A FINANCIAL RISK MANAGEMENT AND CONSULTANCY SOLUTION VIA DATA MINING

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Abstract- The awareness of factors that contribute to making a business successful is important; it is also applicable for all the related parties to have an understanding of financial performance and bankruptcy. It is also important for a financial manager of successful firms to know their firm's possible actions that should be taken when their customers, or suppliers, go into bankruptcy. Similarly, firms should be aware of their own status, of when and where they should take necessary actions in response to their financial problems, as soon as possible rather than when the problems are beyond their control and reach a crisis. Therefore, to bring out the financial distress risk factors into open as early warning signals and manage risk have a vital importance for SMEs as all enterprises. There is no specific method for total prevention for a financial crisis of enterprises. The important point is to set the factors that cause the condition with calmness, to take corrective precautions for a long term, to make a flexible emergency plan towards the potential future crisis. This study was designed as a project to bring out the financial risk factors as early warning signals and develop road maps to manage risk and financial position for SMEs in Turkey. Our project is the biggest study as covered amount and also first study that designed an intelligent data mining model with R integration for SMEs in Turkey. The project has funded by The Small and Medium Enterprises Development Organization.

Keywords- Data Mining, Intelligent Systems, Financial Risk, Early Warning.

BACKGROUND & PROBLEM STATEMENT

Small and Medium-sized Enterprises (SMEs) are defined as enterprises in the non-financial business economy (NACE, Nomenclature statistique des activités économiques dans la Communauté européenne (Statistical classification of economic activities in the European Community)) that employ less than 250 persons. The complements of SMEs – enterprises that employ 250 or more persons – are large scale enterprises (LSEs). Within the SME sector, the following size-classes are distinguished:

- Micro enterprises, employing less than 10 persons.
- Small enterprises, employing at least 10 but less than 50 persons.
- Medium-sized enterprises that employ between 50 and 250 persons.

This definition is used for statistical reasons. In the European definition of SMEs two additional criteria are added: annual turnover should be less than 50 million €, and balance sheet total should be less than 43 million € (Commission Recommendation, 2003/361/EC).

SMEs have made an important contribution to world's rapid economic growth and the fast industrialization process. The majority of the developing economies have acknowledged that SMEs are an engine of economic growth and a source of sustainable development, crucial for industrial restructuring and for the generation of new jobs, creating income for the population. Economic stagnation, high inflation, instability, frequent change in economic measures, inability to compete with firms, which have high competitive power as well as factors, such globalization, alignment with the EU acquits, and the Basel-II and Basel III result in failure and performance degradation of SMEs. SMEs exposed too much different kind of risks like listed above and financial and operational performance of SMEs are affected by these risks. Access to financing is the most significant challenges for the creation, survival and growth of SMEs, especially innovative ones. The problem is strongly exacerbated by the financial and economic crisis as SMEs have suffered a double shock: a drastic drop in demand for goods and services and a tightening in credit terms, which are severely affecting their cash flows(OECD, 2009). As a result, all these factors throw SMEs in financial distress.

The failure of a business is an event which can produce substantial losses to all parties like creditors, investors, auditors, financial institutions, stockholders, employees, and customers, and it undoubtedly reflects the economics of the countries concerned. When a business with financial problems is not able to pay its financial obligations, the business may be driven into the situation of becoming a non-performing loan business and, finally, if the problems cannot be solved, the business may become bankrupt and forced to close down.

Those business failures inevitably influence all businesses as a whole. Direct and indirect bankruptcy costs are incurred which include the expenses of either liquidating or an attempting to reorganize businesses, accounting fees, legal fees and other professional service costs and the disaster broadens to other businesses and the economics of the countries involved (Warner, 1977).

The awareness of factors that contribute to making a business successful is important; it is also applicable for all the related parties to have an understanding of financial performance and bankruptcy. It is also important for a financial manager of successful firms to know their firm's possible actions that should be taken when their customers, or suppliers, go into bankruptcy. Similarly, firms should be aware of their own status, of when and where they should take necessary actions in response to their financial problems, as soon as possible rather than when the problems are beyond their control and reach a crisis.

Therefore, to bring out the financial distress risk factors into open as early warning signals have a vital importance for SMEs as all enterprises. There is no specific method for total prevention for a financial crisis of enterprises. The important point is to set the factors that cause the condition with calmness, to take corrective precautions for a long term, to make a flexible emergency plan towards the potential future crisis.

This study was designed as a project to bring out the financial risk factors into open as early warning signals for SMEs in Turkey. Our project is the biggest study as covered amount and also first study that designed an intelligent data mining model with R integration for SMEs in Turkey. The project has funded by The Small and Medium Enterprises Development Organization.

II. METHOD

An Early Warning System (EWS) is a system which is using for predicting the success level, probable anomalies and is reducing crisis risk of cases, affairs transactions, systems, phenomenons, firms and people. Furthermore, their current situations and probable risks can be identified quantitatively (Ozgulbas, Koyuncugil, 2010). Financial EWS is a monitoring and reporting system that alerts for the probability of problems, risks and opportunities before they affect the financial statements of firms. EWSs are used for detecting financial performance, financial risk and potential bankruptcies. EWSs give a chance to management to take advantage of opportunities to avoid or mitigate potential problems. Nearly, all of the financial EWSs are based on financial statements. Balance sheets and income tables are the data sources that reflect the financial truth for early warning systems. In essence, the early warning system is a financial analysis technique, and it identifies the achievement analysis of enterprise due to its industry with the help of financial ratios.
The identification of the risk factors by clarifying the relationship between the variables defines the discovery of knowledge. Automatic and estimation oriented information discovery process coincides the definition of data mining. Data mining is the process of sorting through large amounts of data and picking out relevant information. Fawley, et al. (1992) has been described data mining as "the nontrivial extraction of implicit, previously unknown, and potentially useful information from data". Also, Hand, et al. (2001) described data mining as "the science of extracting useful information from large data sets or databases". Data mining, the extraction of hidden predictive information from large databases, is a powerful new technology with great potential to help companies focus on the most important information in their data warehouses.

Koyuncugil and Ozgulbas (2010) described the data mining as "collection of evolved statistical analysis, machine learning and pattern recognition methods via intelligent algorithms which are using for automated uncovering and extraction process of hidden predictional information, patterns, relations, similarities or dissimilarities in (huge) data"

Data mining is used by business intelligence organizations, and financial analysts to get information from the large data sets. Data mining in relation to enterprise resource planning is the statistical and logical analysis of large sets of transaction data, looking for patterns that can aid decision making (Monk and Wagner, 2006). Today, data mining technology integrated measurement of different kinds of is moving into focus to measure and hedging risk. Data mining techniques have been successfully applied like fraud detection and bankruptcy prediction by Tam and Kiang (1992), Lee et al. (1996), Kumar et al(1997), strategic decision-making by Nazem and Shin (1999) and financial performance by Eklund et al. (2003), Chang et al. (2003), Kloptchenko et al, (2004). Also, some earlier studies of Koyuncugil and Ozgulbas (2006a, 2006b, 2006c, 2007a, 2007b, 2008a, 2008b, 2009a, 2009b) Ozgulbas and Koyuncugil (2006) conducted on financial performance, financial risk and operational risk of Small and Medium Enterprises (SMEs) and hospitals by data mining.

During the modeling; an easy to understand, easy to interpret and easy to apply utilitarian model that is far from the requirement of theoretical background is targeted by the discovery of the implicit relationships between the data and the identification of effect level of every factor. The first phase of study consists of the process of determining the levels of financial performance of SMEs and obtaining data which will be used in development of the Early Warning System for SMEs.

The model of EWS based on data mining and data flow diagram of the EWS is shown in Figure 1.

The steps of the EWS are:
I. Preparation of data collection

II. Implementation of DM method
III. Determination of risk profiles
IV. Identification for current situation of SMEs from risk profiles and early warning signs
V. Description of roadmap for SMEs

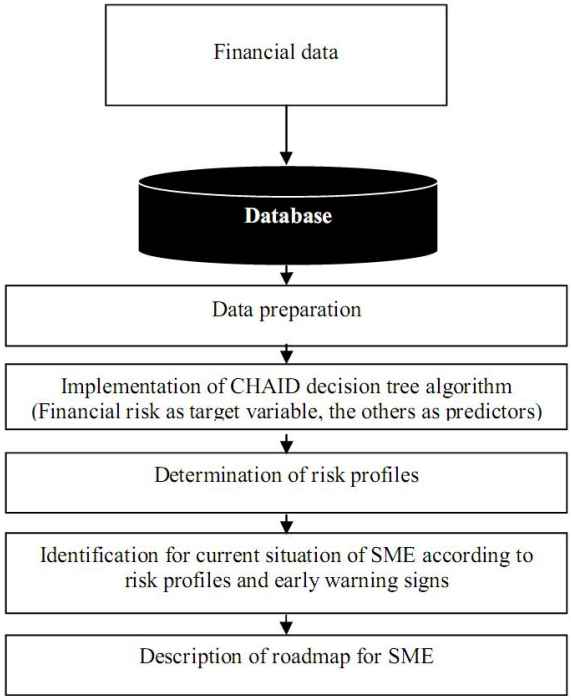


Figure1. Data flow diagram of the EWS

EXPECTED RESULTS & CONCLUSION

EWSs should develop and implement in every business, to provide information relating to the actions of individual officers, supervisors, and specific units or divisions. In deciding what information to include in their early warning system, business should balance the need for sufficient information for the system to be comprehensive with the need for a system that is not too cumbersome to be utilized effectively. The system should provide supervisors and managers with both statistical information and descriptive information about the function of business.

In case of using our EWS model by SMEs, some of expected contributions can be summarized as:

- Determine financial performance and position of firms,
- Determine financial strategies by minimum level of finance education and information
- Financial and operational risk detection
- Roadmaps for risk mitigation
- Prevent for financial distress
- Decrease the possibility of bankruptcy
- Decrease risk rate
- Efficient usage of financial resources
- By efficiency in recources;
- Increase the competition capacity
- New potential for export,
- Decrease the unemployment rate
- More taxes for government
- Adaptation to BASEL II-III Capital Accord

Developing a financial EWS based on financial risk is not enough for to understand and manage the financial risks that can cause insolvency and distress. Managers need also to manage operational risks that can arise from execution of a company's business functions, and strategically risks that can undermine the viability of their business models and strategies or reduce their growth prospects and damage their market value. For this reason we suggest to develop EWS that contain all kind of risk factors.

REFERENCES

[1]. Chang, S., H. Chang, C. Lin and S. Kao, (2003) "The Effect Of Organizational Attributes On The Adoption Of Data Mining Techniques In The Financial Service Industry: An Empirical Study In Taiwan," International Journal of Management, 20(1), 497-503.

[2]. Commission Recommendation of 6 May 2003 Concerning the Definition of Micro, Small and Medium-sized Enterprises (2003/361/EC), L 124/36 2003. Official Journal of the European Union, Retrieved December, 2009, from http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:124:0036:0041:en:PDF

[3]. Eklund, T., B. Back, H. Vanharanta and A.Visa, (2003) "Using The Self- Organizing Map As A Visualization Tool In Financial Benchmarking," Information Visualization, 2(3), 171-81.

[4]. Frawley, W., G. Piatetsky-Shapiro and C. Matheus, (1992) "Knowledge Discovery In Databases: An Overview," AI Magazine: Fall, 213-28.

[5]. Hand, D., H. Mannila and P. Smyth, P (2001) Principles Of Data Mining. Cambridge: MIT Press.

[6]. Kloptchenko, A., T. Eklund, J. Karlsson, B. Back, H. Vanhatanta and A.Visa (2004) "Combining Data And Text Mining Techniques For Analysing Financial Reports," Intelligent Systems in Accounting Finance and Management, 12(1), 29-41.

[7]. Koyuncugil, A. S. (2006) Fuzzy Data Mining and its application to capital markets. Unpublished doctoral dissertation, Ankara University, Ankara.

[8]. Koyuncugil, A. S. and N. Ozgulbas, (2006a) "Financial Profiling of SMEs: An Application by Data Mining," The European Applied Business Research (EABR) Conference, Clute Institute for Academic Research.

[9]. Koyuncugil, A. S. and N. Ozgulbas, (2006b) "Is There A Specific Measure For Financial Performance of SMEs?" The Business Review, Cambridge, 5(2), 314-319.

[10]. Koyuncugil, A. S. and N. Ozgulbas, (2006c) "Determination of Factors Affected Financial Distress of SMEs Listed in ISE by Data Mining," 3rd Congress of SMEs and Productivity. KOSGEB and Istanbul Kultur University, Istanbul.

[11]. Koyuncugil, A. S. and N. Ozgulbas, (2007a) "Developing Financial Early Warning System Via Data Mining," Paper presented in 4th Congress of SMEs and Productivity, Istanbul.

[12]. Koyuncugil, A. S. and N. Ozgulbas, (2007b) "Detecting Financial Early Warning Signs In Istanbul Stock Exchange

By Data Mining, " International Journal of Business Research, VII(3),

[13]. Koyuncugil, A. S. and N. Ozgulbas, (2008a) "Strengths and Weaknesses of SMEs listed in ISE: A CHAID Decision Tree Application, " Journal of Dokuz Eylul University, Faculty of Economics and Administrative Sciences, 23(1), 1-22.

[14]. Koyuncugil, A. S. and N. Ozgulbas, (2008b) "Early Warning System for SMEs as a Financial Risk Detector," Hakikur Rahman (Ed), Data Mining Applications For Empowering Knowledge Societies (pp. 221-240), USA: Idea Group Inc,

[15]. Koyuncugil, A. S. and N. Ozgulbas, (2009a) "Measuring And Hedging Operational Risk By Data Mining," Paper presented in the World Summit on Economic-Financial Crisis and International Business, Washington.

[16]. Koyuncugil, A. S. and N. Ozgulbas, (2009b) "An Intelligent Financial Early Warning System Model Based On Data Mining for SMEs" International Conference on Future Computer and Communication, Kuala Lumpur, Malaysia.

[17]. Ozgulbas, N., A. S. Koyuncugil, (2010) "Financial Early Warning System For Risk Detection and Prevention from Financial Crisis," Surveillance Technologies and Early Warning Systems: Data Mining Applications for Risk Detection (eds Koyuncugil Ali Serhan and Özgülbaş Nermin), pp.76-108, Idea Group Inc., USA, 2010.

[18]. Lee, K. C., I. Han, I. and Y. Kwon, (1996) "Hybrid Neural Network Models For Bankruntcy Predictions, " Decision Support Systems, 18, 63-73.

[19]. Monk, E. and B. Wagner, (2006) Concepts in Enterprise Resource Planning, Second Edition. Boston: Thomson Course Technology.

[20]. Nazem, S. and B. Shin, (1999) "Data Mining: New Arsenal For Strategic Decision Making, "Journal of Database Management, 10(1), 39-42.

[21]. OECD. (2009). The observatory of European SMEs, 2007 observatory survey, http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-observatory/index_en.htm#h2-2007-observatory-survey

[22]. Ozgulbas, N. and A.S. Koyuncugil, (2006) "Profiling And Determining The Strengths And Weaknesses of SMEs listed in ISE by the Data Mining Decision Trees Algorithm CHAID, " 10th National Finance Symposium, Izmir.

[23]. Tam, K. Y. and M.Y. Kiang, (1992) "Managerial Applications Of Neural Networks: The Case Of Bank Failure Predictions, " Decision Sciences, 38, 926-48.

[24]. Warner, J. (1977) "Bankruptcy Costs: Some Evidence," Journal of Finance, 32, 337-347.

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