

# The Seveso Directives and Their Application to Enterprise Risk Management

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**Abstract – Enterprise Risk Management is a relatively new concept which has emerged as a new paradigm for managing the portfolio of risks that face organizations. In this paper we explain what enterprise risk management is, how it differs from traditional risk management, what new skills are involved in this process and what advantages and opportunities this approach offers compared to prior techniques. Additionally, a relation with the Seveso Directives as a tool to manage risk is also provided. We conclude that Seveso Directives are an effective mechanism to achieve ERM objectives. Yet, this will only be accomplished by using Seveso activity as an improvement process rather than a compliance focused activity. Indeed, if applied with an eye beyond pure compliance, Seveso reports can deliver significant business opportunity.**

**Keywords – Enterprise Risk Management, Management Control Systems, Seveso Directives, uncertainty, COSO**

## 1. Introduction

The ultimate goal of a company is to create value, utility and wealth, through the rational and effective use "of various inputs (such as, people, goods and capital) that combined together, allow the production of goods and services" (García, 1998). Thus, one should expect that the value generated by a company should be greater than the sum of the partial values induced by each production factor.

However, the economic and technological evolution has brought new dimensions to business risk, many of them not yet fully recognized in organizations. Indeed, several different types of risks can be considered when analyzing business activity, such as, for example, credit risk, production risk, financial risk, environmental risk, *inter alia*.

Since risk and uncertainty are closely related but slightly different concepts a clarification about its meaning is necessary. According to Knight (1921) whereas risk is randomness in which events have measurable probabilities, such is not the case of uncertainty where the probability of occurrence of

each possible event is completely unknown.

The occurrence of a number of natural disasters, especially over the last few decades, with adverse consequences for human beings, uncovered the need for an effective Enterprise Risk Management (ERM). In this context a disaster is understood as a serious disruption of the regular activity of a community and/or company that results in losses of human lives, injuries, illnesses, *inter alia*.

For a long time, companies have used insurances to hedge against disasters that could appear. Even if insurance continues to be a popular way to transfer risks, such as, the occurrence of fire, natural disasters, etc, management recognize nowadays that this is only a part of the risk a company needs to hedge against.

In fact, management is usually committed to identify, assess and prevent risks and, above all, to reduce (or even eliminate) potential losses, since:

- Risks that may affect a company's activity are diffuse, disseminate and heterogeneous, often affecting different areas at the level of departments and functions. Monitoring them requires technical skills in various disciplines as well as their inclusion in the strategic planning of a company;
- Risk assessment techniques are imperfect;
- Stakeholders tend to be naturally optimistic about the company's ability to perceive and control risks.

In this context, risk management can be broadly defined as the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities. According to Arruda (2004) it is a set of techniques and tools that are used in order to avoid potential losses.

Traditionally, managing risks used to include analyzing, monitoring and transferring risks to another part. The reasons for this are two-fold: (i) first, it is important to anticipate and minimize risks; (ii) it is necessary to maximize the cost/benefit associated to a given investment.

As a result of the increasing number of competitors in the market and the action of Governments and Non-Governmental Organizations (NGO's), entrepreneurs begin to implement more prudent risk control policies. Hence, risk management is nowadays understood as an active part of the decision-making and strategic planning process since it helps reducing potential losses, therefore.

Given (i) the importance ERM has assumed today and (ii) the adoption in EU of regulatory legislation aimed at preventing and mitigating accidents in which risk assessment plays a crucial role we analyze in this paper how the Seveso Directives have contributed to implement an effective ERM system.

The remainder of this paper will proceed as follows. In Section 2 we discuss the Seveso Directives. Section 3 focuses on ERM. Section 4 debates the relation between the Seveso Directives and ERM and finally, Section 5 concludes.

## 2. The Seveso Directives

### 2.1 Seveso I Directive

A series of major accidents on refinery and chemical plants across Europe from 1960 to 1970 led to growing concern over the safe operation in industrial sites, especially those which could represent major hazard potential to local populations.

In July 1976, an explosion in a chemical plant manufacturing pesticides and herbicides at Seveso, Italy, contaminated more than 10 square miles of land and vegetation and demanded the immediate evacuation of more than 600 people from their homes. In the overall, about 2.000 people had to receive medical assistance. This was caused by a dense vapour cloud containing tetrachlorodibenzoparadioxin (TCDD), which was released from a reactor used for the production of trichlorophenol. Commonly known as dioxin, this was a poisonous and carcinogenic by-product of an uncontrolled exothermic reaction.

As a consequence of this severe accident the Council Directive 82/501/EEC (known as the Seveso I Directive) on major-accident hazards of certain

activities was adopted in 1982 in order to prevent and control such accidents. This legislation required, amongst other things:

- The production of a safety report detailing how major accidents are prevented and controlled.
- An assessment of the possible major accidents, their likely consequences and approximate frequencies.
- The development of on-site emergency plans.
- The production of an off-site emergency plan by the local authorities responsible for such matters.

In 3 December 1984, an explosion in Union Carbide a pesticide factory at Bhopal, India, followed by fire caused the leakage of methyl isocyanate gas (MIC), forming a toxic cloud that caused the death of more than 2.500 people, having been affected a total of 100.000 people. Although located outside Europe this accident – whose environmental consequences are still yet to be fully determined – assumed such proportions that prompted the amendment of Seveso I Directive.

Meanwhile an explosion in a chemical plant in Basel, Switzerland, in 1986, where fire-fighting water was contaminated with mercury organophosphate pesticides and other chemicals, caused massive pollution of the Rhine and the death of half a million fish.

Motivated by these events two amendments to the Seveso I Directive were produced, namely: Directive 87/216/EEC and Directive 88/610/EEC. Both amendments aimed at broadening the scope of the Directive, in particular to include the storage of dangerous substances.

### 2.2 Seveso II Directive

On 9 December 1996 Seveso I Directive was finally subjected to a fundamental review by the European Commission. A number of problem areas were identified giving rise to the production of a new Directive (96/82/EC) replacing the earlier Seveso I Directive. Known as Seveso II Directive, the legislation came into force across Member States in 1999. The Directive in addition to the European Union is also adopted by Norway, Iceland and Switzerland and countries intending to join the EU. Seveso II Directive is based on the experiences accumulated during the implementation of Seveso I, in particular lessons learnt from accidents. It includes

a revision and extension of the scope; the introduction of new requirements relating to safety management systems; emergency planning and land-use planning and a reinforcement of the provisions on inspections to be carried out by Member States. The aim of this Directive is two-fold. First, it aims at the prevention of major hazards involving dangerous substances. Secondly, the Directive aims at the limitation of consequences of accidents that still may occur, for man and environment.

According to Kozine and Hagen (2008) there are a number of ways the new Directive differs from the old:

- The scope of Seveso II has been broadened and simplified, referring to the presence of dangerous substances at establishments in excess of threshold quantities, while Seveso I referred either to substances in connection with certain industrial activities or to separate storage of substances. It covers both industrial activities as well as the storage of dangerous chemicals. The Directive can be viewed as providing for three levels of proportionate controls, where larger quantities mean more controls. In this sense a company who holds a quantity of dangerous substance less than the lower threshold levels given in the Directive is not covered by this legislation. On the other hand, companies that hold a larger quantity of dangerous substance, which is above the lower threshold contained in the Directive, will be covered by lower tier requirements. Finally, companies that hold quantities of dangerous substances above the upper threshold contained in the Directive will be covered by all requirements contained within the Directive.
- The measures to be undertaken by Operators of Establishments to prevent and limit the consequences of major-accidents have been redefined and now include the setting up of a "Major-Accident Prevention Policy". The intention is to emphasize the importance of setting up of safety management systems as important elements to promote high levels of protection.
- Increased emphasis on measures to minimize environmental impacts of major-accidents including emergency preparedness and land-use planning, identification of

possible domino effects and information to public.

- To obtain uniform levels of protection throughout the European Union, the Member States are required to ensure that the Competent Authorities assess the Safety reports and in particular are required to organize a system of ongoing inspections.
- The purpose of the Directive is the prevention of major accidents and to harmonize the efforts in this field within the EU.
- Seveso II is related to the new EU legislation on the protection of safety and health of workers.

The Directive contains general and specific obligation on both Operators and Member States Authorities falling into the categories of the two aims of the Directive, *i.e.*, control measures aimed at the prevention of major accidents and control measures aimed at the limitation of consequences of major accidents. One obligation of Operators of establishments of utmost importance is the production of a Safety Report, demonstrating that (Kozine and Hagen, 2008):

- A major accident prevention policy and a safety management system for implementing it are in effect.
- Major accident hazards have been identified and necessary measures have been taken to prevent such accidents and limit their consequences for man and environment.
- Adequate safety and reliability have been incorporated into the design, construction, operation and maintenance linked to major accident hazards.
- Internal emergency plans have been drawn up and information has been supplied to the Authorities enabling an emergency plan to be drawn up.

Notwithstanding its advance when compared to the older Directive, important areas were excluded from the scope of Seveso II including nuclear safety, the transport of dangerous substances and intermediate temporary storage outside establishments and the transport of dangerous substances by pipelines.

In the light of more recent industrial accidents (Toulouse, Baia Mare, *inter alia*) the Seveso II Directive was extended by Directive 2003/105/EC to cover risks arising from storage and processing

activities in mining, from pyrotechnic and explosive substances and from storage of ammonium nitrate and ammonium nitrate based fertilizers.

### 2.3 Seveso III Directive

The Seveso III Directive 2012/18/EU was adopted on 4<sup>th</sup> July 2012 and entered into force on 13<sup>th</sup> August 2012. The main changes when compared to Seveso II Directive are:

- Technical updates to take account for changes in EU chemicals classification. This is because the European system for the Classification, Packaging and Labeling (CPL) of Dangerous Substances is being replaced by the Globally Harmonized System (GHS). This prompted the need to adapt the Seveso II Directive, since its scope is based on the former chemicals classification.
- Better access for citizens to information about risks from activities of nearby companies. The aim is to improve the level of information available to the public.
- More effective rules on participation by the public concerned in land-use planning projects in the vicinity of Seveso establishments.
- Stricter standards for inspections of installations to ensure more effective implementation of safety rules.
- Access to justice for citizens who have not been granted appropriate access to information or participation.

However, the degree of change brought about by this new legislation is much less significant than that brought about by the transition from the original Seveso Directive to the Seveso II legislation.

## 3. Enterprise Risk Management

Managing risk is a fundamental concern of today's dynamic global environment. This is because risk is inherent to any business activity and may directly arise from:

- A new product launched in the market;
- Changes in products or in manufacturing processes;
- Modification or installation of new manufacturing equipments;
- Alternative forms of financing new projects;
- etc.

However technological and economic developments have brought new dimensions to business risks, sometimes producing effects that are difficult to control. In this context, we can mention:

- The increasing dimension of facilities;
- The use of new techniques, raw materials and products;
- The increasing specialization of production aggravating the consequences of production stops along the production chain;
- etc.

Traditionally managers were not too much concerned about the Enterprise Risk Management. However, this new term has emerged in a systematic manner since the late 1940s and early 1950s due to two main causes (Dickinson, 2001):

- First, in the sequence of a series of company failures, corporate scandals and frauds the scope of corporate governance has broadened to include all risks that a company takes. As a result Directors are now increasingly required to report on their internal risk control systems.
- Second, shareholder value models are playing a major role in strategic planning. Thus, while early strategic planning models paid insufficient attention to risk, modern strategic planning are based more on shareholder value concepts drawn from financial models.

### 3.1 Defining Enterprise Risk Management

To define Enterprise Risk Management it is first necessary to clarify the meaning of enterprise risk. According to Dickinson (2001) enterprise risk can be viewed as the extent to which the outcomes from the corporate strategy of a company may differ from those specified in its corporate objectives. In other words, it is the extent to which the outcomes fail to meet these objectives. In this process, the strategy adopted to achieve the corporate objectives has to be in accordance with the risk profile of a company. This risk profile is usually divided into three broad categories: (i) aggressive risk investors/companies; (ii) moderate risk investors/companies and (iii) low risk profile investors/companies. While the first and the third categories privileges high and low risk investments, respectively, the second one refers to a medium degree of risk. In this assessment it is important to bare in mind that the greater the risk associated to an investment, the greater the returns

required. This constitutes the so-called risk/return tradeoff.

There are however a set of causes that can originate deviations from the original corporate objectives. Some external causes are inherent to those in the marketplace in which a company competes, such as, new entrants into the market, changing consumer tastes or new product developments, *inter alia*. Others, occur in a much more macro level and implicate, for example, modifications in the economy, changes in the stock market conditions and all changes related to political, legal, technological, and demographic environments. The common factor among all of these causes is that they are all beyond the control of management. Another set of causes, internal to the company, that should be considered encompass human error, fraud, disruption of production, etc.

To assess the impact of these factors and measure enterprise risk several techniques like scenario analysis or shareholder value models, are available. The former is mainly a process of analyzing possible future events by considering alternative possible outcomes. Therefore, this method does not try to show one exact picture of the future. Instead, it presents consciously several alternative future developments. Consequently, a scope of possible future outcomes is observable. On the other hand, shareholders value models postulates that the corporate objectives of a company should be coincident of those from the shareholders. Nonetheless, shareholder risk can only be determined indirectly, since it depends on how stock markets value the expected risk of future expected incomes (Dickinson, 2001).

Given this, several definitions for Enterprise Risk Management have been advanced in literature. According to Meulbroek (2002), ERM is a management process that requires a firm's management to identify and assess the collective risks that affect firm value and apply an enterprise wide strategy to manage those risks in order to establish an effective risk management strategy. It is widely recognized that the primary goal of risk management is to maximize shareholder value (Sobel and Reding, 2004; Lajili and Zeghal, 2005; Breasley *et al.*, 2008; Pagach and Warr, 2011; Hoyt and Liebenberg, 2011). Firstly, this is achieved by improving capital efficiency through the provision of an objective basis for allocating corporate resources. This is accomplished by reducing expenditures on immaterial risks and exploiting natural hedges.

Secondly, ERM can support decision-making by exposing areas of high risk and suggesting risk-based advances. Thirdly, ERM will help improve investor confidence by establishing a process which by its activities can stabilize financial results.

In this line, CAS<sup>1</sup> (2003, p. 8) defines ERM as:

“The discipline, by which an organization in an industry assesses, controls, exploits finances and monitors risks from all sources for the purpose of increasing the organization's short-and-long term value to its shareholders.”

The CAS (2003) then proceeds to enumerate the types of risk subject to ERM as hazard, financial, operational and strategic. Hazard risks are those risks that have traditionally been addressed by insurers, including fire, theft, windstorm, liability, business interruption, pollution, health and pensions. Financial risks cover potential losses due to changes in financial markets, including interest rates, foreign exchange rates, commodity prices, liquidity risks and credit risk. Operational risks comprise customer satisfaction, product development, product failure, trademark protection, corporate leadership, information technology, management fraud and information risk. Strategic risks comprehend such factors as completion, customer preferences, technological innovation and regulatory or political impediments.

Another popular definition of ERM used in the literature is the one provided by COSO<sup>2</sup> (2004) that describes this concept as follows:

“Enterprise risk management is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.”

In COSO (2004) perspective, an organization's ERM system should be oriented toward achieving the following objectives: (i) Strategy: high level goals aligned with and supporting the organization's mission. (ii) Operations: effective and efficient use of the organization's resources. (iii) Reporting: reliability of the organization's reporting system. (iv) Compliance: organizational compliance with applicable laws and regulations.

<sup>1</sup> CAS stands for Casualty Actuarial Society.

<sup>2</sup> COSO stands for Committee of Sponsoring Organizations of the Treadway Commission.

It is worthy to note that COSO (2004) acknowledges that the adequate ERM system is contingent, that is, will likely vary from firm to firm. This perspective is in consonance with literature that examines the more generic notion of management control systems (e.g., Chenhall, 2003; Luft and Shields, 2003; Gerdin and Greve, 2008).

In the light of the above, a common thread to ERM is that the overall risks of companies are managed in aggregate, rather than in a separate form. This denotes an evolution from the initial view of ERM, traceable from the late 1940s and early 1950s, where risks were evaluated from a “silo” perspective. In this context, risks were transferred through insurance or other financial products, such as, Derivatives. As documented above ERM is now treated as a holistic all-encompassing view including other kind of risks, such as, operational risk, reputational risk and strategic risk and not only hazard risk. This is because managing each risk class in a separate silo creates inefficiencies due to lack of coordination between the various risk departments. Consequently, the level of decision making under ERM is also shifted, from the insurance risk manager, who would generally seek to control risk, to CEO, or Board of Directors, who would be willing to embrace profitable risk opportunities.

### 3.2 Components and Steps of Enterprise Risk Management

Having clarified the meaning and extent of ERM it is now necessary to shed some light on how ERM should be carried out. Following COSO (2004), ERM comprises:

- *Aligning risk appetite and strategy* where the entity’s risk appetite in evaluating strategic alternatives, setting related objectives and developing mechanisms to manage related risk is accounted for by management.
- *Enhancing risk response decisions* by providing the rigor to identify and select among alternative risk responses, such as, risk avoidance, reduction, sharing and acceptance.
- *Reducing operational surprises* and losses through enhanced capabilities to identify potential events and establish responses.
- *Identifying and managing multiple cross-enterprise risks.* This approach facilitates effective response to the interrelated impacts and integrated responses to multiple risks.

- *Seizing opportunities.* By considering a full range of potential events, management is positioned to identify and proactively realize opportunities.
- *Improving deployment of capital.* By providing robust risk information this method allows management to effectively assess overall capital needs and enhance capital allocation.

ERM is represented as a three dimensional matrix of eight elements deemed essential for achieve strategic, operational, reporting and compliance goals. These objectives are represented by vertical columns, the eight components by horizontal rows and an entity’s units by the third dimension. As stated in COSO (2004, p. 5): “This matrix illustrates the ability to focus on the entirety of an entity’s enterprise risk management, or by objectives category, component, entity unit, or any subset thereof”. The eight components are:

- *Internal environment;*
- *Objective setting;*
- *Event identification;*
- *Risk assessment;*
- *Risk response;*
- *Control activities;*
- *Information and communication;*
- *Monitoring.*

Firstly the *internal environment* (i) determines how risk is perceived and addressed by the organization, defining its approach to risk management. *Objective setting* (ii) is the process by which the entity’s goals are defined and communicated across the organization. *Event identification* (iii) comprises the recognition of internal and external events (both risks and opportunities). *Risk assessment* (iv) is the analysis and evaluation of potential risks, considering their frequency of occurrence and their impact. *Risk response* (v) covers the identification of proper actions for responding to risks, and aligning them with the organization’s risk appetite. *Control activities* (vi) are the policies and procedures for ensuring that risk responses are effectively carried out. *Information and communication* (vii) denotes the mechanisms for ensuring effective communication and flows of information across the organization. Finally, *monitoring* (viii) refers to the ongoing management activities for verifying the effectiveness of the process put in place.

However, ERM is not strictly a serial process,<sup>3</sup> where one component affects only the next but is instead a multidirectional iterative process in which there is interdependency among all components. Moreover, it also encompasses internal control forming a more robust tool for management. Therefore, the effectiveness of an entity's Enterprise Risk Management is a judgment resulting from an assessment of whether the eight components are present and functioning effectively. For this to happen there can be no material weakness and risk needs to have been taken into account. However, these components will not function identically in every entity. Hence, small and mid-size entities may have a less formal and structured application.

The increasing complexity associated to ERM triggered the emergence of new co-ordinating management role – that is the Chief Risk Officer (CRO) who is in charge of all activities related to risk.

While Enterprise Risk Management provides important benefits, limitations exist. One has to do with human failures such as simple errors or mistakes arising from faulty decision making. Another, as discussed by Power (2007, pp. 76-82), refers to COSO simplistic view of organizations, which imposes a mechanical and cybernetic form of control that is defined in a top-down manner abstracted from organizational processes. Finally, firms, especially, the non-financial ones, may tend to introduce ERM merely as a compliance device, or as a self-contained internal control activity, but without assimilating it more closely to business activity.

#### 4. Enterprise Risk Management and the Seveso Directives

As a tool for managing risks Seveso Directives constitutes an instrument to achieve ERM objectives. Thus, effective risk management developed in the context of the Seveso process has the potential to re-orientate a whole organization around performance. There are a number of examples where Seveso process can be applied as a part of ERM, especially in the areas of (DNV Consulting):

- Increasing organizational value;

- Ensuring the asset and capitalize on opportunities in the marketplace;
- Optimizing capital expenditure strategies;
- Improving forward planning and decision making;
- Evaluating project opportunity assessment against risk and return;
- Developing risk mitigation strategies for safety and business critical tasks.

The link between Enterprise Risk Management and safety/environmental risk is strong. By taking an overall approach of “integrated risk” where all risks are analyzed across the organization, Operators will get a better picture of the improvement options available and their associated risks.

The overall objective of managing business risk is to provide an assessment of the company's risk threshold in return for substantial improvements to business results. This is done through a structured and documented process that keeps key business objectives in focus and allows organizations to build a risk portfolio that yields improved business performance and project returns. This process of identifying hazards, evaluating event likelihood and consequence, and developing ERM management strategies is fundamental to the Seveso II process. The management of ERM through the Seveso directives provides a (DNV Consulting):

- Focus on the most vital aspects for successful operation of the organization by developing a thorough understanding of critical business objectives and strategies.
- Planned and structured method, involving both senior management and operational personnel as needed.
- Provides a common communication framework within which all those involved in operating, maintaining and managing the asset can gain a common understanding of the drivers and their associated management controls.

#### 5. Conclusions

Risks are pervasive to all kind of organizations and will increase if not effectively managed.

In recent years, a paradigm shift has occurred regarding the way organizations view risk management. Instead of looking at it from a silo-based perspective, the trend is to take a holistic view.

<sup>3</sup> This approach commonly relies on the following one-directional steps (Ackerman, 2001): (i) identify the question(s); (ii) identify risks; (iii) risk measurements; (iv) formulate strategies to limit risk; (v) implement strategies; (vi) monitor results and repeat ... In the same line, another consulting firm (ARI, 2001) considers the following steps: (i) identify risk on an enterprise basis; (ii) measure it; (iii) formulate strategies and tactics to limit leverage it; (iv) execute those strategies and tactics; and, (v) monitor process.

This new perspective, known as ERM, seeks to link risk management with business strategy and objective-setting, entering the domains of control, accountability and decision making.

In addition, legislation has been adopted in the EU – the so-called Seveso Directives – in order to regulate major accidents hazards. Given its importance in assessing and controlling risk we analyzed in this paper how these Directives have contributed to implement an appropriate ERM system in organizations.

We concluded that Seveso Directives are an effective tool to achieve ERM objectives. However, this will only be accomplished by using Seveso activity as an improvement process rather than a compliance focused activity. We expect, therefore, that in the future companies tend to regard Seveso reports as an opportunity to explore wide risk management issues.

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