

## Chapter 25

# Early Warning System Framework Proposal Based on Structured Analytical Techniques, SNA, and Fuzzy Expert System for Different Industries

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### ABSTRACT

*Early warning systems are made with purpose to efficiently recognize deviant and potentially dangerous trends related to company business as early as possible and with significant relevance. There are numerous ways to set up early warning systems within company. Those solutions are often based on single data mining methods, and they rarely provide the holistic and qualitative approach needed in modern market uncertainty conditions. This chapter gives a novel concept for early warning system design within company, applicable in different industries. The core of the proposed framework is hybrid fuzzy expert system, which can contain a variety of data mining predictive models responsible for some specific areas in addition to traditional rule blocks. It can also include social network analysis metrics based on linguistic variables and incorporated within rule blocks. As part of this framework, SNA methods are also explained and introduced as a very powerful and unique tool to be used in modern early warning systems.*

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## **1. INTRODUCTION**

Modern global environment include companies constant exposure to market influences of different kinds. While in distant past company's analytic value was measured by its ability to find information, recent past introduce value as ability to collect data. Modern decade fights with problem how to interact and efficiently use large available data collections. Different industries up until today developed large scale analytic methods used for market, customer and profitability analysis and forecasting. Ability to "understand" data still remains one of top analytic priorities. However, due to development of industry specific expert knowledge and due to fact that many industries face significant changes in past years followed by globalization and technology evolutions, concept of developing black box indicator models is more and more used every day. Those models combine industry and expert knowledge but are easy to use. Described as Early Warning Systems (EWS) those models are packed with state-of-the-art knowledge and KPI's which helps business people to deal with numerous influences, large data sets and market trends. Early Warning Systems are also in close connection with risk assessment and modeling. Risk management methods often precede development phase and are used as starting point for early warning systems development.

By dealing with knowledge, term intelligence and, furthermore, business intelligence needs to be introduced first. Intelligence concerns the awareness and knowledge of the external business environment. The definition that is used here is that business intelligence is a systematized and continuous approach to focus, collect, analyze, communicate, and use information about customers, competitors, distributors, technology, political issues, macroeconomic issues, and political issues in order to increase the competitiveness of the organization (Hedin & Kovero 2006).

Ability to capture business rules starts with trading companies way back in the past. In modern management, intelligence was implicitly referred to as environmental scanning in the early writings of strategy in the 1960s. A decade later, intelligence was often included as a subset of market analysis while in 1980s, industry analysis researches argued that there is a "need for some form of formalized competitor intelligence system" since the informal approach is not rigorous enough to navigate today's turbulent and complex business environment. End if 20th Century brings analysis tools for understanding the competitive forces of an industry, which gave industry analysts, intelligence professionals, and managers a framework for understanding the external business environment (Hedin & Kovero 2006).

While looking for company's understanding of the environment, intelligence systems and early warning systems start to be more and more formalized. Many organizations state that they rely mostly on informal mechanisms to support this external knowledge. This disproportionate reliance on informal mechanisms is a vestige of management thinking from the previous century. No well-managed modern business corporation should rely on an informal sales system, R&D process, or any other process that is of paramount importance to the success of their business model (Hedin & Kovero 2006).

While developing early warning systems and models, several approaches are usually applied, like probit/logit approach and signaling approach (Chang, 2009). The former is often applied on a multivariate model, which allows testing of statistical significance of explanatory variables. This type of models requires large samples and can only accommodate a limited number of explanatory variables to avoid multicollinearity. On the other hand, the signaling approach is frequently applied in univariate models, which involve monitoring a set of high-frequency leading indicators. It is noted that those selected indicators would behave differently prior to some extraordinary event (why early warning systems

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