# Use of Neural Networks in Enterprise Risk Management Applications

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The term "risk management" has turned into something of a joke. Recent debacles in the financial services industry were preceded by soothing (and somewhat condescending) statements from the industry to investors about their "advanced risk management techniques."

Given this environment, it's entirely understandable that many view companies' efforts to proactively manage risk with a degree of skepticism; what the skeptics overlook however, is that risk management is not a recent invention.

The management of company risks has been done by conscientious managers at well run companies since the concept of a company was invented. The modern term for this well established management technique is Enterprise Risk Management (ERM).

Contrary to the view of many commentators, what is required at this junction in economic history is not a soul searching escapade for the "true definition" of ERM, but rather modern tools and techniques to facilitate and accomplish this well established and critical business function. In this paper we introduce one of the most effective techniques for implementing and sustaining ERM: a professional risk assessment supported by neural network technology.

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## ERM Overview

To provide context to our discussion the illustration below summarizes the modern concept of ERM:

Across the top of the cube are the main objectives of management: having the right strategy, executing operations, reporting the results and complying with laws and regulations. These are fairly obvious.

Written across the face of the cube are the components of ERM: the items that need to be implemented in order to effectively manage the risk company's risk environment.

Our focus is on Risk Assessment and how it supports and benefits management's objectives.

### The Keystone

As its name implies Risk Assessment is the keystone of an effective ERM system. Without effectively identifying and evaluating risk, all of the other objectives are rendered moot.

Companies have traditionally struggled with methods of identifying and evaluating risks. Some of the challenges have been:

- How to ensure we identify all risk areas
- Does one risk area impact another? If so how?
- What measure do we apply to evaluate risk areas?
- How do we perform an evaluation when the risk areas often overlap one another?
- How do we retain and pass along our risk knowledge?
- Are we getting better at risk assessment over time?

To attempt to answer some of these questions, companies have employed various methods of risk assessment. These are presented below along with the advantages and disadvantages of each method.

| Method | Description | Advantages | Disadvantages |
|---|---|---|---|
| Rotation | • Simplest method<br>• Allocates the same resources toward all risk areas<br>• Not a true risk assessment per se | • Easy to implement<br>• Best used for homogenous operations | • Does not take into account varying risks between risk areas<br>• Wastes resources on units that may not require management attention |
| Industry Lists | • Generic listing of organizational risks<br>• Complied by industry experts | • Well researched<br>• Contain information from many industry sources | • Too general<br>• Do not take into account your company's situation or history |
| Interviews | • Conducting interviews with Senior and Operating Management and the Board of Directors<br>• Compiling the results of the interviews into a holistic picture | • Management and Board are typically familiar with company risks and history<br>• Company specific risks and future plans can be identified and evaluated | • Overcoming biases of people being interviewed and those conducting the interview<br>• Compiling and reporting the results can be very challenging |
| Excel | • Moderately automates the process<br>• Uses a systematic method to create a risk score | • Significant amounts of data can be processed<br>• Can objectively compare the risk score for auditable units | • Does not have the ability to see patterns in the data<br>• Can only evaluate each risk separately; cannot see the whole picture |
| Neural Networks | • Uses artificial intelligence to analyze and evaluate risk<br>• Processes data non linearly and can see patterns in the data | • Will identify risks that other models cannot<br>• Becomes smarter over time as it "learns" more about the company | • Complex scientific tool<br>• Requires professional expertise to use |

Of these methods of risk assessment, a neural network model coupled with professional judgment is the most sophisticated and effective method for assessing organizational risk.

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## What are Neural Networks

Neural networks, also known as artificial intelligence, have been around for decades. The typical use of the technology has been to develop complex relationships between inputs and outputs and identify patterns in the data.

So what does this really mean?

It means that a neural network has the ability to evaluate organizational risk in ways that other models cannot. Specifically, neural network models not only evaluate the risk presented by one risk area but also take into account how the risk areas interact with one another. For example:

A company identifies four risk areas for evaluation and using an Excel model calculates a risk score for each area as follows:

| Auditable Unit | Risk Score |
|---|---|
| Brazil Operation | Medium |
| Worldwide Gold Mining Business Line | Low |
| Cash Transactions | Medium |
| Complex Accounting | Low |

Excel looks at each of these four risk areas separately and has assessed each one as either low or medium risk. If the company stopped their risk assessment here they would be missing an important point.

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On the other hand, a company using a neural networks model would further recognize that a company division operating in Brazil, that is selling gold, dealing in cash, and using a complex system of accounting presents a very high risk to the company.

## The Value of Professional Judgment

Neural networks are very powerful and effective tools for use in risk assessment. Technology alone, however, cannot produce the results we require. Technology is the handmaiden to human decision making and not its master. If we strip the human element out of the decision making process our systems become hopelessly ineffective. Neural networks work best when used by trained professionals that are familiar with how to configure a risk universe, obtain the risk knowledge from those inside the organization and interpret the model's output.

In short, professional judgment is the dominant criteria for an effective risk assessment and neural networks serve as an enhancer and magnifier of the professional risk assessment.

## Neural Network Based Risk Assessment in Action

Stated bluntly, no one knows the risks facing a company better than the people within the company itself. The challenge is to extract this data into a central location where it can be scientifically evaluated in a comprehensive manner.

Anyone can come into a company, conduct a bunch of interviews and then regurgitate what management has patiently explained to them. This is called, "telling management what they already know." A neural network model has the advantage of showing management the complex interrelationships between risks and what this means for the company.

Here we outline a typical risk assessment using neural networks.

The risk assessment starts with the risk evaluator mapping the risk areas of the company whether by geography, function, product line, or more likely a fusion of many factors.

Through an extensive interview process with key personnel, past experience with risk and risk patterns are obtained from the company. A customized neural network risk assessment model is then built for the company and the information fed into it. After processing the data, the model will produce a number of risk scores and risk patterns for evaluation by management. The results are interpreted by management and their advisors and the information is used in a number of ways depending on where they are in the ERM process.

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## What are the Benefits?

The benefits of an effective risk assessment can be summarized as follows:

| Benefit | Description |
|---|---|
| Align risk appetite and strategy | By identifying and quantifying the company's risks, Senior Management and Board can make better decisions about the level of risk that is acceptable |
| Enhancing risk response decisions | When risks manifest themselves the company can formulate appropriate responses based on their understanding of the risks |
| Reducing operational surprises and losses | Having an inventory of organizational risks allows management to develop responses even before the risk manifests itself |
| Identifying and managing multiple and cross-enterprise risks | A risk assessment that "sees" patterns of risks and how risk elements relate to one another will ensure management is able to anticipate risk events and formulate the appropriate responses |
| Improving deployment of capital | Understanding the risks enhances management's ability to choose between various capital structure options |
| Seizing opportunities | Knowing the number and seriousness of the risks allows management to take calculated risks that other may shy away from |

The best ERM approaches provide a forum and a methodology for those who know the company best to discuss, identify and evaluate risks.  In past days, and in smaller companies today, this is done naturally in the course of business by management.  Indeed these meetings of management about risk were the original "neural network."

Today large and mid-size companies have more complex operations and operate in a very fluid business environment.  People in the company still have the answers, but require a process and methodology to extract the information and analyze it scientifically.  A professional risk assessment coupled with neural network technology does just that.

### About the Author
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