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## **Enterprise Risk Management Framework as an Ecosystem**

By Laura Whitaker

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# Enterprise Risk Management Framework as an Ecosystem

Laura Whitaker<sup>1</sup>

## Abstract

**A sound enterprise risk management (ERM) framework functions as an ecosystem by balancing the complex interdependencies of its elements while constantly adapting to an ever-changing, external environment.** Each living organism (stakeholder) has a unique role to play in forming a thriving ERM ecosystem (framework). It has to maintain synchronization across the various levels—legal entities, business lines, products and risk categories—and be risk-conscious in its decision-making. For an ERM framework to withstand events causing severe disruption to the system, an institution must:

- Identify all inherent and emerging risks, including their correlations/dependencies
- Implement key business decisions and actions on behalf of all of its shareholders
- Instill a common risk culture and language that is well understood and practiced by all levels/ business units
- Balance risk mitigation and risk-taking behavior to achieve the goals set out by and for its stakeholders

The ERM ecosystem is established at the most senior level of the organization. The board, executive committee and/or an ERM committee determines how effective, integrated and resilient the ERM framework will be. We live in a dynamic **biosphere** where external factors can **disrupt** how we routinely conduct business. Drastic changes in regulation, market trends, terrorist's attacks and extreme natural disasters are often categorized as one-in-200 events. These extreme scenarios can destroy a weak or adequately rated ERM ecosystem.

## 1. Introduction

**A sound enterprise risk management (ERM) framework functions as an ecosystem by balancing the complex interdependencies of its elements while constantly adapting to an ever-changing, external environment.** Each living organism (stakeholder) has a unique role to play in forming a thriving ERM ecosystem (framework). It has to maintain synchronization across the various levels—legal entities, business lines, products and risk categories—and be risk-conscious in its decision-making. For an ERM framework to withstand events causing severe disruption to the system, an institution must be conscious of its surroundings and its internal processes. A resilient ERM framework has a single well-

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understood risk language and culture to promote healthy risk-taking behaviors. The central focus of such a framework is concentrated around all stakeholders and everyone is held accountable.

Every day, external forces can potentially **disrupt** how we operatively conduct business. Unforeseen changes in regulation, market trends, terrorist's attacks and extreme natural disasters are often categorized as extremely adverse. In reality, these rare scenarios can destroy a weak or adequately rated ERM ecosystem. How then will your ERM ecosystem survive the one-in-200 event and continue to flourish through dynamically changing environments?

According to the textbook *Ecology: From Individuals to Ecosystems*, "**Ecology** is the scientific study of the interactions between organisms and their environment."<sup>2</sup> The first term, environmental, describes anything naturally occurring, without intervention of mankind. The second term, systems, denotes how components found in nature interact with each other and their surrounding environment. The particular branch of ecology serving as the basis for this paper is called **ecosystems ecology**. This specialized study observes the energy flow among the living and nonliving elements in an ecosystem.

In terms of the paper's structure, Section 1 digs into the science behind ecosystems. The intrinsic behaviors found in ecosystems are actually imitated in ERM frameworks. Section 2 contains a brief overview of what constitutes a sound ERM framework. In Section 3, we introduce the similarities and outline basic principles drawn from our research of ecosystems and ERM frameworks. Two case studies are presented in Section 4. The catastrophic outcomes from the two cases could have been subsided, or even avoided, if the ecosystem principles were practiced in their respective frameworks. Section 5 concludes the paper with key takeaways for ERM practitioners to create a sustainable ERM ecosystem.

## 2. Ecosystem

### 2.1. What is an Ecosystem?

An **ecosystem** is a complex set of living things (plants, animals and organisms) interacting with each other and with their nonliving environment (weather, earth, sun, soil, climate and atmosphere).<sup>3</sup> Ecosystems vary significantly in size from a single oak tree to an entire redwood forest. Each living component of an ecosystem is dependent on the other living and nonliving elements. An ecosystem is a biological community comprised of the living members known as **biotic** factors and the nonliving features create the **abiotic** factors.<sup>4</sup> Figure 1 gives an example of these factors.

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<sup>2</sup> Michael Begon, Colin R. Townsend and John L. Harper, *Ecology: From Individuals to Ecosystems* (Oxford, UK: Blackwell Publishing, 2006).

<sup>3</sup> "What is an Ecosystem?" eSchooltoday, retrieved Jan. 3, 2016, <http://eschooltoday.com/ecosystems/what-is-an-ecosystem.html>.

<sup>4</sup> "Overview of Ecosystems," Enviropol, retrieved Jan. 4, 2016, <http://enviropol.com/index.php/overview-of-ecosystems>.

**Figure 1. Ecosystem in Green Mountain Forest, Vermont**



Credit: Kelley Barber (Reproduced by permission)

Consider a creek in your backyard as a simple example of an ecosystem. In this natural setting, you will notice the biotic factors such as green plants, algae, fish, tadpoles, worms, water insects and birds perched on a nearby log. Without the essential abiotic factors such as water, sun, soil, rocks and the exchange of gases in and around the creek, the living plants and organisms would cease to exist.<sup>5</sup> For instance, if the green plants and algae are removed, the insects and the worms would have no food source. The fish and tadpoles who feed off the insects and worms also have a depleted food source. The birds are forced to migrate elsewhere for nourishment. The ecosystem shuts down because the energy flow, once circulating, has now come to an abrupt stop. This hypothetical scenario shows that when a particular area of an ecosystem fails, the rest of the ecological community will be negatively affected.<sup>6</sup>

## **2.2. How Does an Ecosystem Work?**

### *2.2.1. Definition of an Ecosystem*

An ecosystem is a script providing a supporting role for each of its characters. In the biotic role, living things act as food for other biotic members higher on the food chain. Their byproducts become nutrients for the abiotic soils and gases for the atmosphere, creating a soil nutrient cycle. Even more fascinating, ecosystems are the supplier of foods, energy, fiber, genetic resources, medicines, fresh water and minerals<sup>7</sup> that we consume. Our very own vitality as human beings is dependent upon the

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<sup>5</sup> "What is an Ecosystem?" eSchooldtoday.

<sup>6</sup> Ibid.

<sup>7</sup> "Overview of Ecosystems," Enviropol.

offspring of ecosystems. Preservation of the coral reefs, rain forests and bodies of water is our global responsibility.

### 2.2.2. Life Cycle of an Ecosystem

The sun infuses energy into the ecosystem, which is then absorbed by the plants. The plant photosynthesizes the sun's light energy into food. Plants are the producers in this food chain and, in return, become a food source for the primary consumers. The vegetarian primary consumers are dinner for the secondary consumers, carnivores that eat animals and plants, alike, so on and so forth.

At an earlier part of the food chain, where photosynthesis occurs, before the producers are ready to convert the energy, radiated by the sun, into food, carbon dioxide (CO<sub>2</sub>) has to be absorbed.<sup>8</sup> Without CO<sub>2</sub>, photosynthesis fails and has a cascading-up effect on the food chain. When we exhale, heat our homes, or even when animals or plants die, carbon dioxide is released into the atmosphere and the ground, respectively. The bacteria and fungus living in the earth's soil decompose the matter into minerals and nutrients and the carbon has become recycled.<sup>9</sup> Some energy is lost and emitted as heat into the air, but a portion is transferred into the very building blocks of life.<sup>10</sup>

### 2.2.3. External Threats

Unfortunately, the food and carbon cycles organically occurring in an ecosystem are threatened by external forces. Depending upon the invasiveness, they can distort the entire biological balance. Without proper mitigation, this could harm or ultimately destroy the ecosystem.<sup>11</sup> Activities such as mining, farming, construction, overfishing, pollution and UV radiation have catastrophic consequences on ecosystems, endangering the living species.<sup>12</sup> Climate change remains a constant hazard toward the health of ecosystems. Climate change appears as an important theme throughout this paper.

### 2.2.4. Biodiversity

A sustainable ecosystem necessitates balance in all interrelationships, proper adaptability/treatment of new threats, as well as the support of biodiversity.<sup>13</sup>

Ecosystems have proven to be resilient by adapting to change. **Biodiversity** is the variety of life in the world or in a particular habitat or ecosystem.<sup>14</sup> The more diverse the species or even the genetic make-up of a particular population is the higher probability of withstanding a disruption to the ecosystem. Figure 2 shows an example of biodiversity.

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<sup>8</sup> "What is an Ecosystem?" eSchooltoday.

<sup>9</sup> "Overview of Ecosystems," Enviropol.

<sup>10</sup> Oxford Dictionaries, s.v. "biodiversity," retrieved Jan. 4, 2016, [http://www.oxforddictionaries.com/us/definition/american\\_english/biodiversity](http://www.oxforddictionaries.com/us/definition/american_english/biodiversity).

<sup>11</sup> "Overview of Ecosystems," Enviropol.

<sup>12</sup> Ibid.

<sup>13</sup> Ibid.

<sup>14</sup> Oxford Dictionaries, s.v. "biodiversity."

**Figure 2. Biodiversity in an Ecosystem**



Credit: Corry Flegeal, Acqua Corps Design Studio (Reproduced by permission)

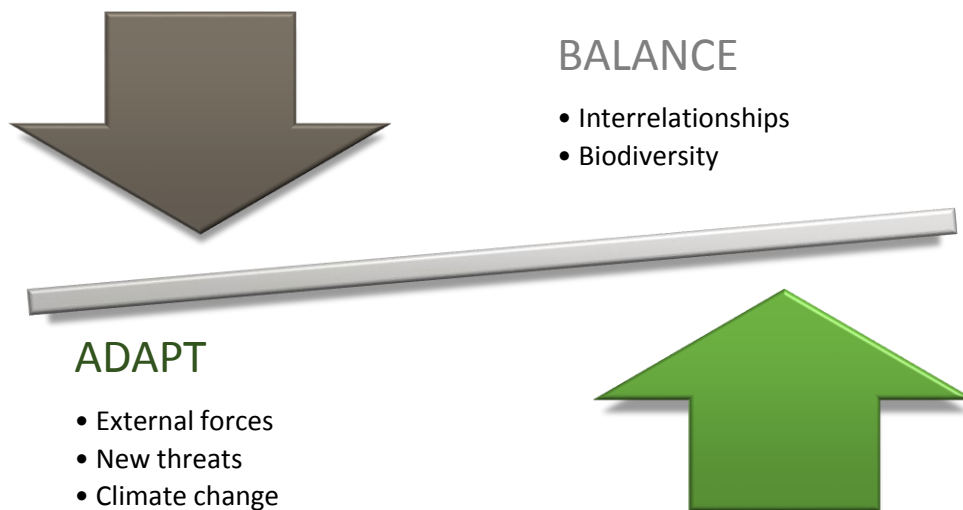
### 2.2.5. Adapting and Balancing

Figure 3 is a depiction of how ecosystems simultaneously have to adapt and balance. Adapting can be in the forms of:

- Repelling against external threats
- Assimilating to a new ecological habitat
- Inducing slight shifts to the naturally occurring cycles to adjust accordingly

The balancing side is seeking out harmony among its cohabitants to better face disruption or climate change. A system supporting both sides, equally and attentively, will be best equipped to thrive under severe circumstances. Reliance on **keystone species** becomes prevalent in such scenarios. Keystone species are detailed in Section 2.4.

**Figure 3. The Dynamic Interaction Between Balance and Adapt**



### 2.3. Levels of Organization of Ecology

We are all part of a much larger spectrum, one nearly impossible to fathom. Just as the smallest form of life, the cell, has a place on the scale, we, too, belong to a certain level of organization of ecology.

There are six levels of organization that compartmentalize ecology.<sup>15</sup> Let's take a closer look at each of the following levels.

1. The first ecology level, **organisms**, refers to any individual, species, living thing or organism.
2. **Populations** make up the second tier as a group of individuals of a given species in a specified region. Fish in the population level may have slightly different characteristics, yet all come from the same gene pool or species.
3. Next, the **communities** level represents all populations in a specific area. There are different species cohabitating in a single location at a particular point in time—goldfish, jelly fish, crustaceans, salmon and plants. A thriving community has a high degree of biodiversity.
4. **Ecosystems** are a level above communities but are at a level below, or equal to, biomes. Ecosystems now include the interaction with nonliving elements as opposed to communities that consists of living species and their environment.
5. **Biomes** are series of ecosystems that have adapted to their environment and abiotic factors.
6. The final organization level of ecology belongs to the **biosphere**. The biosphere is the world in which we breathe, live, work and play. It is the summation of all biomes, geographic regions, humans, plants and animals here on Earth.<sup>16</sup>

The distribution of plant life and biodiversity of living species of an ecosystem is controlled by the ecosystem's thermometer. Animals necessitating plenty of water or a cool climate would not be found in the Mojave Desert. Yet, the vegetation and soil may be conducive to the well-being of coyotes, deer and bobcats. The desert wildlife have adapted to these extreme desert conditions, fending off the heat and finding ways to retain water.

### 2.4. Keystone Species

A **keystone species** is a plant or animal that plays a unique and crucial role in the way an ecosystem functions. Without the keystone species, the ecosystem would be dramatically different or cease to exist altogether.<sup>17</sup>

In 1969, zoologist Robert T. Paine first postulated the existence of keystone species, according to National Geographic.<sup>18</sup> Paine and his students from the University of Washington removed starfish from an area on the coast of Tatoosh Island, Washington, over a span of 25 years, to observe the aftereffects. Paine was one of the first scientists in his field to experiment in such an unconventional fashion. With

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<sup>15</sup> "What is an Ecosystem?" eSchooldtoday.

<sup>16</sup> Ibid.

<sup>17</sup> *National Geographic Society encyclopedia*, s.v. "keystone species," retrieved Jan. 5, 2016, <http://education.nationalgeographic.org/encyclopedia/keystone-species/>.

<sup>18</sup> Ibid.



the starfish gone, mussels overpopulated the area and forced out the other species. The starfish in the Tatoosh Island ecosystem was indeed a keystone species. Whether or not Paine's methodology was ethical in practice is a question for another day; however, his theory paved a new pathway in ecological studies. One species existence rests on another; without it, the other species deteriorates over time.

This prevalent species regulates the other living and nonliving members in a given ecosystem.

National Geographic provides another example in the sea otter of the Pacific Northwest.<sup>19</sup> This keystone species feed on sea urchins, limiting the urchins' overpopulation. Without the otters, the sea urchins would consume the entire ecosystem's supply of kelp. One may think nothing of it, but this giant seaweed is an essential food source and habitat for the ecosystem. Certain species of crustaceans and snails eat kelp. Fish hide in the lush kelp forests as an escape from predators. The ecosystem is now endangered. Classifying inhabitants as keystone species is actually a principle embedded in a sensible ERM framework.

We have now brushed up on Ecology 101 and will review the pillars of a sound ERM framework in Section 3.

## 3. ERM Framework

### 3.1. A Sound ERM Framework

Let's start with the basics: How is ERM defined? What are the core elements of an ERM framework? Who are the key stakeholders? How is ERM measured/rated?

#### 3.1.1. Definition of an ERM Framework

ERM is defined as "the discipline by which an enterprise in any industry assesses, controls, exploits, finances and monitors risks from all sources for the purpose of increasing the enterprise's short- and long-term value to its stakeholders."<sup>20</sup> Key phrases have been strategically placed in this definition: **discipline, enterprise, any industry, assess, control, monitor, risk, all sources, short- and long-term value, stakeholder**. Now, a clear ERM image is appearing. ERM is a *discipline* for any institution, in any *industry*, to learn and practice. *Risks* (future, past and present) across the *enterprise* are identified, *assessed, controlled and monitored from all sources*. Risks are then aggregated and reported using the appropriate risk-adjusted measure. Ethical business decision-making is based upon these metrics, keeping *stakeholder* value at the forefront of management minds. There is a risk language understood by all and a culture embedded deep in the organization. No one individual is exempt. Transparency and accountability go hand in hand for following the proper risk policies and procedures. Interrelationships are established and thinking altruistically about risks will only augment the stability of the framework.

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<sup>19</sup> Ibid.

<sup>20</sup> Casualty Actuarial Society Enterprise Risk Management Committee, "Overview of Enterprise Risk Management" (May 2003), <https://www.casact.org/area/erm/overview.pdf>.



In the 2013 “Insurance Enterprise Risk Management Practices” by the American Academy of Actuaries (AAA),<sup>21</sup> effective ERM relies on two primary goals:

1. To identify, evaluate and, where possible, quantify risks and their correlations and/or dependencies from all sources across an organization
2. To ensure the organization actively implements risk treatment strategies that leverage knowledge of its risks to achieve appropriate risk and return tradeoffs in accordance with an organization’s values and goals.

All frameworks shall incorporate these objectives within their performance measurement.

### *3.1.2. Risk Culture and Risk Language*

Which risk language do you speak within your company? Is everyone fluent in the same language or do they speak in different tongues representative of their own territories of business units and teams? Is the language hard to learn? Does it prove to be difficult to understand at times? Conducting a companywide survey with these questions may have surprising results. The responses may not be what one wants to hear but they will serve as an honest check.

The risk culture at any company should be easily understood and integrated throughout the enterprise. As a test, any individual selected at random should be able to speak fluently about his/her risk framework ideals, the risk appetite statement and major risks faced by the company. Do you think your framework is well positioned for a deeply rooted risk culture and risk language?

To help answer that question, the Financial Standards Board (FSB) outlines the key indicators of a sound risk culture. The following is a direct excerpt from the FSB’s “Guidance on Supervisory Interaction with Financial Institutions on Risk Culture.”<sup>22</sup> The list was intended to be illustrative of the indicators used in any framework, not exhaustive.

- **Tone from the top.** The board and senior management are the starting point for setting the financial institution’s core values and expectations for the risk culture of the institution and their behavior must reflect the values being espoused. A key value that should be espoused is the expectation that staff act with integrity (doing the right thing) and promptly escalate observed non-compliance within or outside the organization (no surprises approach). The leadership of the institution promotes, monitors and assesses the risk culture of the financial institution; considers the impact of culture on safety and soundness; and makes changes where necessary.
- **Accountability.** Relevant employees at all levels understand the core values of the institution and its approach to risk, are capable of

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<sup>21</sup> American Academy of Actuaries ERM Committee, “Insurance Enterprise Risk Management Practices” (March 2013).

<sup>22</sup> Financial Stability Board, “Guidance on Supervisory Interaction with Financial Institutions on Risk Culture: A Framework for Assessing Risk Culture” (April 7, 2014), <http://www.fsb.org/wp-content/uploads/140407.pdf>.

performing their prescribed roles and are aware that they are held accountable for their actions in relation to the institution's risk-taking behavior. Self-acceptance of risk-related goals and related values is essential.

- **Effective communication and challenge.** A sound risk culture promotes an environment of open communication and effective challenge in which decision-making processes encourage a range of views; allow for testing of current practices; stimulate a positive, critical attitude among employees; and promote an environment of open and constructive engagement.
- **Incentives.** Performance and talent management encourage and reinforce maintenance of the financial institution's desired risk management behavior. Financial and nonfinancial incentives support the core values and risk culture at all levels of the institution.

### *3.1.3. Risk Appetite, Risk Tolerance, Risk Limits and Risk Profile*

If you think of a well-defined risk appetite statement as a trunk of the tree, the risk tolerance as the main branches and the limits as the secondary branches, you will visualize all parts connected. The trunk needs to be solid and strong to support all of the branches; one that is wavering may be easily overcome by a storm. All tolerances and limits need to be approved, communicated, executed and reviewed. If there is a potential limit breach, the risk exposure should be appropriately communicated in a timely manner. This is why tolerances and limits need to be transparent and individuals held accountable.

For a quick vocabulary review, the AAA<sup>23</sup> has defined each of the terms accordingly:

- **Risk appetite.** The amount of specific and aggregate risk an organization chooses to take during a defined time period in pursuit of its objectives
- **Risk tolerance.** The aggregate risk-taking capacity of an organization
- **Risk limits.** A threshold used to monitor the actual risk exposure of a specific unit or units of the organization to ensure the level of aggregate risk remains within the risk tolerance
- **Risk profile.** The risks to which an organization is exposed over a specified period

### *3.1.4. Risk Organization Structure*

The board sits at the top of the risk framework tree and approves the appetite statement brought forth by the chief risk officer (or chief executive officer) as the spokesman from the risk committee or team (depending on size). The exact risk organization hierarchy will vary by company size, maturity and staff resourcing. In an ideal setting, an ERM team is desired to be the advocates of the risk framework and is

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<sup>23</sup> AAA ERM Committee, "Insurance Enterprise Risk Management Practices."

overseen by the CRO. The ERM team is an umbrella covering all product lines, business units and teams, from weatherly conditions.

### *3.1.5. Risk Identification*

Revisiting the ERM definition again, **all** risks originating from **all** sources need to be identified, **known** or **unknown**. Perform bottom-up and a top-down approach to solicit feedback from all areas of the company. Using this inventory of risks, determine and define the high-level risk categories. This listing is your company's risk taxonomy. Each primary risk category should be equipped with a corresponding risk policy guiding the practitioners on expectations, roles and responsibilities and how to measure the risk consistently across the institution. Deviations from the standard should go through an approval process; ensure the decisions and new methods are well documented.

### *3.1.6. Risk Assessment*

Will you accept, mitigate, transfer or remove the risk?

The risk appetite, risk tolerance and limits will set the boundaries for management's ultimate treatment of risk. Once the risk response is confirmed, the next step is dividing up which risks are quantifiable from those that are not. Of the risks that can be quantifiable, the subject matter experts should model judiciously using high quality data<sup>24</sup> and follow the respective policy developed for that particular risk. The unquantifiable risks undergo scrutiny and powerful discussion as it becomes now more art than science. Using a form of operational risk in light of current events, how does one figure out a dollar amount associated with cyber risk? Weighing both frequency and severity, which risk is more severe: a) not meeting company's goals (form of strategic risk) or b) a steep drop in employee retention of key individuals (form of people risk)? This may be material for another paper at another time, yet the risk priority setting and assessment by, for example, heat maps, influence matrices or tail risk extrapolations are critical for the hard-to-quantify risks.

### *3.1.6. Risk Aggregation*

As observed in ecosystems, risks do not occur in isolation. Figuring out how all risks interact with each other to compute an enterprise value is a tall task. The trade-offs of precision, timing, budget and available computational power are important factors to consider when comparing options. Risk professionals knowledgeable across risk categories could vet which risk aggregation technique is the most appropriate. The Basel Committee on Banking Supervision<sup>25</sup> compared and contrasted three aggregation methods:

- **Var-covar approach (correlations).** Creating a matrix of how risks are correlated is fairly easy to create, modify and explain. However, correlations are linear scalars invariant with time.

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<sup>24</sup> Refer to Actuarial Standards Board, "Actuarial Standard of Proactive No. 23: Data Quality," Doc. No. 141 (December 2004).

<sup>25</sup> Basel Committee on Banking Supervision, "Developments in Modelling Risk Aggregation" (October 2010), <http://www.bis.org/publ/joint25.pdf>.

Correlations also assume a normal distribution of risks. These two shortcomings are contradicted in reality.

- **Distribution-based (copulas).** The copula conjoins the marginal distributions of each individual risk and directly controls the dependency structure to allow any match of marginal distributions. An advantage to using copulas is specifying the dependencies among the risks. Copulas modeling tail dependence are used for risks known to be correlated in the tail. Explaining the assumptions and practice of building copulas can be complicated.
- **Scenario-based.** Risk drivers are identified to simulate scenarios through algorithms and processes. Yet to the approach's disadvantage, the scenarios are highly sensitive to the algorithms and formulas. Scenario-based aggregation is the most sophisticated approach. It can be applied consistently yet a cutting-edge economic scenario generator requires additional resources and even funding.

### *3.1.8. Risk Monitoring: Risk-Adjusted Performance Metrics and Economic Capital*

**Economic capital** is the amount of capital an organization requires to survive or to meet a business objective for a specified period of time and risk metric, given its risk profile.<sup>26</sup>

We have been talking risk. Performance metrics should be selected in a way that the risk generated to produce the return is reflected in the metric reported. The key metric itself depends upon the type of risk/product. Nevertheless, performance risk metrics are a good gauge of where the company stands comparative to its target, for example, 15 percent risk-adjusted return on capital (RAROC) on new business, 450 percent risk-based capital.

Economic capital answers the shareholder's question of how effectively the available capital is used. Too much capital, you may be losing out on potential shareholder value. Too little, you become at risk of insolvency. Economic capital is explicitly evaluated in Standard & Poor's ERM assessment<sup>27</sup> of operating insurance companies. To receive a "very strong" ERM rating, an insurer must have "positive" scores for all five subfactors and either a "good" or "superior" rating of their economic capital model based on S&P's criteria.<sup>28</sup> Rating agencies appear on the roster of shareholders. A company should constantly strive to meet, if not exceed, the short- and long-term objectives of their shareholders.

This concludes a high level overview of a sound ERM framework. In the following section, the characteristics of an ecosystem are blended into an ERM framework.

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<sup>26</sup> AAA, "Insurance Enterprise Risk Management Practices."

<sup>27</sup> Sridhar Manyem, "S&P's ERM Framework" (presentation, May 2015), <http://www.ultirisk.com/pdf/ultimate-risk-may-2015-sridahr-presentation.pdf>.

<sup>28</sup> Ibid.

## 4. Analysis of an ERM Ecosystem

Q: What is an ERM ecosystem?

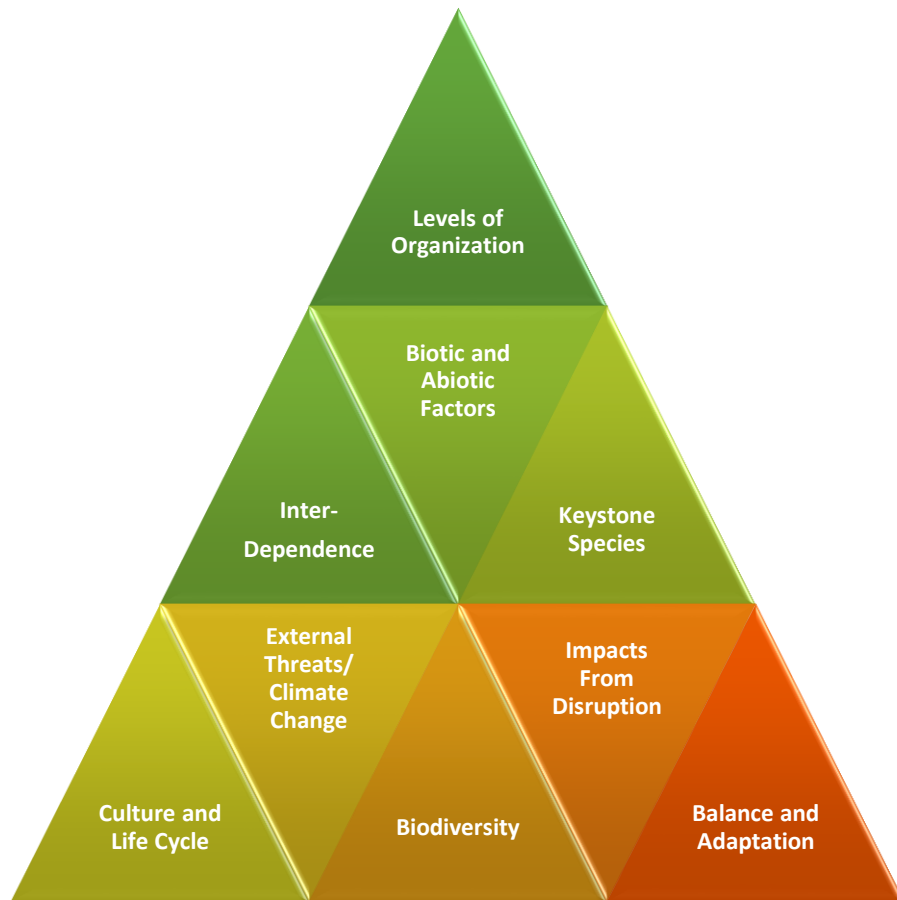
A: An ERM framework that balances the complex interdependencies of its risks and processes while constantly adapting to an external, ever-changing environment to best achieve the goals set out by all of its constituents.

### 4.1. What Similarities Exist Between Ecosystems and ERM Frameworks?

Although it may not have been apparent at the outset, there are many commonalities between ecosystems and ERM frameworks. Did the light bulb turn on? Perhaps one of the key characteristics of an ecosystem struck a nerve enabling you to find that counterpart in your own ERM framework. Do not worry if this was not the case, we will review the underpinnings supporting both systems in upcoming sections. Believe it or not, a task you may perform on a daily basis, as an ERM practitioner, goes back to the very fundamentals of ecology.

The similarities between ecosystems and ERM frameworks are recorded in Figure 4. This is not an exhaustive list but rather a cross-section of parallels.

**Figure 4. Similarities Between Ecosystems and ERM Frameworks**



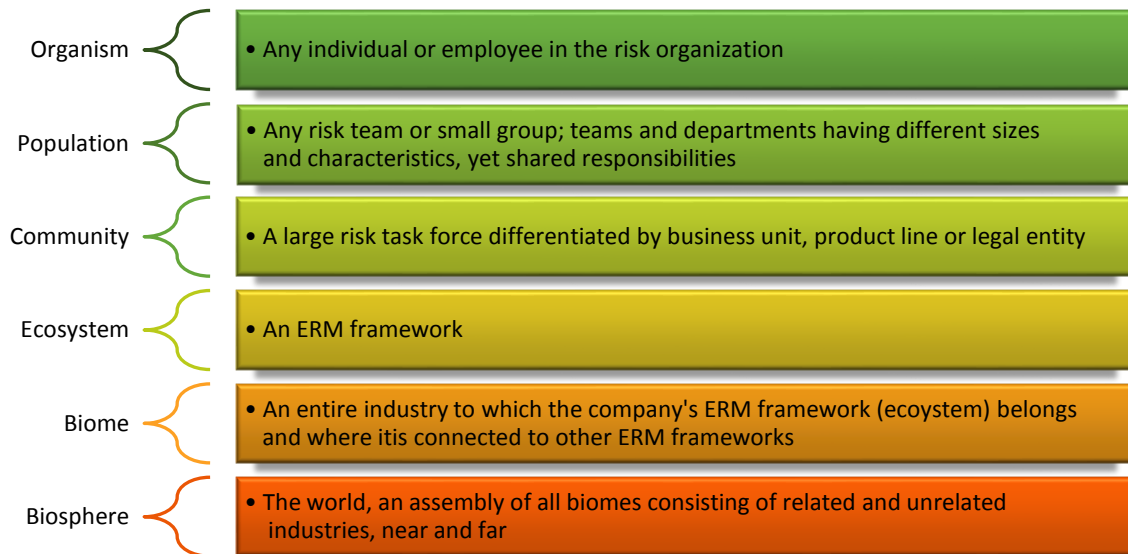
Each corollary is viewed from an ERM framework’s perspective in Figure 5.

**Figure 5. Ecosystem Characteristics Defined in an ERM Framework**

Similarities	ERM Framework Description
<b>Levels of Organization</b>	<ul style="list-style-type: none"> <li>• An ERM framework fits in a larger universe as did the ecosystem in the level of organization of ecology. The cross-reference at each level is shown in Figure 6.</li> </ul>
<b>Interdependence</b>	<ul style="list-style-type: none"> <li>• Interrelationships exist among teams, units, risks, metrics and the list continues the more one drills down in an ERM system. Acknowledging risks do not live in isolation is a continual practice.</li> <li>• The life cycle (see Culture and Life Cycle entry) reiterates the dependency of relationships among core risks, processes and stakeholders.</li> </ul>
<b>Biotic and Abiotic Factors</b>	<ul style="list-style-type: none"> <li>• The biotic factors are the risk employees.</li> <li>• The abiotic factors embody the policies, risk appetite, tolerance and limits, the risk culture, risks and the models measuring those risks.</li> </ul>
<b>Keystone Species</b>	<ul style="list-style-type: none"> <li>• From the individual risk contributor to the CRO and to the board, all influential risk professionals are classified as keystone species.</li> <li>• If a keystone individual or team is removed, the organization structure either shifts accordingly to fill the gap or makes efficient use of other resources readily available. A detrimental response is negligence, causing the framework to collapse.</li> </ul>
<b>Culture and Life Cycle</b>	<ul style="list-style-type: none"> <li>• A sound framework encapsulates the risk culture of its individuals. Different traditions are embraced and unified into one culture. The risk language is spoken and the risk appetite is clearly communicated.</li> <li>• The ERM framework receives the energy from the life cycle. The principles outlined later in this section are the CO<sub>2</sub> components found in the ecosystem energy cycle.</li> </ul>
<b>External Threats/ Climate Change</b>	<ul style="list-style-type: none"> <li>• External threats are a type of emerging risk. Accounting for emerging risk in an ERM framework is crucial.</li> <li>• As the climate changes, so does our industry landscape. Baby boomers are retiring and living longer. The millennials are undeniably the most proficient multitaskers this planet has ever seen. They are accessible anywhere, anytime being only one text, one snapchat, one tweet away. What does this cultural shift mean for your institution’s future?</li> <li>• Let’s consider Capitol Hill. Has the ERM team met with legal or government relations to brainstorm how the pending insurance legislation or the election of a new U.S. president will affect the company? Research, monitor and react to new trends.</li> <li>• Even if the change is totally unrelated to your business, the risk could spill over into your own industry and is now a threat.</li> </ul>
<b>Biodiversity</b>	<ul style="list-style-type: none"> <li>• The more dispersed an organization is staffed in terms of skill set, experiential knowledge, gender, race, tenure, the more likely it will endure employment-related risk.</li> <li>• Teams comprised of a diverse set of individuals wearing different thinking caps will have a panoramic view of solutions. The benefits of biodiversity are indefinite.</li> </ul>
<b>Impacts from Disruption</b>	<ul style="list-style-type: none"> <li>• When a financial institution is hit by an unexpected market crash, as experienced in the financial crisis of 2008, the shock must be absorbed by the whole institution. No area’s diagnosis should be labeled as unscathed, regardless of its size or nature. The aftermath is pervasive across the system, leaving it susceptible to any downstream implications caused by the crisis. Concentrating only on the directly impacted areas will fail to remediate the framework holistically and comprehensively.</li> </ul>
<b>Balance and Adaptation</b>	<ul style="list-style-type: none"> <li>• An institution must balance all risks it faces by providing the right amount of intellectual property, capital resource and focus. Neglecting one area may have a waterfall effect on the framework.</li> <li>• The board and senior management also balance the expectations of the shareholders with its sales goals. Therefore, executive compensation should promote prudent risk-taking behavior.</li> <li>• The nimbleness of an institution during plausibly extreme or adverse extreme events is an important factor in recovery time following a disaster.</li> <li>• Anticipating new trends could jumpstart the competition by developing the latest suite of products.</li> </ul>

The six levels of organization defining our world in terms of ERM can be seen in Figure 6.

**Figure 6. Levels of Organization of an ERM Framework**



#### 4.2. What Can We Learn From Sustainable Ecosystems?

If we stopped and observed the outdoors, we could learn a great deal from nature. Is this a rudimentary way of thinking? Perhaps it is, but definitely not far-fetched. Surely, the changes in ecosystems may be more gradual than, say, the movement of a stock price. However, beyond the surface, the same natural principles hold true. Our very biome of interlinked ERM systems is driven by technological advancement and monitored by an evolving regulatory landscape. A successful ERM framework matches the record-breaking speed of innovation with the time and investment placed into its framework.

#### 4.3. How Can We Apply Ecosystem Basics to our Complex ERM Frameworks?

Each stakeholder has a unique role to play in forming a thriving ERM ecosystem. It has to maintain synchronization across the various levels—legal entities, business lines, products and risk categories and be risk-conscious in its decision-making. For an ERM framework to withstand events causing severe disruption to the system, an institution must:

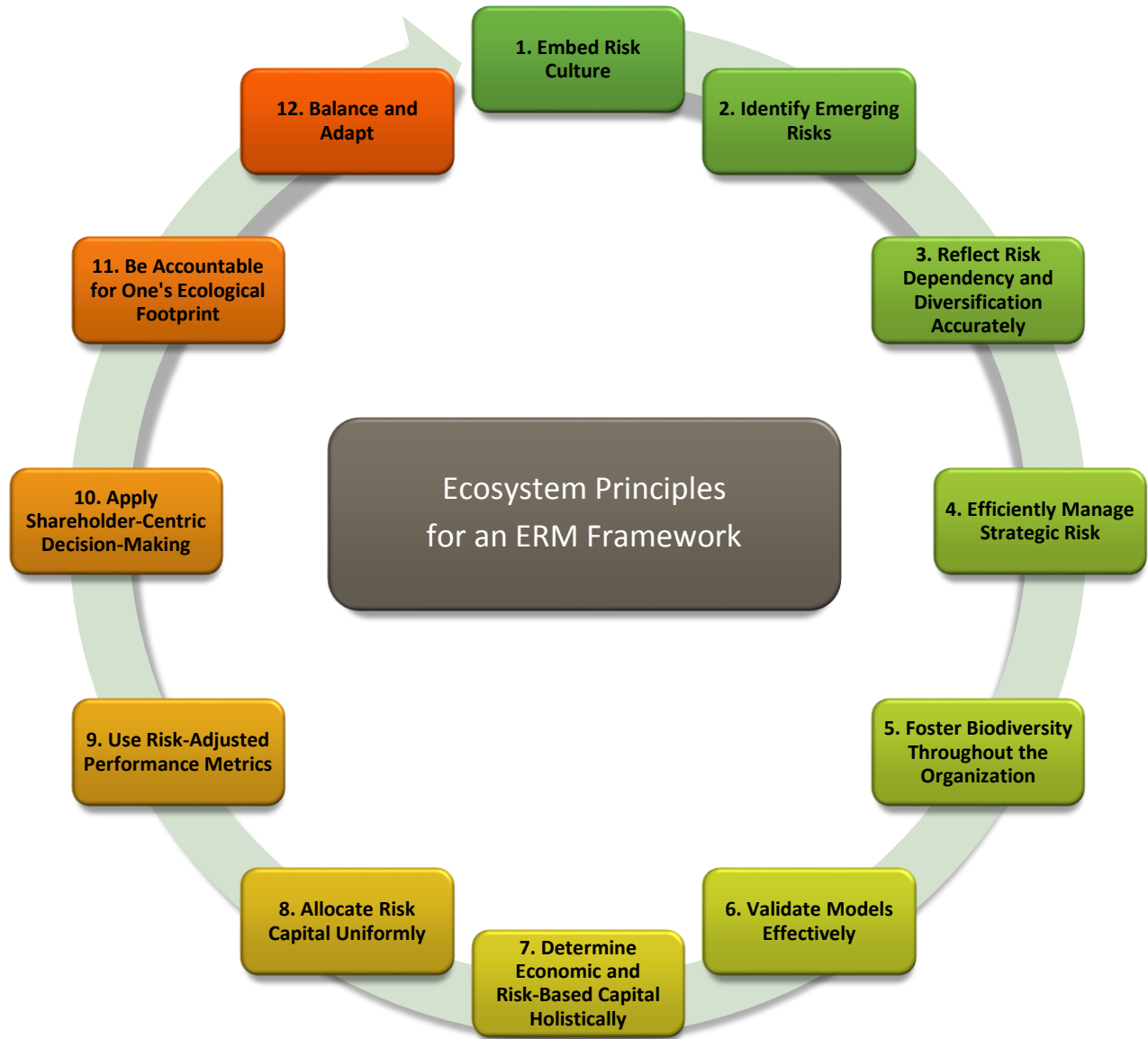
- Identify all inherent and emerging risks, including their correlations/dependencies
- Implement key business decisions and actions on behalf of all of its shareholders
- Instill a common risk culture and language that is well understood and practiced by all levels/business units
- Balance risk mitigation and risk-taking behavior to achieve the goals set out by and for its stakeholders

The ERM ecosystem is set at the most senior level of the organization. The board, executive committee and/or an ERM committee determines how effective, integrated and resilient the ERM framework will be. We live in a dynamic **biosphere** where external factors can **disrupt** how we conduct business on a



routine basis. Drastic changes in regulation, market trends, terrorist’s attacks and extreme natural disasters are often categorized as one-in-200 events. In reality, those extreme events can destroy a weak or adequately rated ERM ecosystem. Figure 7 features the basic ecosystem principles applied in a sound ERM framework to properly mitigate the consequences of the plausibly extreme occurrences.

**Figure 7. Ecosystem Principles in an ERM Framework**



These 12 principles are the CO<sub>2</sub> found in the life cycle of an ecosystem. A solid ERM ecosystem carries out each principle—breathing in and out the energy required to support the framework. Recall from earlier, an **ERM ecosystem** is one that balances the complex interdependencies of its risks and processes while constantly adapting to an ever-changing, external environment to best achieve the goals set out

by all of its constituents. Despite the complex environment in which we work, these naturalistic principles can be implemented in any industry. “Risk-proofed” firms assimilate to new topographies. Constantly scanning for external threats enables their internal risk teams to quickly identify risk exposures and react accordingly. Those sound risk practices are woven throughout these 12 core ERM ecosystem competencies:

1. Embed risk culture
  - Ensure all constituents are fluent in the risk language
  - Clearly communicate a universal culture deeply rooted throughout the institution
  - Place accountability at all levels in the framework
2. Identify emerging risks
  - Actively scan the environment for potential threats
  - Survey risk professionals at all levels in the organization
  - Appropriately integrate emerging risks as part of risk reporting
  - Document decision outcomes of emerging risks
3. Reflect risk dependency and diversification accurately
  - Identify all incumbent risk relationships
  - Properly simulate dependencies in the whole risk distribution and in the extreme tails
  - Stress test the diversification benefit in tail events
  - Recognize the diversification naturally occurring between inter- and intra-business lines
4. Efficiently manage strategic risk
  - Stay competitive with peers
  - Pursue smart business growth opportunities
  - Be industry-savvy using current experience studies and market trends
5. Foster biodiversity throughout the organization
  - Promote biodiversity and encourage conventional and unconventional ways of thinking
  - Maximize the potential of a diverse work culture
  - Retain key species as a method of mitigating people risk
6. Validate models effectively
  - Inventory and risk rate all models supporting company decision and action
  - Validate models to mitigate model risk through an effective, independent challenge
  - Apply a proportionate amount of rigor to the development and validation of models
7. Determine economic and risk-based capital holistically
  - Develop prudent assumptions in calculating capital
  - Conduct stress tests and scenario analysis
  - Hold a sufficient amount of capital to maintain the desired credit rating
8. Allocate risk capital uniformly
  - Assess how risk capital can be allocated fairly across the board
  - Invest in hedging if material risks expose the firm to large unexpected losses
9. Use risk-adjusted performance metrics
  - Report on a risk-adjusted basis

- Align incentive compensation plans with healthy risk-taking behavior
10. Apply shareholder-centric decision-making
    - Adhere to current and impending regulation
    - Create work/life balance for employees
    - Consider shareholder value in business decision-making
  11. Be accountable for one's ecological footprint
    - Be socially responsible for consequences resulting from an ERM framework failure, for example, a bailout
    - Adopt an altruistic outlook on how company actions can shape the future of the industry/world
  12. Balance and adapt
    - Provide support in all areas and teams
    - Devise business continuity plans for the unexpected
    - Assimilate the firm to new climates

In Section 5, two case studies are presented to understand how ERM frameworks break down. We then identify which ERM ecosystem principles were not carried through specifically and consider how the outcome would have been different had those key principles been applied.

## 5. Real World Scenarios

### 5.1. Case Studies

#### 5.1.1 General Motors Co. (GM)

GM's risk management culture was not as developed as it should have been. Exposing individuals at various levels of management to the goals and objectives of the ERM program are not the same as promoting and embedding risk awareness. The company was not as adept at spotting, assessing and mitigating risks as it imagined. No one in the firm seems to have owned this particular risk, so no plans appear to have been developed to manage it.<sup>29</sup>

General Motors Co. (GM) in 2012 boasted a new ERM program estimated to add the type of value coveted by any risk professional, trade journalist or academic.<sup>30</sup> GM recalled more than 1.6 million cars

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<sup>29</sup> Steven Slezak, "GM's Risk Management Failure a Lesson for Other Firms," *Global Risk Insights* (March 26, 2014), <http://globalriskinsights.com/2014/03/gms-risk-management-failures-provide-example-for-other-firms/>.

<sup>30</sup> Ibid.

with ignition switch failures.<sup>31</sup> A faulty ignition switch could immediately shut off your car while in drive, while disengaging the airbag, power steering and power brakes.<sup>32</sup>

The automaker disclosed that their employees knew of the ignition switch failures a decade before any cars were recalled. It was deemed a low probability event; yet, this unlikely event's consequences included 124 fatalities, \$900 million for the company to settle criminal charges, and other fines and repair costs, not to mention residual reputation destruction.<sup>33</sup>

Laura Christian, whose 16-year-old daughter Amber Marie Rose was killed in 2005, said following disclosure of the settlement in September 2015, "While nothing can bring my daughter back, we need a system where auto executives are accountable to the public and not just corporate profits."<sup>34</sup>

The following ERM ecosystem principles are missing from GM's framework:

- Embed risk culture
- Reflect risk dependency and diversification accurately
- Validate models effectively
- Be accountable for one's ecological footprint
- Apply shareholder-centric decision-making

An ERM framework is much more than a compliance check; it should be the driver of how business is conducted judiciously with shareholder (customer, in this case) interest at the forefront of management action and decision-making. **A firm risk culture runs through all tributaries of an ERM ecosystem.** ERM is not just the responsibility for the main bodies. Everyone is held accountable and expected to act with integrity, transparency and professionalism.

### 5.1.2. AOL and Time Warner

Reaching the summit of the internet era, AOL and Time Warner merged in 2000.<sup>35</sup> The merger is deemed as one of the worst recorded in history.<sup>36</sup> Time Warner was an old-time media company and AOL was, at that time, the primary provider for internet and email (cue dial-up sounds). With the merger, Time Warner would establish an internet presence and AOL could access Time Warner's cable network and content. All for a small price tag of \$164 billion.<sup>37</sup> Love at first sight, right? Wrong. The synergies were overestimated, the two company cultures clashed, the dot-com bubble blew up and dial-

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<sup>31</sup> Ben Klayman, "GM Recalls 1.5 Mln More Vehicles; CEO Says 'Terrible Things Happened,'" *Reuters* (March 17, 2014), <http://www.reuters.com/article/gm-recall-idUSL2N0ME0SH20140317>.

<sup>32</sup> Chris Isidore and Evan Perez, "GM CEO: 'People Died in our Cars,'" *CNN Money* (Sept. 17, 2015), <http://money.cnn.com/2015/09/17/news/companies/gm-recall-ignition-switch/index.html>.

<sup>33</sup> *Ibid.*

<sup>34</sup> *Ibid.*

<sup>35</sup> Brian McCullough, "What Ever Happened to AOL?," *Internet History Podcast* (blog) (July 8, 2014), <http://www.internethistorypodcast.com/2014/07/what-ever-happened-to-aol/>.

<sup>36</sup> Rita Gunther McGrath, "15 Years Later, Lessons From the Failed AOL-Time Warner Merger," *Fortune Insider Network* (blog) (Jan. 10, 2015), <http://fortune.com/2015/01/10/15-years-later-lessons-from-the-failed-aol-time-warner-merger/>.

<sup>37</sup> McCullough, "What Ever Happened to AOL?"

up internet quickly became a thing of the past. Two years later, AOL/Time Warner reported an annual loss amounting to a \$100 billion, making it the largest loss in corporate history.<sup>38</sup> In 2008, AOL was spun off from Time Warner as an independent company.<sup>39</sup>

The two populations were separated by their cultural differences. AOL/Time Warner could have written a fairytale ending instead of writing down a massive loss. By embracing their biodiversity and making shareholder-centric decisions, AOL/Time Warner's merger failure may have not been as severe. Even at the onset, AOL/Time Warner should have diligently scanned for potential risks, such as shifts in technology, during the merger valuation of future profits and synergies.

AOL/Time Warner's losses could have been subsided or even avoided all together if the following principles were applied during the merger:

- Embed risk culture
- Efficiently manage strategic risk
- Foster biodiversity throughout the organization
- Apply shareholder-centric decision-making
- Balance and adapt

## 6. Conclusion

An ecosystem is a complex set of living things (biotic factors) interacting with each other and with their nonliving elements (abiotic factors). Although ecosystems vary in size, the significance of the dependency structure between the biotic and abiotic factors remains consistent. The life cycle supplies the energy needed to fuel an ecosystem. The levels of organization, biodiversity and keystone species, as well as balancing and adapting are paramount traits of an ecological community. We switched gears and reviewed the supports holding up a strong ERM framework. We went on to discover how ecosystems are not that different from our ERM frameworks. Both face external threats and are affected by climate change. The interrelationships of individuals, cycles and systems exist in ecosystems and ERM frameworks. There is a deeply rooted culture to embrace diversity among its inhabitants and promote healthy risk-taking behavior.

We invented a new term, the ERM ecosystem—a framework that balances the complex interdependencies of its risks and processes while constantly adapting to an ever-changing, external environment to best achieve the goals set out by all of its stakeholders. The investment and rigor infused into the development of an ERM ecosystem is proportional to the value derived from it. We established a new set of principles conjuring the essence of a sustainable ERM ecosystem. These principles are the CO2 found in the life cycle of an ecosystem. A thriving ERM ecosystem implements each individual principle at all levels:

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<sup>38</sup> Ibid.

<sup>39</sup> Ibid.

1. Embed risk culture
2. Identify emerging risks
3. Reflect risk dependency and diversification accurately
4. Efficiently manage strategic risk
5. Foster biodiversity throughout the organization
6. Validate models effectively
7. Determine economic and risk-based capital holistically
8. Allocate risk capital uniformly
9. Use risk-adjusted performance metrics
10. Apply shareholder-centric decision-making
11. Be accountable for one's ecological footprint
12. Balance and adapt

Lastly, in the two case studies, ERM frameworks faltered in the presence of adversity and risk. Choosing to neglect potential risks and shareholder interest proved to be precarious, self-centered decision-making. Healthy risk management requires execution of what nature has taught us.

**Figure 8. Ecosystem: Metaphoric Interaction of Adapt and Balance**



Credit: Corry Flegeal, Aqua Corps Design Studio (Reproduced by permission)

I'll challenge you again as I did in the beginning: How will your ERM ecosystem adapt and balance in our unpredictable environments?