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Using a fuzzy approach to support financial analysis in the corporate acquisition process

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Abstract

In the global market place, many companies have had to adapt their strategies to meet significant challenges. A strategy adopted by some companies has been international expansion via acquisitions. The need for expert knowledge to determine an appropriate company to acquire has been complicated by the sheer size of the global market place. The costs associated with this in relation to time and personnel have created the need for a computerised expert system to be developed. This paper endeavours to show how a proposed fuzzy based system can assist in the identification of a company for acquisition. The authors discuss the manipulation of the magnitude of fuzzy membership functions to communicate priorities within the system. The fuzzy system is designed to assist financial experts in identifying a suitable company for acquisition in the corporate acquisition process. This includes the deliberate weighting of certain inputs and results above others in the decision-making process. The system attempts to learn and simulate the human precedence given to particular financial statistics in company analysis. The system uses the magnitude of the fuzzy membership functions to reflect the human precedence given to each financial ratio. This enables a particular company's strengths and weakness to be considered while concurrently considering their significance and relevance to the acquiring organisation. The system will enable a larger number of companies to be analysed in a more time and cost-effective manner. The development of this system is intended to illustrate that a fuzzy system can aid the financial experts of an acquiring organisation in the global acquisition process.

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1. Introduction

The development of the global market has created many changes that impact upon how individual companies must compete to survive (Harrison, 1994). In order for many companies to compete in the current market place, they have been forced to expand, either within their national market or in the international market. This required growth can be achieved in a number of ways; one strategy that firms have adopted is expansion via acquisitions (Newton, 1981; Schniederjans & Hoffman, 1992). In an international market place, the number of companies that an acquiring organisation must consider for acquisition can be immense. The access to financial data through on-line databases such as value line, FAME and compustat has provided more readily accessible sources of corporate information. However, the number of possibilities increases both the research effort

from the company's financial experts and the cost to the acquiring organisation. This therefore represents a considerable investment by any acquiring organisation (Schoenberg & Reeves, 1999).

The availability of increasing amounts of data in all disciplines has encouraged the development of technologies that can perform data analysis on vast amounts of data. These technologies include machine learning (Murata, Ma, & Isahara, 2002) such as induction, data mining and statistical and conceptual clustering; neural networks (Dreiseitl & Ohno-Machado, 2002); genetic algorithms (Chi, Yan, & Pahn, 1996).

This paper sets out to identify how a fuzzy system (Bellman & Zadeh, 1970) can be effectively utilised to evaluate a large source of financial data while applying preferences to particular inputs within the analysis. The diversity of potential companies to acquire and the diversity of the acquiring organisations itself, dictate that varying data inputs and preferences will be required for different organisations. This promotes the necessity of a user centred

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approach enabling the system to adapt to the user and their requirements (Marsala & Bouchon-Meunier, 1999).

The proposed fuzzy system employs a hierarchical system (Wei & Wang, 2000) with scalable fuzzy membership functions (Sharma & Tokhi, 2000; Warne, Prasad, Siddique, & Maguire, 2003) both of which are dictated by the requirements of the acquiring organisation. The basis on which the system architecture is designed is based on a detailed profile of the acquiring organisation. The system derives an architecture for the acquiring organisation with corresponding priorities for inputs within the system. A simplified version of the system containing the system architecture and priorities is presented to the user. The user can then approve the current settings or adjustment through the use of a graphical user interface (GUI).

This paper illustrates the potential benefits of the system by providing results obtained for a particular acquiring organisation over a number of corporate acquisitions. Section 5 illustrates how the system adapts to provide results in line with the requirements of the acquiring organisations. Particular attention is given to how the system can identify potential acquisition targets through the extraction and analysis of financial information from on-line databases. The authors have provided results that illustrate the potential benefits of the system by providing results obtained for different acquiring organisations from the same on-line database of companies. The system discussed serves as a basis for discussion and future research.

2. The acquisition process

National and international expansion can provide a firm with an external environment where: new markets exist; labour costs are cheaper; transportation costs are less expensive; and/or the taxes are less. Many European and US firms have expanded operations by moving to developing countries to take advantage of cheaper labour costs (Davis, 1992). In the 1990s, international acquisitions have been prevalent in a number of industries including newspapers and media, food and drink, and telecommunications. Cross-border acquisitions include all acquisitions of organisations across two national boundaries. In 1998, there were 3000 cross-border acquisitions in Europe, valued at \$220 billion (Schoenberg & Reeves, 1999). The advantages and popularity of acquisitions as a policy for corporate development are well established (Johnson & Scholes, 2002; Rappaport, 1979). There are many reasons why such an organisation may wish to acquire another (Czogala & Pedrycz, 1981), have identified the following as potential motives for acquisitions:

- Low cost route into a new market or new product area
- Achieve operational synergies
- Increases in power
- Increased market share

- Cost reductions
- Financial credibility
- Managing an under-performing firm
- Reducing competition or over-capacity in an industry
- Reducing the threat of a take-over
- Personal ambition.

There are a number of key stages in the acquisition process a previous review (Grundy, Johnson, & Scholes, 1998) has identified the key stages as:

1. *Strategy and objectives*—the acquiring organisation must be clear about its current strategic position and intent.
2. *Search*—it is important that very clear criteria are established in order to screen potential acquisition targets.
3. *The deal*—essentially this stage is concerned with ensuring that the strategic objectives established in the previous two stages are being met.
4. *Integration*—during this phase any changes to management, operations and strategy are implemented and new opportunities for further development may be identified.
5. *Investment and learning*—during this phase, managers review whether the acquisition has delivered what was expected—strategically, financially and organisationally.

Once the objectives and criteria of the acquisition are established, the acquiring organisation must identify companies which meet these objectives; this is the focus of this paper. Clearly, in an international context, there may be thousands of firms representing dozens of industries that may be suitable. The corporate acquisitions model described in this paper attempts to overcome some of the problems associated with the acquisition process, and act as a decision aid in the analysis of large databases of potential acquisitions. However, it must be emphasised that the model is not a panacea for all of the problems associated with corporate acquisition analysis. The model illustrates how the process of evaluating potential acquisitions can be assisted with the aid of a fuzzy system to take advantage of advances in the electronic distribution of on-line corporate databases. The stages involved in this corporate acquisitions model are illustrated on a decision tree in Fig. 1. A full description of the stages involved in the model will be presented in Section 3.3.

3. The development of the acquisition system

3.1. Problem definition

The proposed system is concerned with providing an acquiring organisation with a structure to follow in the corporate acquisition decision-making process. The system proposes to obtain a precise set of aims

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