANIAN FOOD AND AGRICULTURAL CORPORATION

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June 2015

Chairman: Zainal Abidin Mohamed, PhD
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It is a common understanding that bankruptcy is not a sudden event for any community. The predicting bankruptcy by new methods could be taken as a shield of production to lower the risk and danger levels of company bankruptcy. Thus, these are much meaning to owners, creditors, investors and academics alike.

With a simple plane to improve the availability literatures, The main goal of this study is to explore the predictive power of neural network model and Logistic regression model to bankruptcy prediction by measuring its percentage accuracy on the listed firms in Tehran Stock Exchange(TSE).Logistic regression model is also provided as performance benchmarks for neural network classifiers. Depending on the purposive sampling method, this study covered 94 listed companies in TSE, whereby 47 companies were healthy and 47 companies that have filed for bankruptcy during of 2005-2009.The sample analysis (85% of samples) was joint to train and validation the corporate bankruptcy prediction model. In addition, the sample validation (15% of samples) was employed to test accuracy of the corporate bankruptcy prediction models.

ANNs were appraised as a tool to predict bankruptcy prediction model .They are often classified into two different training types : supervised or unsupervised .Prior researchers in business have mainly used Back Propagation(BP) networks . So this study examined BP model for their efficiency and profitability in bankruptcy prediction. Also the study uses the Receiver Operating Characteristic (ROC) curves and the accuracy rate approach to compare the predictive ability of all models that find which one model is the first.

The result shows significant difference between the two models .The overall Ann's accuracy was 87% compared to 82% for Logistic regression. Besides, the Area under ROC values for ANN achieved above 88% compared to the Area under ROC values of above .82% for Logistic regression model.

The study found significant difference between the two models. It means that non-linear classifiers tend to outperform their linear model. Clearly, ANN is stands both efficient and valid preference in the terms of bankruptcy prediction for Iranian listed

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firms. A further result observes the majority of the selected factors belong to high leveraged and small liquidity and profitability groups cause the likelihood of bankruptcy. These findings agree strongly with the findings of as studies by (Zhang et al., 1999; Parker et al .,2002).

Keywords: Neural Networks, Roc curve, Logistic regression, corporate failure prediction, Iranian listed firms, Tehran Stock Exchange.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PENILAIAN PRESTASI KEWANGAN DAN REMALAN KEGAGALAN MAKANAN IRAN DAN SYARIKAT PERTANIAN

Oleh

MOHAMMAD REZA HAJ SEYED JAVADI

Jun 2015

Pengerusi: Zainal Abidin Mohamed, PhD
Fakulti: Pertanian

Ia pengetahuan umum bahawa kebankrapan bukan acara tiba-tiba untuk mana-mana komuniti.The kebankrapan meramalkan dengan kaedah baru boleh diambil sebagai perisai pengeluaran untuk mengurangkan risiko dan bahaya tahap kebankrapan syarikat. Oleh itu, ini adalah lebih makna kepada pemilik, pemiutang, pelabur dan ahli akademik sama.

Dengan pesawat mudah untuk meningkatkan literatur ketersediaan, Matlamat utama kajian ini adalah untuk meneroka kuasa ramalan model rangkaian neural dan model regresi logistik kepada ramalan kebankrapan dengan mengukur ketepatan peratusannya kepada syarikat yang disenaraikan di Bursa Saham Teheran (TSE). model regresi logistik juga disediakan sebagai penanda aras prestasi bagi penjodoh rangkaian neural. Bergantung kepada kaedah persampelan purposive, kajian ini meliputi 94 syarikat yang tersenarai di TSE, di mana 47 syarikat sihat dan 47 syarikat yang telah memfailkan untuk muflis semasa daripada 2005¬-2009. analisis sampel (85% daripada sampel) telah bersama untuk melatih dan Pengesahan kebankrapan model ramalan korporat. Di samping itu, pengesahan sampel (15% daripada sampel) telah digunakan untuk menguji ketepatan korporat model ramalan muflis.

ANN telah dinilai sebagai alat untuk meramalkan model ramalan kebankrapan .Mereka sering dikelaskan kepada dua jenis latihan yang berbeza: diselia atau tanpa pengawasan penyelidik .Prior dalam perniagaan telah digunakan terutamanya Rambatan Balik (BP) rangkaian. Supaya kajian ini diperiksa model BP untuk kecekapan dan keuntungan mereka dalam ramalan muflis. Juga kajian menggunakan Penerima pengendalian ciri (ROC) keluk dan pendekatan kadar ketepatan untuk membandingkan keupayaan ramalan semua model yang mencari yang mana satu model yang pertama.

Hasil kajian menunjukkan terdapat perbezaan yang signifikan antara kedua-dua model ketepatan .The keseluruhan Ann telah 87 % berbanding dengan 82% bagi Logistic regresi. Selain itu, kawasan di bawah nilai ROC untuk ANN dicapai di atas 88% berbanding dengan Kawasan di bawah nilai ROC melebihi 0,82% bagi model regresi logistik. kajian mendapati perbezaan yang signifikan antara kedua-dua model. Ini bermakna bahawa penjodoh bukan linear cenderung untuk mengatasi model linear mereka. Jelas sekali, ANN ialah berdiri kedua-dua pilihan yang cekap dan sah dalam syarat-syarat ramalan kebankrapan syarikat Iran yang disenaraikan. Satu keputusan lagi

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memerhati majoriti faktor dipilih tergolong dalam memanfaatkan dan nisbah mudah tunai kumpulan, menyebabkan kemungkinan muflis. Penemuan ini bersetuju sangat dengan penemuan kerana kajian oleh (Zhang et al., 1999;Parker et al .,2002).

kata kunci: Rangkaian Neural, keluk ROC, regresi logistik, kegagalan ramalan korporat, Iran syarikat yang disenaraikan di Bursa Saham Tehran.

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I certify that a Thesis Examination Committee has met on 15 June 2015 to conduct the final examination of Mohammad Reza Haj Seyed Javadi on his thesis entitled "Financial Performance Evaluation and Failure Prediction of Iranian Food and Agricultural Corporation" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy.

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This is to confirm that:
- The research conducted and the writing of this thesis was under our supervision;

- Supervision responsibilities as slated in Rule 41 in Rules 2003
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LIST OF ABBREVIATIONS

AGRI-FOOD	Agricultural and food production enterprise
ANN	Artificial Neural Network
AUROC	The Area Under the Receiver Operating Characteristics
BP	Back-propagation Perception
CA	Currency Asset
CART	Metric Ton
CL	Currency liabilities
EBIT	Earnings Before Interest &Taxes
FA	Fix Asset
FN	False Negative
GA	Genetic Algorithm
GP	Genetic Programming
ID3	Marginal Physical Product
INV	Inventory
ISO	Iran Standard Organization
KNN	K Nearest Neiborhood
LOGISTIC	Logistic regression Model
MDA	Multiple Discriminant Analysis
MLP	Multi-Layer Perceptron
NIC	National Industrial Classification
OI	Operation Interest
PCA	Principal Component Analysis
PE	Processing Element
SAL	Sales
SEO	Security Organization
SPSS	Statistical Package
SVM	Support Vector Machines
TA	Total Asset
TL	Total Liability
TN	True Negative
TP	True Positive
TSE	Tehran Stock Exchange
WCAP	Working Capital

CHAPTER 1

INTRODUCTION

1.1 Introduction

This study focuses on applying to neural networks approach for analysis of bankruptcy. The goal of the study is to alert and give the warning signs in an earlier stage to the firms that meeting financial problem and cope with bankruptcy. Company business failures are common in the competitive business environment where market forces guarantee the survival of the company. It is equivalent to an event of default which relate to different events referring to bankruptcy containing the incapacity to face debt payments, debt restricting and more others.

Bankruptcy risk is introduced by the technique which the company supplies its investments. If a firm uses only common stock to finance its investments, it gains only business risks. If a company borrows money to finance its investments, it require spaying fixed financing expenses such as interest. So, the ability to face the financing agreements to the lenders affects the degree of financial distress of a company. Also, these financing expenses have priority over the distribution of income to the shareholders and then the doubt fullness of returns to the common equity shareholders growth. The ambiguity of returns to the shareholders causes to the higher risk premium desired of the stock.

Bankruptcy prediction models give suitable data the stockholders such as management and investors as the early warning signs extracted from these models.

1.2 Background

The investigation of corporate bankruptcy prediction enlarged the accounting literature. To forecast adequately the event of bankruptcy, due to its significant social and economic costs and its opposed impact on a different classify of people. In new times, the number of firms settled as bankrupt due to the recession has increased. A profitable early forecasting of signals typical of bankruptcy enables managers to reduce the bankruptcy-caused expenses.

The economy of Iran is one of the most advanced in the Middle East. Due to the high world oil prices, the export revenues had increased, which helped to this improvement. Iran attained technological progress in the all dimensions within a significant period of privatization of Governmental companies to develop their share Private sector businesses in the economy.

In the first five-year economic reform where the government together with the parliament defined the economic prospects of the country for the coming five years. Attention to promotion of the private sector and new interest in the TSE brought life back to the market.

1.1

In 2006, Market capitalization of the 417 companies currently listed on the TSE more than $ 415 billion at the currency exchange rate. The growth in the number of listed companies is a direct consequence of the fact that most state-owned companies have been privatized through a listing of their shares on the TSE. Based on Table 1.1, It is evident that the TSE's growth over the past few years.

Table 1.1: Summery important Indicators for Tehran Stock Exchange between 2006-2009

Years	2006	2007	2008	2009
Number of Healthy Listed Companies	417	420	419	416
(USD Millions)Market Capitalization	43,794	45,574	49,040	58,698
Total Value of Share Trading (USD Millions)	6,230	7,872	15,252	16,875
Daily Average Trading Value (USD Millions)	26.1	32.5	63.8	65.4
Total Number of Trade in Share (Millions)	15,839	23,401	37,975	82,479
No. of Transactions (in thousands)	1866	2107	1978	2646
No. of Trading Days	239	242	239	258
Share TurnoverVelocity (%)	15.6	16.37	26.5	28.74
P/E ratio	**5.4**	**5.2**	**4.1**	**5.5**
(%)Dividend yield	10.44	14.5	12.3	15.8
Market Capitalization/GDP (%)	17.9	15.4	14.1	15.2

Exchange rate: 1 US $=10,004 IRR (2009)

(Source: TSE, statistical report yearly)

The TSE is regulated by the Capital Market Authority in Iran. The TSE opened in April 1968. There are four periods in the term of activities of stock exchange organization:

a) First period (1968-1978): expansion of the stock market activity with sharing privacy section;

b) Second period (1979-1988): limit of the economy following the revolution by expanding public sector control over the economy and reduced the need for private capital.

c) Third period (1989-2004): with the revitalization of the private sector ,through privatization with promotion of private sector economic activity according to the end of imposed war and performing the first five –year development plan of the country;

d) Forth period from 2005 up to now: in execution of 2005 Market and Securities Act of the Iran, the Securities Organization of Iran (SEO) launched its activities as a supervisory entity for self-regularization of the national capital market through providing various types of securities services including:

1) Development of instruments, markets and financial entities in securities market.
2) The implementation of new information system of security issuers for increasing transparency market and Development of E-services and so on.

Note the Table 1.2, SEO has a responsibility about 429 companies listed in TSE that

Available at www.Tse.ir (Tehran Stock Exchange,2009).There are expected to be financial healthy and efficient trading for the firms listed under the SEO, but all companies did not have the sound position. Since the end of business profile change direction to failure in spite of these listed firms must meet the listing need of SEO. (Depend on financial desire, governance or risk and etc.)

Table 1.2: Numbers of bankrupt and healthy companies

Year	Firms	Bankrupt Firms	Healthy Firms	Percent 0f Bankrupt Firms
2004	406	14	392	3.4
2005	416	18	398	4.3
2006	424	7	417	1.6
2007	426	6	420	1.4
2008	428	9	419	2.1
2009	429	13	416	3
2010	429	7	422	1.6
Firm/Year	2958	74	2884	2.5

(Source: Security Organization of Iran)

This indicates that the economy of Iran is a transition economy with a large public sector and some 50% of the economy centrally planned. It is also a diversified economy with over 30 sectors directly involved in the Tehran Stock Exchange. For example the food and kindred product Sector alone accounts to 40 companies at a market capitalization of US$897.5 million in 2009. Thus to provide effective parameters for investors to protect them from market potential risk ,it is necessary to assessment of firm's financial situation (surveillance in the TSE) and identification of potential distress market by developing sound and reliable models.

This study of bankruptcy prediction will focus on firms listed in Tehran Stock Exchange between 2005 and 2009.

1.3

Table1.3: Set statistical for all industries of the sample based on the SIC codes

Digit SIC code	Industry Type	Total Number of Firms	Total Number of Bankrupt Firms	Percent 0f Bankrupt Firms
38&42	Food and Kindred product	35	15	42.8
29	Machinery	30	16	53.3
17	Textile products	9	6	66.6
25	Rubber & Plastic Products	12	5	41.6
43	Tile & Ceramics	8	5	62.5
Total		94	47	

(Source: developed for this thesis)

Table 1.3 provides summery statistics for industry failure rates based on individual companies for the one year before bankruptcy .According Table 1.3, the failure rates vary meaningfully among industry systematic classification. As can be seen, machinery and Food and Kindred product industries with together 31 bankrupt companies, are the most risky national industries in view of bankruptcy risk (investigation and information of the data structure to lead choose this group and other groups with food enterprise to overcome limit choose 47 bankrupt firms.

At the present, failure forecasting is not itself a new topic in Iran. Until this moment, many researchers tried to develop models to compute the performance of failure for Iranian listed company. Most of the studies that have been published on the comparison of various statistical models. Some of the leading studies have also been summarized in the following paragraphs.

Amiri (2003) conducted the information about 30 healthy and 30 bankrupt firms. he posed a model by employing a regression model to estimate failure firms registered in TSE. He tested them in one, two and three years before the bankruptcy. The consequences displayed that the model had classified the total sample properly in one, two, three years with 85%, 80% and 82% accuracies, respectively.

Ahmadi (2005) presented the Altman's pattern in instruments and home appliances. According of the consequences could discriminate the healthy and bankrupt firms in the industry reminded with 70.8% percent.

Mehrani et al.(2005) conducted the connection between bankruptcy prediction and financial ratios. To compute the main financial ratios includes five research ratios. By using Z Altman model, results exhibited that the obtained Z score model correctly grouped healthy and bankrupt firms without any error.

1.4

Raee et al. (2004) investigated applicant of ANN model in prediction of failure firms. To estimate the financial distress in 80 manufacturing firms and operated a Logistic regression model as a comparative model .On the basis of the conclusion, they deduced that ANN model has more accuracy than logistic model. ANN was superior to logistic in bankruptcy predict of Iranian listed firms activated in (TSE).

Moghadam et al. (2009) investigate of the prediction power of Altman and Ohlson logistic model in bankruptcy prediction of Iranian listed companies. They concluded that Altman Z score can forecast firm bankruptcy with 47.5%, 37.5% and 32.5% for one, two and three years before bankruptcy, respectively. At last, he recommended that the Altman Z score model does not have power in bankruptcy prediction of Iranian listed companies.

The study focuses on applying ANN analysis for examination of bankruptcy model which goal to alert the companies that meeting financial that almost bankrupt in earlier periods. By contrast the classification accuracy of the logistic model.

1.3 Research objectives

In this section, the objectives of this study are separated into two parts which are main and specific objectives. The descriptions are item listed as below:

The main objective of this study is to test applicability of ANN's bankruptcy prediction model to discrimination between healthy and bankrupt Iranian listed companies on the TSE from period 2005-2009 .In this practical aspect , we need a robust model to cover important factors e.g. complex financial market, nonlinear system, a high degree of uncertainly.

The specific objectives of this study are:

1) To configure wrap feature selection method (F statistical test) to pre-selection the predictors that recognize healthy from bankrupt firms both Logistic model and ANN model.
2) To identify the probability of corporate failure prediction on Iranian listed companies in TSE by ANN and Logistic regression models.
3) To compare evaluation performance of two models by ROC curves.
4) Test a limit number of non-financial variables in separate only by Logistic model B.

1.4 Statement of the problem

Corporate business failure is an important and widely studied topic science such as the financial system. Bankruptcy prediction and early warning signs do influence a company creates entire survival .Also it has increased costs to the firms (Moyer et al., 1977).

In today's dynamic economic environment, it is a basic problem to prevent the number of firms that bankrupt since protect economic growth (Ahn et al., 2000). In 2008,

financial tsunami started (the world economy goes to depression) and the hit rate of firms bankruptcy has increased with significant. As a consequence, there is an ever increasing need for fast, automated recognition systems. To guarantee the economic development (the identification of potential basis failures and offering early warning of the impending financial crisis). The individual point of view is that the ability of the financial failure models can be useful tools. They simulated both private agents and by the government that target to leave bad performing firms.

In summary, the development corporate failure prediction model can be very important economic circumstance due to as follows:

1) The outcomes and its great social and economic cost in national economy level (lensberg et al, 2006).
2) Bankruptcy prediction models give suitable data the stockholders such as management and investors as the early warning signs extracted from these models against the stock exchange instabilities in these countries and also the worries of capital owner.
3) The number of bankrupt firms can be considered as an index of the development and strength of the economy countries (zopounidis &Dimitras ,1998).

The Iranian government has been actively selling the shares of government-owned companies on the TSE. Some 40 percent of the companies subject to Article 44 of the law would be moved and the rest through the Organization. So that, the generally positive performance of listed companies has increased large and small investors in TSE . Gradually giving people decision making a financial investment such as, stocks. In fact, a fast growing capital market in Iran economy in recent years(i.e. in 2009, listed over 416 firms with over 30 sectors directly involved in the TSE).

Despite the enormous growth of the stock market, there are also many structural issues and problems in the TSE. For example, sometimes TSE management decides to postpone and hang trading in some company shares through internal and external nervousness (change macro indexes) and uncertainties (policy crisis). The irregular delay makes company shares illiquid and works against the interest of small investors (low transparency) and finally failure for many Iranian listed firms.

In this case, the benefit of using such ANN models profitability both private agents and by the Iranian government that to predict the future behavior of stocks and take direct actions upon them to detect bad performing companies. It gives a warranty for collect receivables to exactly situation firms and creditors, shareholders, and investor to protect them from market potential risk.

In summary, our study is more important since, the active people or really investors which stocks to buy or which to sell just according to the status of TSE market or just random labeling, there is no shield behind it, but our developed model, it creates new profit opportunities to each person who use the market especially amateur invest or on Tehran Stock Exchange.

1.5 Research questions

This research addressed the following questions the considering ability of a neural network model in predicting bankruptcy.

1) How does the ANN method present performance in comparison to Logistic regression model?
2) Which kind of financial variables are important for expressing failure situation on the Tehran Stock Exchange?

1.6 Significance of the study

From the point of view business managers, predicting bankruptcy provides to adoption timely strategic actions and avoid from bankruptcy. Thus the development of the models for bankruptcy prediction in advance can be very significant to the firms in different ways as follows:

1) These models would decrease important economic losses for the firm by making early warnings to all the stakeholders (Wu, 2004). It means that chance for the management to take quick improving action (e.g. changes in operating and/or financing positions). In reason of prevent incurring cost of the bankruptcy firm.
2) The early prediction of bankruptcy also has significant implications for the public positions.
3) When distress is not available, these prediction models allow the management to take an optional strategy (e.g., reorganization, liquidation and merger). These models permit companies to speed up the timing of the bankruptcy filing without further defect of valued.
4) These models can be applied in helping loan officers of financial institutions and investors with evaluation of the companies (Ahn et al.,2000).Before creditors respond to corporate loans demand they should be able to possibility of firm**'s** bankruptcy. Another hand, prior to ending their investment decision, investors may count on those models to test a company's risk of bankruptcy and this will cause to increase the value of these companies for existent shareholders.
5) Academic scholars continue to further research on bankruptcy various failure prediction models.
6) The other view point, the advantage of using such machine learning system helps corporate investors to predict the future behavior of stocks .This takes immediate actions upon them. They can beat the market, gain more profit or prevent failure.
7) Tehran Stock brokers do the trading for the individual investors. They provide them with many suggestions of the positions of various group activities stock. They suggest the investors, which stocks to buy or which to sell just based on the status of the market .Generally, there is no warranty behind it (the accuracy of their prediction is the same random labeling based on financial market position).However, if they operate the Prediction model, what they recommend to their customers and individual investors nearly

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80% of the time is true and the customers would be fulfilled .Since the stock broker has made them gain more profit.

8) At the end keeping and increasing the customer contended gain more profit for the stock brokers. While the reasons reminded above are the favorable causes why the study is helpful to us .It is clear that well-designed bankruptcy prediction models have significant contributions.

1.7 Scope of the study

The study will focus on various methods that are attainable in predicting crossing series data and studying method that has been applied in bankruptcy prediction.

1) Predict corporate bankruptcy applying two learning rule of neural networks methods contains: Back Propagation and Conjugate Gradient.
2) The datasets are from TSE Services Company (TSESC) who in charge of computerized site and supplier computer services (Tehran Stock Exchange, 2005) from 2005-2009.
3) The datasets are pre-processed and converted into suitable values to guarantee better classification model.

1.8 Organization of the study

To achieve the objectives listed above, the thesis is structured as shown in Figure 1-1. Chapter one has a background section and goals of the study and continuous by the importance of failure prediction bankruptcy. Chapter two is discussed the literature review in relation to previous researchers in the area of corporate bankruptcy prediction models. The review focuses on the results and estimation methods used in past bankruptcy prediction studies. Chapter tree presents the data used and the data preparation process such as research design. Besides, methods are reviewed which include Logistic regression model and description of the ANN model in this study. Chapter four is the debate of empirical consequences of this project. It consist of development model, test the model and performance accuracy applying to distinctive prediction models used. Furthermore, this chapter supplies also an interpretation of the observations and evaluation results will be compared the methods adopted (i.e., ROC curve). Chapter five states the concluding remarks, limitations and directions for future research.

Figure 1-1 Overview of the thesis

The flowchart contains the following boxes:

Left column:
- Introduction
- Literature Review
- Methodology
- Failure Knowledge

Right column:
- Intelligence Modeling Technique
- Combination feature with ANN model
- Develop failure model
- Discussion of Results
- Conclusion & Recommendation
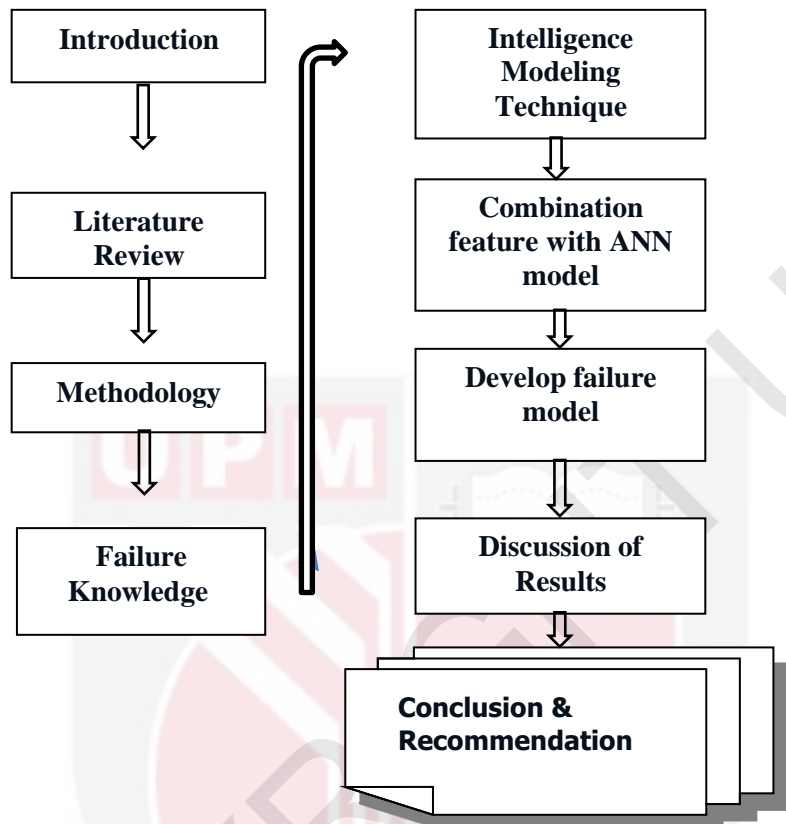
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